RAND CORPORATION

Tour Lengths, Permanent Changes of Station, and Alternatives for Savings and Improved Stability

Craig A. Bond, Jennifer Lamping Lewis, Henry A. Leonard, Julia Pollak, Christopher Guo, Bernard D. Rostker

For more information on this publication, visit www.rand.org/t/rr1034

Library of Congress Cataloging-in-Publication Data
ISBN: 978-0-8330-9122-2

Published by the RAND Corporation, Santa Monica, Calif.

Preface

This document describes the results of research conducted for a project entitled "Assessment of Possible Changes to Military Tour Lengths." The study was designed in part to support the Department of Defense (DoD) in preparing a report for Congress on its permanent change of station (PCS) programs. It examined the workings of those programs with the goal of determining the potential for savings that could accrue from reducing the total number of PCS moves by increasing the average amount of time between them. The research covered current policies and programs, looking particularly at incentive programs designed to encourage servicemembers to stay longer at their current stations. As part of the study, researchers worked with the Defense Manpower Data Center (DMDC) to develop a set of questions to be included in DMDC's annual Status of Forces Survey, conducted in late 2013. The data were received and analyzed by RAND in 2014 and were incorporated into DoD's report to Congress.

Data on responses to that survey play heavily in the analysis in this report, particularly as they pertain to attitudinal and financial considerations and the relative importance respondents assigned to those considerations. This report presents findings regarding the stated preferences of servicemembers and the potential viability of incentive programs in light of the survey responses and analyzes possible cost and savings impacts of such programs.

This report should be of interest to service and DoD personnel managers as they seek to balance operational requirements, the needs and morale of servicemembers and their families, and the continuing search for savings in PCS programs. It will also be of interest to those seeking to understand the applicability of auction mechanisms and stated-preference models that include attitudinal data, as well as data on possible responses to financial inducements.

This research was sponsored by the Under Secretary of Defense for Personnel and Readiness and conducted within the Forces and Resources Policy Center of the RAND National Defense Research Institute (NDRI), a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, the Unified Combatant Commands, the Navy, the Marine Corps, the defense agencies, and the Defense Intelligence Community. For more information on the RAND Forces and Resources Policy Center, see http://www.rand.org/nsrd/ndri/centers/frp/html or contact the director (contact information is provided on the Web page).

Contents

Figures

Tables

Summary

The Department of Defense (DoD) moves about one-third of its military servicemembers each year. Recently, the Senate Authorizations Committee (SAC) asked DoD to review its permanent change of station (PCS) programs and submit a report on the review. The committee indicated that the report should include an analysis of the impact of increased tour lengths on families, quality of life, and job performance. It further asked that the report examine the impact that increased tour lengths would have on professional development and promotion opportunities and on servicemembers and their families serving in hardship locations. Finally, the committee requested that the report identify the cost savings associated with increasing tour lengths.

To aid in preparation of the report and to broaden understanding of alternatives for increasing time between PCS moves, the Under Secretary of Defense for Personnel and Readiness asked the RAND Corporation to undertake an analysis focusing on both single and married military personnel currently serving or who had recently served at locations that might be appropriate candidates for an increase in tour length, with a focus on overseas tours, which are generally the most costly of moves. Of particular importance was an assessment of the impact that increasing tour lengths might have on quality of life, job performance, and the morale of both servicemembers and their families. As work on this project progressed, it became obvious that the research should focus on alternatives both for rotational moves (i.e., to and from overseas) and for operational moves (those within a geographic area).

The PCS Program and Programs to Increase Tour Lengths

PCS moves take place when military personnel enter or leave their service or when they are reassigned from one duty station to another. The PCS program consists of varying numbers of six basic categories of moves. Four of them—accession, separation, training, and unit moves—are closely tied to basic personnel management goals (or force management requirements, in the case of unit moves) and, thus, do not offer much flexibility. Two other types of moves—rotational (transoceanic moves to or from an overseas duty station) and operational (moves within the continental United States or an operational theater)—are more susceptible to management through changes in policies regarding tour lengths and time between moves. In fiscal year (FY) 2014, the total cost of the PCS program was $4.4 billion, of which $1.5 billion went toward rotational moves and $1.3 billion went toward operational moves. Modest changes in these parts of the program would thus appear on the surface to offer some significant savings

potential. Just how much savings potential depends on other factors, including operational, professional development, and personal considerations.

The number of rotational and operational moves can be reduced through four policy actions: (1) establishing longer prescribed overseas tour lengths and longer minimum stateside time-on-station (TOS) requirements, (2) restricting the circumstances under which tour curtailments are authorized, (3) encouraging servicemembers to extend their tours, and (4) encouraging servicemembers to accept back-to-back tours in the same location. All of these actions work in one way or another to increase the amount of time between moves for affected servicemembers—thus, over time, reducing the number of moves and the associated cost. This report examines the impacts and potential savings associated with tour length and TOS increases, but it concentrates on options for encouraging tour extensions.

All other things being equal, longer tours will reduce the number of people moving every year and, thus, the overall costs of the PCS program. Whether imposing involuntary increases is a good idea is far more ambiguous: Mandating longer tour and TOS requirements and restricting curtailments can yield more continuity and stability in units, allow personnel to gain deeper experience, and reduce the number of times servicemembers and their families must uproot themselves. But such actions could also conceivably reduce morale (both for families and servicemembers, especially if the tours are in "undesirable"[1] locations) and inhibit career development, therefore negatively affecting readiness and retention. Because of these ambiguities, past research is inconclusive on the benefits of lengthening overseas tours and stateside TOS requirements. By contrast, options 3 and 4, which increase personnel choice in the assignment process, could potentially reduce manpower costs while simultaneously increasing job satisfaction and morale, thereby improving readiness and retention. The services could manage voluntary tour increases in ways that would mitigate any negative effects on career development.

The services currently have in place a variety of incentive programs that work to increase tour lengths and time between moves:

- The Overseas Tour Extension Incentive Program (OTEIP) offers a choice between cash and in-kind incentives in the form of additional leave and/or round-trip air travel.
- Assignment Incentive Pay (AIP) programs are used both for encouraging voluntary extensions and for compensating involuntary extensions. Examples are the Army's Korea Assignment Program and the Marine Corps Deployment Extension Program.
- In-place consecutive overseas tours (IPCOTs) allow servicemembers to remain at the same permanent duty stations for a second complete prescribed overseas tour at that location, thereby eliminating a PCS move.
- Intratheater consecutive overseas tours (COTs) allow a move, but it is an intratheater move, which is shorter and almost surely less expensive than the rotational move it defers.

Estimating Servicemembers' Willingness to Engage in Longer Tours

We collaborated with the Defense Manpower Data Center (DMDC) to develop survey questions designed to collect responses on individual propensities to extend tours and the factors

[1] This term is itself ambiguous, as our discussions of servicemembers' stated preferences will establish.

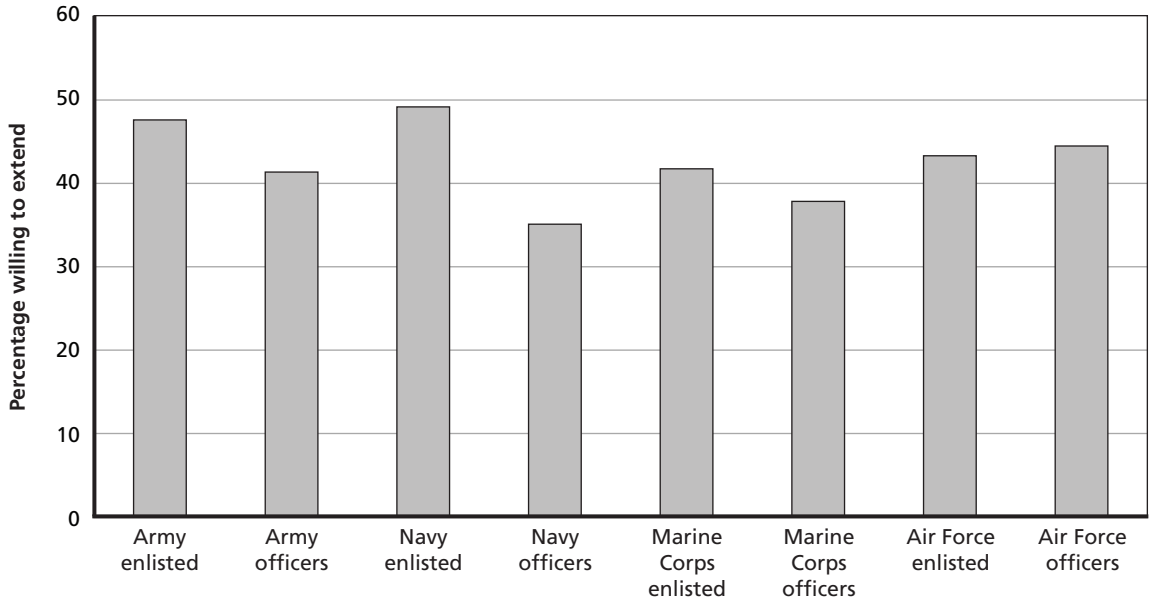
that influence such decisions, with emphasis on overseas tours, which are the most expensive. We estimated stated inclinations to extend tours (as opposed to revealed actual behavior) with a simple "yes" or "no" survey question. We also collected an extensive array of demographic and attitudinal factors that could influence the answer to that question and then explored the impact financial incentives might have on willingness to extend. The data we analyzed ranged from gender and pay grade status to perceived impacts of tour extensions on a variety of quality-of-life and job satisfaction variables.

Figure S.1 is an illustrative overview of our results, showing average proclivities for voluntary extensions for officers and enlisted persons by service for the unweighted sample, but otherwise undifferentiated.

We explored in considerable detail the combined effects of both demographic and attitudinal factors on the inclination of servicemembers to voluntarily extend overseas tours, using an appropriate multivariate statistical model. People with the following characteristics tended to have a more negative view toward extending tour length:

- those with fewer years of service
- those who were currently married
- those without any college experience
- those with a graduate/professional degree
- non-Hispanic blacks and Asian/Pacific Islanders
- those who served unaccompanied tours or dependent-restricted tours
- those serving shorter tours
- those who had served or were serving in Puerto Rico, Turkey, Guam, and South Korea

Figure S.1
Percentage of Servicemembers Surveyed Who Were Willing to Extend Overseas Tours Without Additional Incentive by Service and Rank



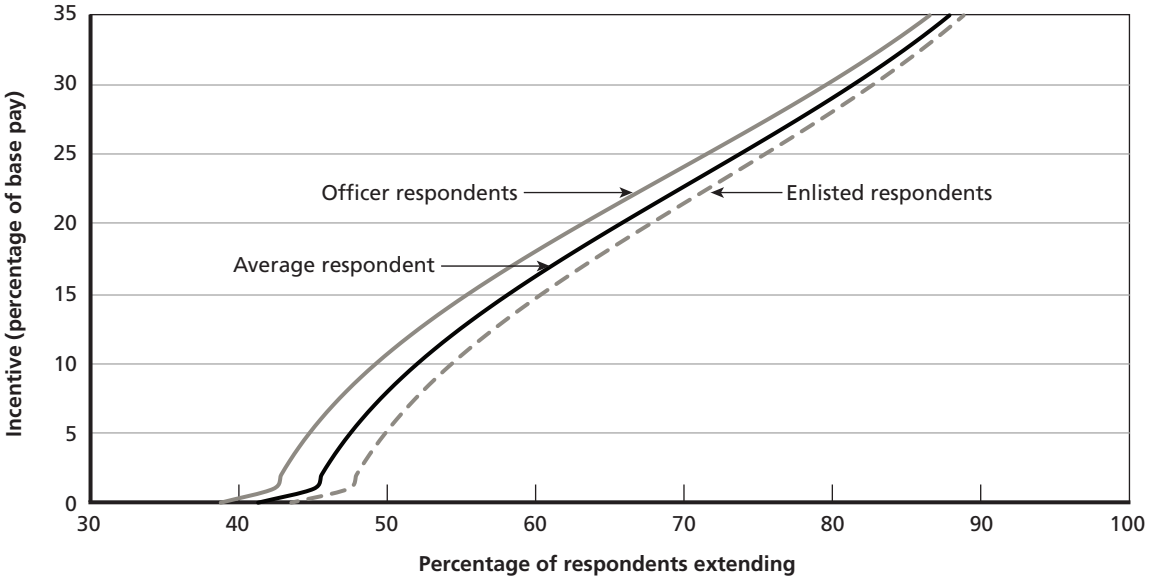
RAND *RR1034-S.1*

- those who emphasized family disinclination to extend, the opportunity for families to visit at no cost, "other" unlisted reasons, and who emphasized no particular reason at all
- those who tended to view the potential impacts on career and well-being as negative.

All in all, the survey analysis shows that a majority of those currently serving overseas and those who have recently served overseas would not volunteer for such an extension. Their responses suggest that a mandatory program would adversely impact quality of life and could negatively impact morale and possible job performance. Figure S.1 shows nearly 60 percent of the individuals in the survey sample did not want to extend their overseas tour. But Figure S.1 also shows there are many servicemembers who would volunteer for such an extension. Our analysis further indicates more would likely volunteer if offered a financial incentive.

We used a stated preference experiment to examine responses to possible financial incentives. Using the data we collected, we estimated a multivariate statistical model that predicts the proportion of the sample that would extend at increasing levels of additional pay, given the effects of demographic variables, tour characteristics, and cluster membership. Varying the incentive levels across the sample allows for estimation of a "supply curve" for tour extensions, with the probability of individual acceptance serving as the quantity and the financial incentive serving as the price. Figure S.2 provides a consolidated supply curve, showing averages for officers, enlisted persons, and the sample as a whole. This curve includes those who might be willing to extend for no incentive, so it starts upward near the 40 percent mark.

Figure S.2
Supply Curves Implied by Multivariate Models for Enlisted Personnel, Officers, and the Average Respondent for Overseas Tours



NOTE: This figure includes both respondents willing to extend for zero financial incentive and those unwilling to extend without a financial incentive.

RAND *RR1034-S.2*

The major implications from our multivariate models are as follows:

- Demographics, tour characteristics, and individual attitudes affect the supply of extensions, though in potentially different ways, depending on the level of incentive and the particular combination of factors for any given respondent.
- Consistent with the preceding observation, individuals have different propensities to extend at any incentive level, depending on their demographics, tour experiences, and attitudes.
- Regardless of characteristics, including strongly negative perceptions of the impact of tour extensions on various aspects of life, individuals tend to be more likely to extend at higher incentive levels (i.e., the supply of tour extensions is upward sloping).
- The minimum cost of obtaining a fixed number of voluntary extensions likely differs between personnel classes, as defined on the basis of demographic and tour characteristics.

Thus, our analysis suggests a substantial fraction of those serving overseas would be willing to extend their tour of service if a sufficiently attractive incentive package were offered. The next issue is to determine how to structure such incentives so that they are attractive in terms of savings potential as well.

Implementing a Program to Extend Overseas Tours of Service

We examined current extension incentive programs and compared their strengths and weaknesses. We then investigated ways in which the theory behind auction-based incentives points toward ways that would mitigate or eliminate some of the problems with current programs and developed alternatives that would be likely to operate more efficiently.

The Problem with Existing Incentive Programs

There are three problems inherent in the structure of current incentive programs, which are structured on a "take-it-or-leave-it" basis:

1. Incentive pays are difficult to set correctly because the government cannot accurately observe the amount of additional compensation each servicemember requires in order to extend his or her tour voluntarily.
2. Offering the same incentive pay to any eligible servicemember can and usually does result in overpayment, even when the government is able to set the pay level appropriately.
3. Programs offering incentive pay on a take-it-or-leave-it basis are not responsive to changes in servicemember preferences over time.

Programs that offer incentives in kind (versus monetary incentives) pose the additional problem of cost control.

An Alternative Approach

Unlike a take-it-or-leave-it incentive program, an auction mechanism would allow servicemembers to bid for extensions to their current overseas tours, much like Navy personnel bid for their assignments under the Navy's AIP program. Auctions mitigate the first problem because they set incentive pays using information reported by servicemembers via their bids. Competitive pressures rarely push incentive pay down to the minimum each servicemember requires to voluntarily extend. However, auctions deliver lower incentive pays than other programs do. On average, no incentive program with a take-it-or-leave-it structure delivers a greater number of voluntary extensions for a lower sum of incentive pays than an auction does. Finally, auctions eliminate the third problem entirely: Auctions are inherently responsive to changes in preferences for extensions, enabling adjustment of incentive pays in real time.[2]

This, in essence, is how a simple tour extension auction might work: Each servicemember bids on the incentive pay she or he would accept in exchange for extending her or his tour, and then the government ranks the bids submitted from lowest to highest and moves down the ranked list, accepting bids from servicemembers whose extensions would generate net savings and would otherwise work to accomplish the government's operational and personnel management goals.

The preceding scenario implies that auctions can and should be tailored to ensure they work in the interests of the government as well as those of the servicemember. For example, the government could use one or more factors to screen servicemembers before permitting them to participate in an auction, such as requiring servicemembers to meet certain criteria relating to rank, years of experience, or special skills before permitting them to bid for a tour extension in some cases. In addition, the government may want to preclude extensions that would impede the professional development of the extending servicemember or hinder the development of a servicemember waiting to fill the vacated position. In sum, the advantage of this approach is that it ensures the auction selects servicemembers who want to extend (given sufficient incentive) *and* whose tours the government would like to see extended.

The Relationships Among Tour Lengths, Moves, and Costs

The basic relationship between tour lengths and moves is a simple inverse one: Moves per year are equal to the population divided by the average tour length. The relationship becomes more complicated when we consider the effects of various amounts and lengths of extensions, introduce the possibilities for incentives to encourage voluntary tour extensions, and consider the potential effects of such constraints as operational and professional development considerations. But the basic inverse nature of this relationship holds regardless of the refinements added.

---

[2] To be sure, there are some potential drawbacks of auctions. The cost of setting up and administering a bidding system may be greater than the cost of administering existing incentive programs for extending tour lengths. In addition, collusive behavior among servicemembers may be a greater risk when bidding for tour length extensions. This has not been a problem for the Navy's AIP program, but it would be easier for respondents to collude in an extension incentive program because many potential bidders would be in the same location. Countering the inclination for collusion, of course, is the risk of bidding too high and losing a desirable extension opportunity; program managers would want to ensure potential bidders understand this risk.

At the onset of any notable increase in average tour lengths, regardless of cause, there will be substantial year-to-year variation and an uneven pattern of avoided moves and, thus, in the costs and savings in the part of the PCS program being affected. The instability of avoided moves will be even greater if there is year-to-year variation in the numbers assigned to a base and the proportion of those willing to extend, as there almost certainly will be in practice. As such, it will be impossible to make exact forecasts of the numbers of moves that can be avoided in any given year or the yearly amount by which the budget can be reduced as a result of any policy, voluntary or otherwise, to extend the lengths of tours. It is nevertheless possible to estimate long-run average savings that could accrue from any given change in the PCS program, and these estimates are useful both in helping to compare alternatives and in determining payment levels that will keep incentives in line with their savings potential.

Our savings analyses examined in some detail the potential effects of differences in the following factors:

- extension rates (regardless of cause)
- reasonably sized incentives
- possible professional development and operational constraints.

We then investigated the effects that could ensue from a range of combinations of these different factors, leading to various results that collectively describe the range of possibilities for avoided moves and, thus, saved PCS program funds. For example, in one of the many possible cases we considered, we estimated[3] savings for a case in which 40 percent of overseas tours could be extended by a year without offering any incentives; this case would yield long-run average annual savings in the range of $95 million. A second and a third case, simulating auctions, started with comparable assumptions and incorporated the possible effects of incentive pays. In the second case, the government was assumed to be able to pay incentives differentially across the population of bidders, and in the third the government paid the same incentive to all who were selected for extension. The estimated average savings in the second case were about $84 million annually, compared with $19 million in the third case; together, these two could be considered limiting cases.

The $95 million and $84 million cases are essentially theoretical upper bounds, assuming as they do the government could draw out voluntary extensions at a 40-percent rate and, in the second case, limit incentive payments with a perfectly discerning eye on each person's minimum acceptable price.[4] On the other hand, it may well be possible to improve on the $19 million figure through implementation of an auction mechanism, depending on how the auctions are managed and how eligible servicemembers are selected. Finally, we stress once again in the auction cases the estimated extensions are voluntary, thus minimizing or, in many cases, eliminating negative consequences for servicemembers. In contrast, given the data and analysis presented in this report, it is essentially impossible that an across-the-board tour length increase would affect only those who would have volunteered anyway.

---

[3] The estimates used data available from the services' FY 2015 Budget Justification Books.

[4] Note also that all of these figures derive from assumptions we made based on the stated preferences of respondents in the DMDC survey. They have not yet been validated by revealed preferences—actual behavior—and thus should be considered illustrative of the potential savings.

Recommendations

We conclude with a capsule summary of our chief recommendations.

- **Implement an auction-based incentive program.**

We recommend examination of an auction-based program. Appendix M discusses in detail how an auction pilot might be designed. Such a program is likely to yield PCS savings, enable better longer-term estimates of program effectiveness, and inform decisions as to how to refine a set of programs in which both the servicemembers and the government benefit.

- **More fully evaluate existing incentive programs, both financial and in kind.**

Regardless of whether or not the government wishes to pursue the pilot program, we recommend existing programs be evaluated in terms of their net costs (or savings) to enable better informed cost/benefit decisions.

- **Continue to provide the flexibility to balance between personnel management goals and the goal of achieving PCS savings.**

We have emphasized the potential value of programs that will aid in achieving such a balance. Such programs could bring about longer average tours, more stability, and some savings *without* disruptive and damaging side effects.

Acknowledgments

We are indebted, first, to Juliet M. Beyler, Michael A. Pachuta, Rennie Vazquez, and COL John W. Francis from our sponsor's office, the Office of the Under Secretary of Defense for Personnel and Readiness. Without their guidance, insights, patience, and support, this research would not have been possible. We would also like to thank Stephen B. Nye for his assistance in the final stages of coordinating our publication effort.

Equally critical to our success was the support and advice we received from the DMDC. We are especially grateful to Mary Dixon, the center director, and to the staff who supported and materially guided our efforts to incorporate our data and information needs into their annual Status of Forces Survey. At the risk of missing some who deserve recognition, we offer special thanks for help on our survey needs to Kimberly Williams, Michael T. DiNicolantonio, and all their staff who generously incorporated our needs and helped us frame the algorithms underlying many of our questions to better achieve our aims.

We would also like to offer thanks to Anthony A. Bown, Kerry A. Cerny, and Lt. Col. Wesley A. Frasard for their especially conscientious efforts to help us learn about the U.S. Marine Corps' PCS programs. Members of other military service staffs were also quite helpful, but they are far too numerous to list here. We thank them collectively for their advice and support and for their dedicated service to our nation.

Within RAND, we thank Susan Adler for helping us through all the processes of bringing in DMDC's survey data and for managing and safeguarding those data in her archives and Marilyn Yokota for patiently leading us through the steps needed to comply with Human Subjects Protection guidelines.

Finally, we would like to thank our reviewers, Jill Luoto, Bill Gates, and Luke Matthews, for their painstaking reviews, their edits, and their thoughtful insights.

Abbreviations

ACP	Aviation Continuation Pay
ADMF	Active Duty Master Edit File
AFB	Air Force Base
AFQT	Armed Forces Qualification Test
AFSC	Air Force Specialty Code
AIP	Assignment Incentive Pay
ARSOA	Army Special Operations Aviation
AVIP	Aviation Incentive Pay
AWO	Aviation Warrant Officer
AWG	Asymmetric Warfare Group
BAH	Base Allowance for Housing
BAO	Bilateral Affairs Officer
BoG	boots on ground
CEVIP	Career Enlisted Aviation Incentive Pay
CMF	Career Management Field
CMS/IS	Career Management System Interactive Detailing
CNA	Center for Naval Analyses
CONUS	continental United States
COT	intratheater consecutive overseas tour
CRAM	Combinatorial Retention Auction Mechanism
CSM	Command Sergeant Major

CTS	Contingency Tracking System
DAO	Defense Attaché Office
DEERS	Defense Enrollment Eligibility Reporting System
DEIP	Deployment Extension Incentive Pay
DESP	Deployment Extension Stabilization Pay
DMDC	Defense Manpower Data Center
DoD	U.S. Department of Defense
DoDIG	Department of Defense Inspector General
EAS	expiration of active service
ENL	enlisted
EOD	Explosive Ordnance Disposal
FSTE	Foreign Service Tour Extensions
FY	fiscal year
GAO	U.S. General Accounting Office (prior to 2004); U.S. Government Accountability Office (since 2004)
HDP	hardship duty pay
HQMC M&RA	Headquarters Marine Corps Manpower and Reserve Affairs
HRSAP	Human Resources Strategic Assessment Program
IFSTE	Involuntary Foreign Service Tour Extensions
IPCOT	in-place consecutive overseas tours
JASS	Job Advertising and Selection System
JFTR	Joint Federal Travel Regulations
JSOC	Joint Special Operations Command
JUSMAG-P	Joint U.S. Military Assistance Group—Poland
KAIP	Korea Assignment Incentive Program
MAAG	Military Assistance Advisory Group
MI	military intelligence
MOS	Military Occupational Specialty
NAVSCHOLEOD	Naval School Explosive Ordnance Disposal

NDRI	National Defense Research Institution
NRMP	National Resident Matching Program
NSP	Naval Postgraduate School
NSWDG	Naval Special Warfare Development Group
OCONUS	outside the continental United States
ODC	Office of Defense Cooperation
OFF	Officer
OSD	Office of the Secretary of Defense
OTEIP	Overseas Tour Extension Incentive Program
PBS	preferential bidding system
PCS	permanent change of station
PDUSD (P&R)	Principal Deputy Under Secretary of Defense (Personnel and Readiness)
PDMRA	Post-Deployment/Mobilization Respite Absence
PITE	Point in Time Extract
PME	professional military education
PRD	projected rotation date
QUAD	quality-adjusted discount
RAF	Royal Air Force
ROK	Republic of Korea
RPA	remotely piloted aircraft
S3AM	Sequential Self-Selection Auction Mechanism
SAC	Senate Authorizations Committee
SAO	Security Assistance Office
SCO	security cooperation organization
SDIP-C	Sea Duty Incentive Pay—Curtailment
SDIP-E	Sea Duty Incentive Pay—Extension
SGM	Sergeant Major
SMU	Special Mission Units
SOAR	Special Operations Aviation Regiment

SOCOM	Special Operations Command
SOF	special operations forces
SOFS	Status of Forces Survey
SOFS-A	Status of Forces Survey of Active Duty Members
SRB	Selective Reenlistment Bonus
STG	Special Tactics Group
STS	Special Tactics Squadron
TOS	time on station
TSP	Thrift Savings Plan
UMBS	University of Michigan Ross School of Business
USAF	United States Air Force
USS	United States Ship
VSBAP	Voluntary Stabilized Base Assignment Program
WTA	willingness to accept

CHAPTER ONE

Introduction

The Department of Defense (DoD) moves about one-third of its military servicemembers each year. Recently, the Senate Authorizations Committee[1] expressed its belief "that increasing tour lengths will not only result in cost savings, but it will also lead to less stress on the force and hardship on families that are forced to move frequently. In addition, longer tours will ultimately lead to better performance since servicemembers will have more time in a specific job before departing." The Senate was particularly concerned with operational and rotational moves, since the services have somewhat more discretion in managing these moves, rather than accession, training, unit, and separation moves, which are more or less a direct reflection of programmatic requirements. The committee directed the Under Secretary of Defense for Personnel and Readiness to provide a report that "lays out a plan for the Department of Defense to increase the length of tours" and stated that the report should include an analysis of the impact of increased tour lengths on families, quality of life, and job performance. The committee asked that the report examine the impact that increased tour lengths would have on promotion opportunities[2] and servicemembers and their families serving in hardship locations. Finally, the committee asked that the report identify the cost savings associated with increasing tour lengths.

To aid in preparation of the requested report and to broaden understanding of alternatives for increasing time between permanent change of station (PCS) moves, the Under Secretary for Personnel and Readiness asked the RAND Corporation to undertake a multifaceted analysis focusing on both single and married military personnel currently serving or who had recently served at locations that might be appropriate candidates for an increase in tour length. We focused on overseas tours because they are the most expensive of all PCS moves. Of particular importance was an assessment of the impact that increasing tour lengths might have on quality of life, job performance, and morale of both servicemembers and their families. As work on this project progressed, it became obvious that our research should focus as well on alternatives both for rotational moves (i.e., to and from overseas) and operational moves (those within a geographic area).

This report presents the results of RAND's analysis. Chapter Two of the report examines key aspects of current PCS policy and catalogs incentive pay programs currently offered to encourage voluntary tour extensions. In general, the services have set levels for monetary in-kind extension incentives up front, based on their assessment of the amounts required to

[1] See Senate Report 112-196 (a committee report that accompanies the fiscal year (FY) 2013 Senate defense appropriations bill, H.R. 5856).

[2] PCS moves do not directly affect promotion opportunities. But they do affect professional development opportunities, which can in turn influence promotion opportunities.

induce the desired number of extensions. These incentive pays are offered on a take-it-or-leave-it basis: Eligible servicemembers may accept or reject the pay and terms offered, but they may not make a counteroffer or attempt to negotiate.

Following the discussion of current programs and incentives, we examine the current willingness of the force to voluntarily extend tours, along with the relative importance of numerous influencing factors. Working with the Defense Manpower Data Center (DMDC) through the 2013 Status of Forces Survey of Active Duty Members (SOFS-A),[3] RAND crafted a number of questions designed to elicit information about servicemembers' propensity to extend their tours overseas and the factors that influence that decision. Chapters Three and Four present RAND's analysis of the survey data. Chapter Three assesses the force's willingness to extend voluntarily (without incentives) and reports stated attitudes and perceptions about the impact of longer overseas tours on career prospects, well-being, finances, educational plans, job performance, and overall satisfaction with military service. Chapter Four explores the impact financial incentives may have on servicemembers' willingness to extend. The end result of the analysis is an estimated "supply curve" that specifies the fraction of the force willing to extend their tours by 12 months at various levels of incentive pay. This supply curve is based on stated behavior as implied by survey responses, rather than observed behavior, and is thus subject to potential hypothetical bias. Nevertheless, the analysis points toward a potentially larger role for financial incentives in persuading servicemembers to extend their tours.[4]

Given the potential for financial incentives to induce more servicemembers to accept longer tours at their current overseas base of assignment, Chapter Five examines the most cost-efficient way to design and implement such an incentive program. We generally find that offering incentive pay on a take-it-or-leave-it basis is much less efficient than allowing servicemembers to bid for tour extensions. A bidding program would enable service program managers to select those servicemembers who are most willing to extend their tours and then set their incentive pays at appropriate levels. The Navy's experience with its Assignment Incentive Pay (AIP) program, which allows sailors to bid for hard-to-fill billets, suggests that instituting a bidding program to assign tour extensions could generate a number of benefits, including a higher rate of volunteerism, cost savings relative to existing programs for inducing voluntary tour extensions, increased retention, and greater flexibility to adjust incentive pays over time.[5]

Chapter Six explores the cost savings that might result from implementing programs that extend tours—e.g., extending time on station (TOS). It explains the salient aspects of the dynamic relationships among tour lengths, extension rates, factors that could limit flexibility in allowing (or encouraging) extensions, and the overall impact these variables can have on costs and savings in PCS programs. Chapter Seven presents our conclusions and recommendations.

---

[3] The Status of Forces Survey (SOFS) program is a series of web-based surveys of the total force designed to allow DoD to evaluate existing programs and policies, establish baselines before implementing new programs and policies, and monitor progress of programs and policies and their effects on the total force (DMDC, 2013). The survey is representative of the entire force. See Appendix N for more details about the 2013 SOFS-A, which is a survey of active-duty servicemembers.

[4] There is already some history of successful use of financial inducements for tour extensions. While the analyses in this report strongly support a finding that financial incentives will induce more extensions, the effects of some of the incentives in our analyses, as we note in several places in this report, are based on survey responses and have not yet been validated by actual responses to such incentives (i.e., by revealed behavior). Thus, in part because of the importance of examining such revealed preferences, these findings further demonstrate the value of using a pilot program to obtain better estimates of the potential of incentives.

[5] Appendix L provides a description of the Navy's AIP program.

CHAPTER TWO

Current Permanent Change of Station Policy and Programs to Increase Tour Lengths

Introduction

PCS moves take place when military personnel enter or leave their service or when they are reassigned from one duty station to another. In FY 2014, the total cost of the PCS program was $4.4 billion, of which $1.5 billion went toward rotational moves (transoceanic moves to or from an overseas duty station) and $1.3 billion went toward operational moves (moves within the continental United States [CONUS] or an operational theater) (DoD Comptroller, March 2014).[1]

Each service pays its members' PCS travel expenses from its military personnel appropriations. Congress cut funding from military personnel accounts by approximately $146.8 million in FY 2013 and by $294.3 million in FY 2014 (DoD Comptroller, March 2014). The FY 2014 reduction was categorized as being for "PCS efficiency" ("Consolidated Appropriations Act," 2014). As a result, there is pressure on the services to reduce PCS expenses in an effort to meet budget mandates.

There are two main ways the services can achieve PCS spending reductions. One is to reduce the cost per PCS move by using more cost-effective modes of transportation, shipping, and storage, as the DoD Inspector General (DoDIG) has recommended (DoDIG, 2014). Proposed efficiency initiatives include reducing the weight of household goods for which the services pay shipping costs, reducing the length of time for which the services will pay storage costs, and exploring the use of commercial flights instead of Patriot Express. However, it would likely take substantial efficiency improvements to save a significant amount of PCS moving funds.[2] The other way is to reduce the overall number of PCS moves, and particularly the number of rotational and operational moves, which tend to be both the most expensive and the most responsive to changes in policy, such as changing overseas tour lengths.

Historically, the numbers of accession and separation moves are rather stable and depend on overall force strength. In contrast, the number of rotational and operational moves can be reduced through various policy actions, such as increasing the prescribed lengths of overseas

[1] See Appendix A: Description and Cost of PCS Moves.

[2] The DoDIG report lists a number of PCS cost-reducing opportunities: introducing stricter weight restrictions on the items personnel can move, limiting overpayments for storage, and exploring the use of commercial flights instead of Patriot Express. It does not estimate what these initiatives would save. However, it seems difficult to achieve sizeable savings by reducing weight allowances and storage periods or by shifting personnel from Patriot Express to commercial carriers. Conducting a comprehensive cost-benefit analysis of these proposals may be worthwhile, but doing so is outside the specified scope of the current study.

tours or offering incentive pay to servicemembers who volunteer for back-to-back tours in the same location. This report explores the potential results of large-scale extensions of tour lengths, voluntary or otherwise, but concentrates on options for encouraging servicemembers to voluntarily extend their tours.

Lengthening the average time served per tour could generate substantial PCS savings. However, extending tour lengths at less desirable locations could adversely affect the morale and well-being of servicemembers and their families. Financial incentives could be used to mitigate the adverse effects, but if these incentive programs are poorly designed, their costs could outweigh any PCS savings. That is why designing cost-effective mechanisms for encouraging tour length extensions is of key importance. Our report explores the implications of various mechanisms, with a view toward achieving tour length extensions at lowest cost, while preserving or improving the well-being of the force.

Tour Length and Tour Curtailment Policies

It has been well known since the 1970s and 1980s that the number of PCS moves, and therefore PCS costs, is sensitive to small changes in average tour lengths (U.S. GAO, 1985), as well as to the distances traveled between tours. DoD can therefore reduce PCS expenditures through four policy actions: (1) establishing longer prescribed tour lengths (longer minimum TOS requirements), (2) limiting the conditions under which tour curtailments are authorized, (3) encouraging members to extend their tours, and (4) offering back-to-back tours in the same location.

Past research is divided on the benefits of actions 1 and 2, since mandating longer TOS requirements and restricting curtailments could conceivably reduce morale and inhibit career development, therefore negatively affecting readiness and retention. In contrast, options 3 and 4, which increase personnel choice in the assignment process, could potentially reduce manpower costs while simultaneously increasing job satisfaction, thereby improving readiness and retention. The services could conceivably target options 3 and 4 to mitigate any negative effects on career development. Although we have not conducted a detailed cost-benefit analysis of these options, our report focuses on option 3, which offers the greatest flexibility and lowest downside risk.

Prescribed overseas tour lengths are listed in the Joint Federal Travel Regulations.[3] Tour lengths are typically the same for members of each service at the same station or geographical location but vary between "accompanied" and "unaccompanied" tours.[4] The Under Secretary of Defense for Personnel and Readiness establishes them through consultation with the secretaries of the military departments, the geographic combatant commanders, the directors of the defense agencies, and the chair of the Joint Chiefs of Staff. Together, they set tour lengths with the aim of enhancing operational readiness by stabilizing the workforce in each unit, reducing PCS costs, and improving quality of life for servicemembers and their dependents.[5] Since 1957,

---

[3] See Appendix B: Prescribed Lengths for OCONUS Tours.

[4] "Accompanied by dependents" tours are authorized for some eligible members at certain locations outside the continental United States (OCONUS). Dependents are then permitted to accompany the servicemember on his or her PCS move at DoD expense.

[5] See DoDD 1315.07 and DoDI 1315.18 for relevant instruction.

DoD's stated policy has been that tour lengths in a location should reflect the "desirability" of the location and its standard of living. DoD also strives to achieve professional development and equity objectives—for example, by providing personnel with a balance between assignments to more desirable and less desirable locations.

There is little evidence, however, that tour lengths are decided based on a formal analysis of the cost-benefit trade-offs in terms of PCS costs, morale, readiness, professional development, and retention. Furthermore, the high level of persistence in prescribed tour lengths over time suggests that TOS requirements may not be regularly reevaluated to reflect changing conditions.

Past research is inconclusive on the benefits of lengthening overseas tours and stateside TOS requirements beyond their historic levels. Doing so is associated with both advantages and disadvantages. On the one hand, longer average tour lengths can reduce the number and cost of PCS moves and increase mission continuity and readiness by reducing turnover and keeping personnel in their jobs longer once they are trained. In addition, longer tours could improve family well-being by reducing the number of moves required of military families, a frequent complaint in quality-of-life surveys. On the other hand, prolonged tours, particularly those at undesirable locations, risk damage to morale and possibly undermine recruiting and retention efforts. Longer tours may also upset the distribution of duty assignments between desirable and undesirable locations and undermine career development by reducing the breadth of training that servicemembers receive and reducing the opportunities they have to serve in important developmental assignments.

There is some evidence that simply increasing prescribed tour lengths may not be an effective way to increase the average time actually served per tour. This is because tour completion rates tend to be higher for shorter tours than for longer tours. For example, a 2007 Center for Naval Analyses (CNA) study found that there is only a small difference in average sea time per tour between 48- and 60-month tours in the Navy because 45 percent of 60-month tours are never completed, compared with only 21 percent of 48-month tours (Koopman and Gregory, 2007).

The CNA finding suggests that the effect of any increase in prescribed tour lengths could depend heavily on tour-curtailment policies—i.e., the conditions under which servicemembers are allowed to leave before their tours are completed. However, past research is inconclusive as to whether current levels of tour curtailments are justified and whether they might be responsive to policy changes. When the U.S. General Accounting Office (GAO) analyzed the question in 1985, it found that most curtailments were for reasons that seemed justified, including compassionate or humanitarian reasons, medical reasons or pregnancy, high-priority job reassignments, military training requirements, or promotion. Nonetheless, when GAO surveyed servicemembers who had ended their tours early, 50 percent from each service responded that they could probably have served out their tours without suffering any adverse effect (U.S. GAO, 1985). A more recent study by the Air Force Audit Agency found that 24 percent of the airmen reviewed had conducted a PCS move before meeting their stateside TOS or overseas tour requirements without adequate justification (Air Force Audit Agency, 2010). The study called for improvements to the process for granting waivers.

Although past efforts to impose longer tour lengths have had several negative consequences, there is reason to believe that voluntary tour extensions would be less problematic. Servicemembers are less likely to select tour extensions that would hamper their own careers and are also less likely to cut off tours early that they themselves selected. Policies that encour-

age servicemembers who are so inclined to extend their tours voluntarily or to select back-to-back tours in the same location could offer the benefits described above while mitigating the disadvantages historically associated with longer tours.

Existing Policies for Encouraging Tour Extensions

Involuntary Versus Voluntary Tour Extensions

Current tour lengths for a specific location either are listed in the Joint Federal Travel Regulations (JFTR), Appendix Q, under "OCONUS Tour Lengths/Tours of Duty" or must be approved before selected servicemembers and their families depart for an assignment. Nonetheless, DoD has the authority to extend servicemembers' tours involuntarily once they have already begun, and it also invites servicemembers to request voluntary extensions under certain conditions.

Extending tours involuntarily may sometimes be necessary during wartime to maintain required manpower levels. Due to a policy known as stop-loss, DoD is even authorized to extend a servicemember's tour beyond his or her service commitment to prevent losses of key personnel. The policy of stop-loss was created after the Vietnam War and has been used many times since, during both the Persian Gulf War and the Global War on Terror, as well as during deployments to Somalia, Haiti, Bosnia, and Kosovo. In addition, involuntary extensions have been made on numerous occasions throughout history for operational reasons.

Today, involuntary extensions are seen as an option of last resort because they have many disadvantages, both for the servicemember and the service. They can reduce morale and discipline, impose hardship on military families, and disrupt servicemembers' career development. They can also be expensive. Studies have shown that involuntary assignments made without providing additional compensation have an adverse effect on reenlistment (Christensen et al., 2002; Golfin et al., 2009). To mitigate the negative effects of involuntary assignments, the services typically provide substantial additional compensation to members who are involuntarily assigned. For example, the "Involuntary Extensions in Iraq, Afghanistan or Certain Theater Units Program," authorized in June 2007, entitled eligible servicemembers whose tours had been involuntarily extended to $1,000 in additional compensation per month for the length of the extension. By contrast, the "Voluntary Extension in Iraq, Afghanistan, or Certain Theater Units Program" offered members just $300 per month for voluntary extensions of three months and $500 per month for longer voluntary extensions. In other words, the average cost of each voluntary extension was less than half that of each involuntary extension.

Unsurprisingly, the generally preferred approach is to encourage voluntary tour extensions. Voluntary extensions have the same benefits for the services and servicemembers that longer prescribed tours do (greater mission stability and readiness, lower PCS costs, and improved well-being of military families), but they preserve flexibility. Presumably, they are also more likely to appeal to servicemembers who anticipate the least harm to their professional development.

While there are often servicemembers who are prepared to extend their tours voluntarily without extra pay, the services can induce greater numbers of extensions by providing incentives for doing so. In the next section, we provide an overview of the incentive programs currently offered to encourage voluntary tour extensions.

Some Examples of Incentive Programs for Tour Extensions[6]

DoD's use of special pays or bonuses to encourage servicemembers to extend their duty overseas dates back at least as far as December 1980, when Congress authorized what has become known as the Overseas Tour Extension Incentive Program (OTEIP) under Section 314 of Title 37, United States Code. OTEIP offers eligible Army, Navy, Air Force, and Marine Corps members in designated billets the opportunity to extend their overseas tours by 12 months or more and to choose one of three incentive options: (1) a $2,000 lump sum payment on the first day of the 12-month extension, (2) 30 days of nonchargeable leave during the period of extension, or (3) 15 days of nonchargeable leave plus round-trip transportation at government expense between the overseas location and the port of debarkation in CONUS (20 days for extensions longer than 12 months). The program has enjoyed some popularity: In FY 2013, 122 members of the Marine Corps used the program for a total cost to the service of $346,629.

Assignment Incentive Pay (AIP) programs are the services' newest tools for encouraging voluntary extensions and for compensating involuntary extensions.[7] AIP programs offer eligible Army, Navy, Air Force, and Marine Corps members the opportunity to serve in assignments designated by their service's secretary and to receive additional pay. AIP originated as part of the 2003 National Defense Authorization Act as an effort to offer service secretaries greater flexibility to incentivize assignments for hard-to-fill positions. By 2014, at least 34 distinct AIP programs had been enacted. These programs are cataloged in Appendix D.[8] The services develop and recommend AIP programs to the Office of the Secretary of Defense (OSD) for approval based on their identification of mission critical shortfalls. The maximum monthly rate of incentive pay payable to any member under AIP is $3,000.

One example is the Army's Korea Assignment Program, authorized in 2006. The program offers members the opportunity to volunteer for an initial 24- or 36-month assignment in Korea and receive $300 per month above their regular pay for the length of the assignment, regardless of their rank or years of service. It also offers members who accept an initial tour to Korea the opportunity to extend their tour by 12 or 24 months and receive AIP of $300 per month for the length of the extension. The Air Force has a similar program called the Korea Assignment Incentive Program.

Another example is the Naval Special Warfare Development Group (NSWDG) AIP Program, which offers $750 per month in additional compensation to enlisted personnel who voluntarily remain in an NSWDG billet for an additional 12 months.

Several AIP programs were developed in 2007 to meet manpower needs of the time. For example, the Marine Corps Deployment Extension Program offered Marines $500 per month to extend their enlistments in order to complete a deployment with a unit involuntarily extended in support of Operation Iraqi Freedom, Operation Enduring Freedom, or other missions being carried out at the time. The Army's MOS 09L Interpreter Translator Program offered Army Reserve and National Guard interpreters and translators up to $3,000 per month to volunteer to extend their tours of service beyond 12 months. The AIP level for the Interpreter Translator Program was reduced to $1,500 per month in December 2013.

---

6 See Appendix C: Existing Programs for Encouraging Tour Extensions, In-Place Consecutive Overseas Tours, and Stabilized Basing.

7 The total cost of all special and incentive pays for FY 2014, including those that are not associated with tour extensions, are presented in Appendix E: Combined Cost of All Special and Incentive Pays.

8 See Appendix D: Assignment Incentive Pay Programs Implemented Since 2003.

In each of these cases, the services have set pay levels up front based on their assessment of the pay required to induce the desired number of extensions. These incentive pays are offered on a take-it-or-leave-it basis: Eligible servicemembers may accept or reject the pay and terms offered, but they may not make a counteroffer or attempt to negotiate.

Alternatives to Tour Extensions

In addition to tour extensions, the services have several other tools for reducing PCS costs (see Appendix C). For example, all four services use in-place consecutive overseas tours (IPCOTs) and/or intratheater consecutive overseas tours (COTs), albeit to differing degrees. IPCOT assignments allow servicemembers who complete their initial tours, plus any voluntary extensions, to remain at the same permanent duty stations for a second complete prescribed overseas tour at that location, thereby eliminating a PCS move. COT assignments allow members to proceed to a second prescribed overseas tour in another overseas location instead of returning to CONUS, typically reducing PCS costs.

The sizes of the Marine Corps IPCOT program, COT program, and OTEIP for FY 2013 are shown in Table 2.1.

The Air Force has three additional tools: home-basing, follow-on, and stabilized base assignment programs. Home-basing allows servicemembers to return to the same CONUS duty locations where they served before the overseas tour, which eliminates some PCS travel and moving costs. Follow-on programs allow servicemembers to select their next assignment following an overseas tour but require them to forgo certain entitlements, such as moving their families and household goods.

The Voluntary Stabilized Base Assignment Program (VSBAP) offers airmen the option to volunteer for tours at CONUS bases that have historically been viewed as undesirable by servicemembers and have experienced high turnover. The benefit for the volunteer is a stabilized tour of either four or five years, depending on the location. According to discussions with the Air Force Personnel Center's Assignment Programs and Procedures section, home-basing, follow-on, and IPCOT assignments are popular and receive widespread use because they give personnel more choice. VSBAP receives less use because it is restricted to the most unpopular CONUS locations.

Table 2.1
Marine Corps Extension Programs, FY 2013

Program	Number of Takers	Total Cost	Average Cost	Minimum Individual Cost	Maximum Individual Cost
COT	92	$553,852	$6,020	$815	$23,910
IPCOT	116	$1,173,110	$10,113	$1,390	$28,613
OTEIP	122	$346,629	$2,841	$1,436	$3,278

SOURCE: Headquarters Marine Corps Manpower and Reserve Affairs (HQMC M&RA) Manpower Management Integration Branch, Manpower Management Integration and Administration.

Summary: Extension Incentives in Perspective

Our review of existing policies and programs for encouraging tour extensions reveals that the incentives offered—be they cash incentives or incentives in kind—are set up front, based largely on the government's beliefs about how much is needed to induce servicemembers to extend their tours voluntarily. These incentives are offered to eligible servicemembers on a take-it-or-leave-it basis: Servicemembers may accept or reject the pay and terms offered, but they may not make a counteroffer or attempt to negotiate. In some cases, the incentive levels are set too high, and the number of takers exceeds the desired number of tour extensions. In other cases, the incentive levels are set too low, and the number of takers falls short of the desired number of tour extensions. While offering incentives carries the benefit of inducing servicemembers to voluntarily extend their tours, calibrating the incentive levels to induce the desired number of extensions presents challenges.

CHAPTER THREE

Estimating the Supply of Voluntary Overseas Tour Extensions Without Incentives

Introduction

The willingness of the current force to voluntarily extend tours is critical to any program to increase tour lengths. To this end, we collaborated with DMDC's 2013 SOFS-A to develop survey questions designed to collect responses on the propensity to extend and the factors that influence that decision. We estimated stated propensity to extend respondents' current or most recent tour with a simple "yes" or "no" survey question. We also collected an extensive array of demographic and attitudinal factors that could influence the answer to that question and explored the impact that financial incentives might have on the willingness to voluntarily extend. The collected data ranged from gender and pay grade status to perceived impacts of tour extensions on a variety of quality-of-life and job satisfaction variables. The end result of the analysis of these data is a "supply curve" that describes overseas tour extensions. In this version of a supply curve, the "price" variable is the incentive level offered (which could be zero) to the individual servicemember, expressed in terms of monthly payments during the extension. The "quantity" variable is the proportion of the sample that would extend their tours. An equivalent interpretation of the quantity variable is the probability that any individual would extend his or her tour.

In this chapter, we first describe the data related to the questions asked about the extension of tour lengths and then use descriptive analysis to examine the data. We report the proportions of those who would voluntarily extend and those who would not by demographic category and by the factors that may or may not have influenced the decision. We also describe the stated attitudes and perceptions about the impact of overseas tours on career, well-being, finances, educational plans, job performance, and overall satisfaction with military service. We then estimate a multivariate probability model to explain why respondents would or would not have extended their previous overseas tour by 12 months. Demographic and attitudinal variables are used in the model, as well as characteristics about the most recent overseas tour.

A Survey of Servicemembers

We surveyed a nationally representative sample of active-duty members of the Army, Navy, Marine Corps, and Air Force using the annual SOFS-A administered by DMDC. SOFS-A is a web-based component of the Human Resources Strategic Assessment Program (HRSAP) and is used to collect the attitudes and opinions of active-duty servicemembers on a range of per-

sonnel issues (DMDC, 2014). A single-stage stratified sample design was used to ensure adequate precision for certain key populations, and weights were provided to allow for calculation of representative population-level statistics across the force (DMDC, 2014). Additional details about SOFS-A are provided in Appendix N, including survey methodology and response rates.

RAND worked closely with DMDC staff to incorporate a series of questions related to overseas tours into SOFS-A.[1] In addition, the survey provided data on marital and dependent status, education, and ethnicity, as well as general perceptions about service in the military.[2] The survey was administered late in 2013, and the final data were delivered to RAND early in 2014.

Respondents were asked a number of questions related to overseas tours. Information was collected about when and where their current or last overseas tour took place, its duration, when they arrived in that country, and if their families accompanied them on the tour. They were also asked about their perceived impacts of an extension of that tour for 12 months on aspects related to career, well-being, job performance, educational plans, and finances on a five-point scale ranging from "greatly worsened" to "greatly improved." In a series of discrete choice questions, respondents were then asked if they would have been willing to voluntarily extend their current or most recent tour for 12 months. A subsequent question then asked respondents to describe the importance of potential reasons that may have influenced their choice; this was collected on a five-point scale rating importance from "not at all" to "very large extent."

If they chose not to voluntarily extend, respondents were offered an additional choice to extend their most recent tour for a financial incentive paid every month of the extension. The incentive was a proportion of monthly base pay (keyed to pay grade and years of service) ranging from 1 through 30 percent. The level was randomly assigned to provide variation necessary to estimate the statistical model.

In the event that the respondent declined to accept the financial incentive, a second, higher incentive was offered, and a similar question was asked at the new incentive level. This was done to explore the possibility that the first level was too low to induce the individual to extend, as well as to provide additional variation for the statistical model. The second incentive increased the offer to as much as 45 percent of base pay in order to ensure that all individuals saw an increased incentive.[3]

In order to ensure a sufficient sample size and increase the predictive power of the analysis, the sample includes both those individuals currently serving overseas tours and those who had served overseas in the past. Within the delivered SOFS-A data, 4,324 respondents were active-duty servicemembers currently serving in OCONUS assignments, while 6,982 were permanently stationed CONUS and had served an overseas tour at some time in the past. The effective sample size of respondents for questions relating to extension of overseas tours was thus 11,306, though not all respondents answered every question asked. We statistically tested for differences between those currently serving overseas and those who had served overseas in

---

1 See Appendix F: Survey Questions Relating to Tour Extension.

2 SOFS-A asks a wide range of questions related to the status of forces. Here, we focus only on the questions related to the analysis.

3 Results of the analysis related to financial incentives are presented in Chapter Four.

the past in the multivariate statistical analysis, and, except where noted, there were none. As such, the two groups were combined in the final analysis.[4]

The data were used to statistically model the stated decisions to voluntarily extend at various financial incentive levels (from zero to 45 percent of current base pay) in a multivariate framework. Of particular interest was the proportion of respondents not willing to extend without a financial incentive, the responsiveness of those not willing to extend even with a financial incentive, and the factors that help explain each. This information can be used to compare the costs of alternative incentive programs designed to encourage overseas tour extensions.

Descriptive Statistics

This subsection provides a brief description of the data. We begin by examining the stated willingness to voluntarily extend by demographic characteristics to explore potential differences in the propensity to extend by individual characteristics. We then examine the attitudinal data, including the distribution of the reasons given for the answers, the perceived impacts of tour extension on various aspects of the servicemembers' lives, and their general satisfaction with their military service.[5] This information is provided in order to provide background for the more formal statistical analysis that follows.

Willingness to Extend

In order to gauge the willingness to voluntarily extend an overseas tour, respondents were asked about their likely behavior if they were given the opportunity to extend at their current or most recent tour. Nearly 11,000 individuals (N=10,928) responded to the following question:

> If given the opportunity, would you [voluntarily extend/have voluntarily extended] for an additional 12 months at your [current/most recent] overseas assignment?

A substantial majority—59 percent of respondents—answered "no" to this question, suggesting that for some individuals, additional financial or other incentives would be needed to induce a voluntary overseas tour extension. In addition, as seen in the subsequent figures, there do not appear to be significant variations in the answers to these questions across demographic characteristics or service. In other words, preferences about overseas tour extensions appear to be similar across different demographic categories. These hypotheses will be tested more formally in the multivariate statistical models presented in a later subsection of this chapter.

Figure 3.1 displays the percentage of the sample that would extend by pay grade and service without an additional financial incentive.

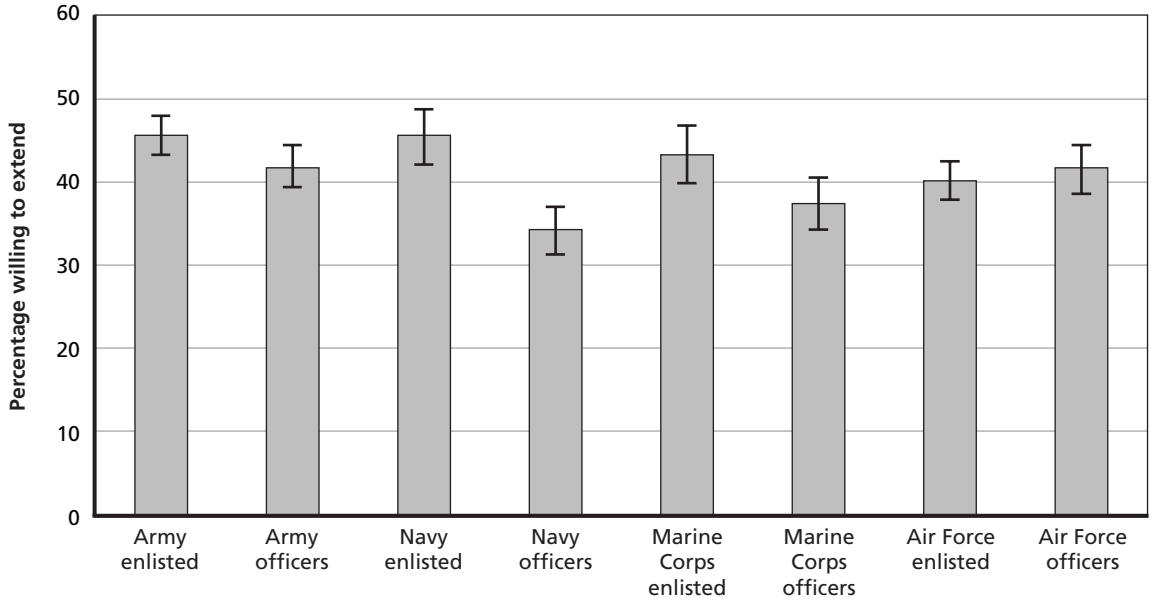
While there is some variation across service and pay grade, between 50 percent and 65 percent of most personnel groupings would not have been willing to extend their tour volun-

---

[4] We use the terminology "most recent" to describe both the most recent tour for those who were currently not on an overseas tour and the current tour for those who were currently serving an overseas tour.

[5] Because the population of interest in our study is those active-duty servicemembers who had previously served or were currently serving an overseas tour (a subset of the total active-duty population), using the weights provided by DMDC would not allow us to create meaningful population-level statistics. As such, all statistics presented in the report are for the sample alone, with equal weighting for each respondent.

Figure 3.1
Percentage of Subsample Willing to Extend Overseas Tours Without Additional Incentive by Service and Rank



NOTES: Results are from the unweighted sample. The 95-percent confidence interval is denoted by error bars.
RAND *RR1034-3.1*

tarily. The lack of patterns in the data suggests that service and rank may not be strong predictors of the decision to extend.

Figure 3.2 displays the percentage of the sample that would extend by marital and dependent status.

Perhaps surprisingly, neither marital status nor the presence of children appears substantially related to the decision to voluntarily extend. This suggests that extension preferences do not differ across individuals with different family situations. Finally, Figure 3.3 displays the sample that would extend by gender and rank.

There is some evidence that women are less likely to extend than men when analyzing by rank; however, most of the confidence intervals overlap. It thus appears that major demographic characteristics are not important statistical predictors of the willingness to extend.

We next turn to the reasons that servicemembers reported for their decision.

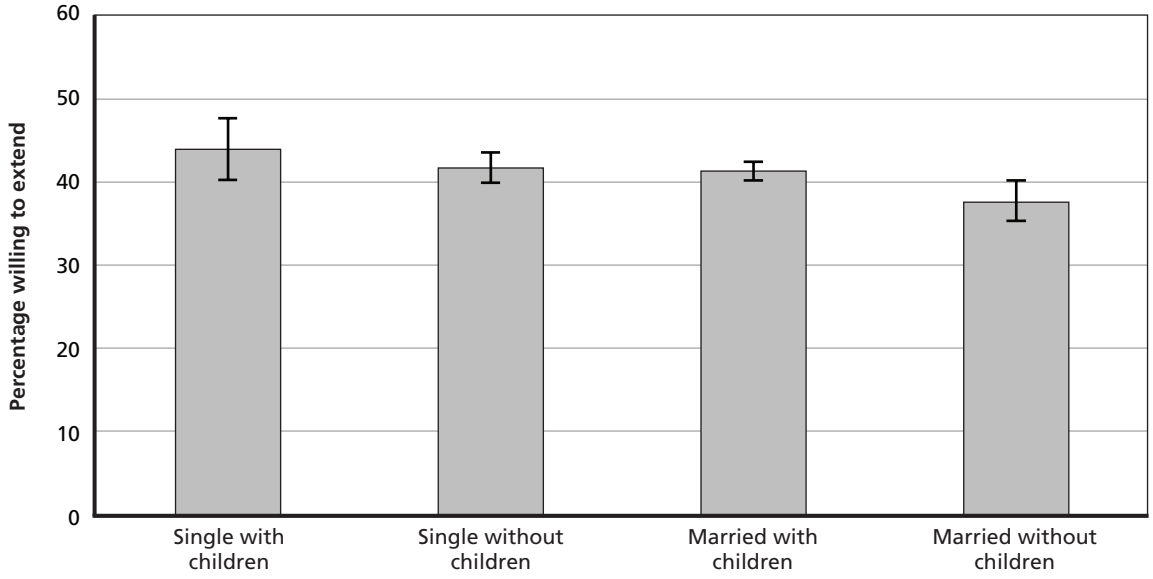
Reasons for Extending or Not Extending

Data were collected on preferences and attitudes regarding tour extensions. Figure 3.4 displays the distribution of responses to the following question:

> To what extent [do/would] the following factors [contribute/have contributed] to your decision [not] to voluntarily extend an additional 12 months . . . ?

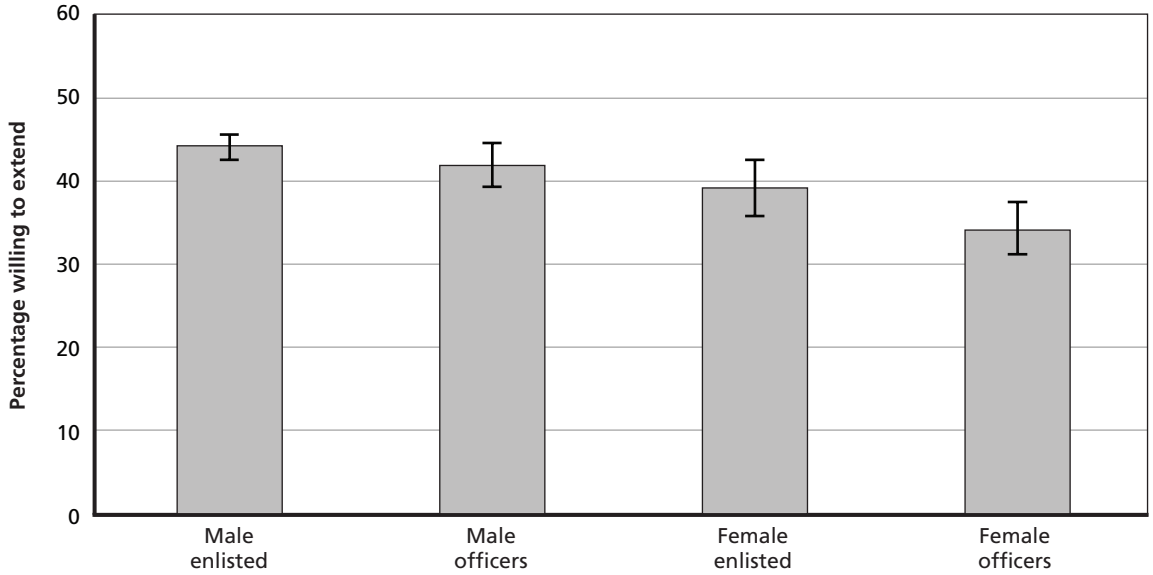
where 1 = not at all, 2 = small extent, 3 = moderate extent, 4 = large extent, and 5 = very large extent. Results are for all respondents, regardless of reported extension decision. The figure is

Figure 3.2
Percentage of Subsample Willing to Extend Overseas Tours Without Additional Incentive by Marital and Dependent Status



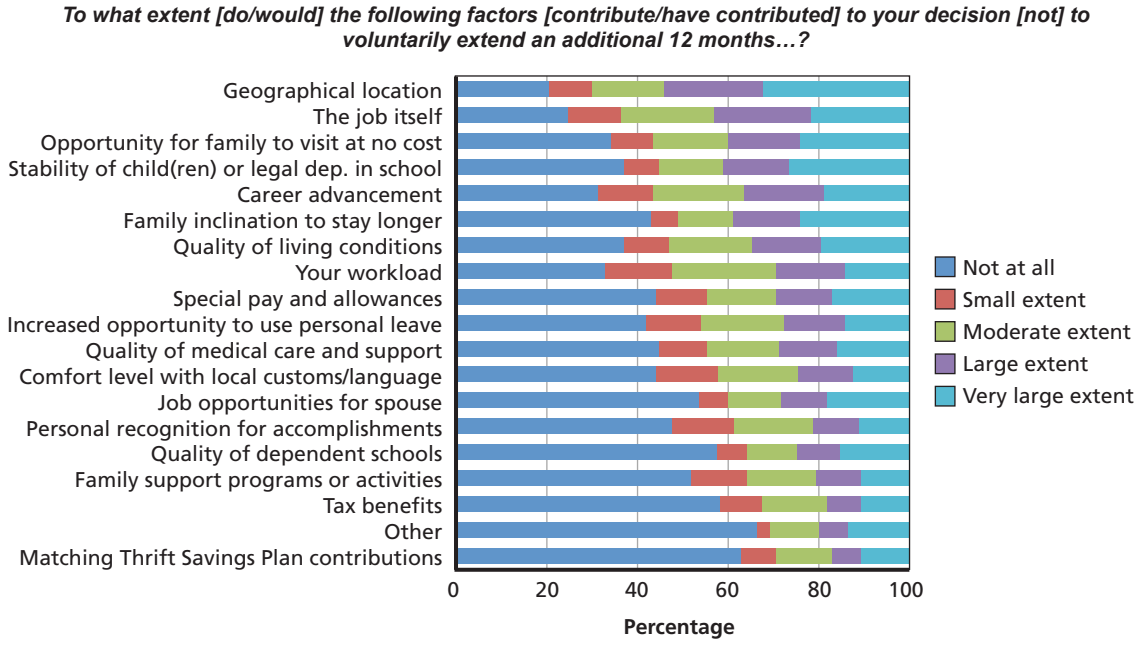
NOTES: Results are from the unweighted sample. The 95-percent confidence interval is denoted by error bars.
RAND *RR1034-3.2*

Figure 3.3
Percentage of Subsample Willing to Extend Overseas Tours Without Additional Incentive by Gender and Rank



NOTES: Results are from the unweighted sample. The 95-percent confidence interval is denoted by error bars.
RAND *RR1034-3.3*

Figure 3.4
Distribution of Stated Reasons for Voluntary Overseas Tour Extension Decision



NOTES: Values of answers were 5 = very large extent, 4 = large extent, 3 = moderate extent, 2 = small extent, and 1 = not at all. Each colored bar shows the proportion of the sample who answered each question with each categorical response. Not all respondents answered every question. The figure is sorted by mean response, with higher means at the top of the figure. Appendix G tables the same information along with information about means, standard deviations, and sample size.

RAND *RR1034-3.4*

ranked by the mean response from largest to smallest for all individuals who answered a particular question.[6]

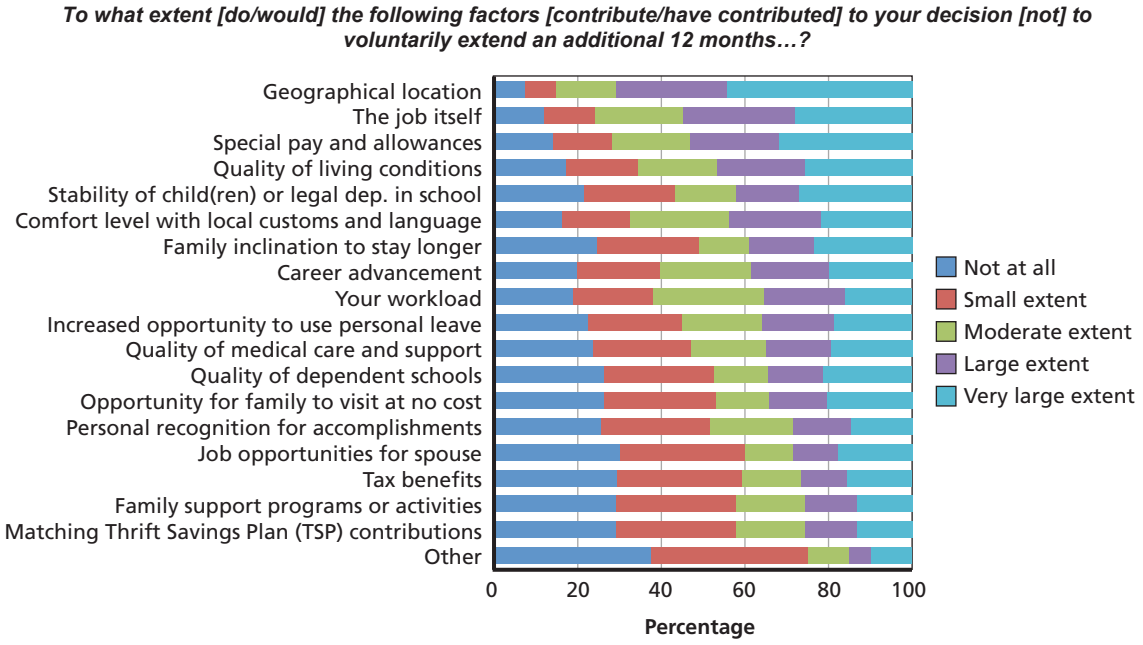
Geographic location is viewed as having a large or very large impact on the decision to extend by a majority (54.2 percent) of respondents who answered the question. This is the only factor that a majority perceived as having a large or very large impact. Subsequent analysis showed that this factor can be either a (strong) positive or negative influence on any given individual for a given location. The influence of geographic location on groups of individuals on average is much less pronounced. Career advancement was cited as a major explanatory factor in the decision (i.e., the reason contributed to a large or very large extent) by just over 36 percent. Other top factors that a majority cited as at least a moderate factor involved the nature of the job itself, opportunity for no-cost family visits, stability of the education of dependents,[7] the inclination (or not) of the family to stay in the location longer, the quality of living conditions, and the workload of the job.

However, as shown in Figures 3.5 and 3.6, the patterns of reasons given for answering the question "yes" or "no" differ between these two groups. For example, geographic location was

[6] Appendix G reports the same information, plus means, standard deviation, and sample size, in table form.

[7] Note that a smaller portion of the sample provided an answer to this question than many of the others, likely due to inapplicability.

Figure 3.5
Distribution of Stated Reasons for Those Willing to Extend Overseas Tours



NOTES: Values of answers were 5 = very large extent, 4 = large extent, 3 = moderate extent, 2 = small extent, and 1 = not at all. Each colored bar shows the proportion of the sample who answered each question with each categorical response. Not all respondents answered every question. The figure is sorted by mean response, with higher means at the top of the figure. Appendix G tables the same information along with information about means, standard deviations, and sample size.

RAND *RR1034-3.5*

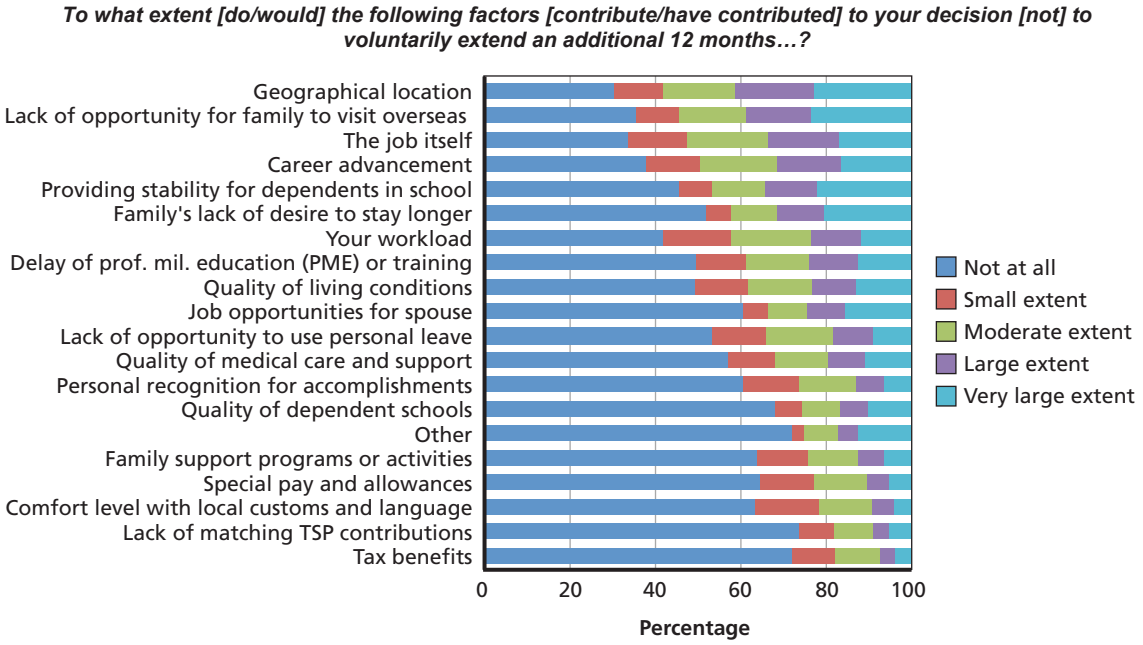
cited as have a large or very large impact for three-quarters for those that were willing to extend (Figure 3.5) but only 40 percent for those that were unwilling (Figure 3.6).

Of those willing to extend (Figure 3.5), 50 percent or more also cited the job itself, special pay and allowances, the quality of the living conditions, and the stability of children or other legal dependents in school as major explanatory factors. Career advancement was a minor factor for nearly one-third of this group but a major factor for 40 percent of it.

In general, those who responded "no" to voluntary extension (Figure 3.6) do not appear to have a dominant reason for answering this way, in that the overall mean five-point scale values are relatively small (ranging from 1.56 to 2.92) and no factor is cited by more than 50 percent as contributing to the decision to a large or very large extent. On the other hand, only the factors of geographic location, lack of opportunity for family to visit at no cost, and the job itself did not garner more than 50 percent of the relevant sample population, indicating that they contributed to a small extent or not at all. Geographic location was cited as contributing to a large or very large extent by 41 percent of the sample but was also relatively unimportant for another 42 percent.[8] Career advancement was cited as a major explanatory factor in not extending by nearly one-third of the sample but as a small factor or a nonissue for slightly more than 50 percent.

[8] The actual location of the overseas tour as a determinant of the probability of extending is used in the formal statistical model; the results presented here are not conditioned on location.

Figure 3.6
Distribution of Stated Reasons for Those Not Willing to Extend Overseas Tours



NOTES: Values of answers were 5 = very large extent, 4 = large extent, 3 = moderate extent, 2 = small extent, and 1 = not at all. Each colored bar shows the proportion of the sample who answered each question with each categorical response. Not all respondents answered every question. The figure is sorted by mean response, with higher means at the top of the figure. Appendix G tables the same information along with information about means, standard deviations, and sample size.

RAND *RR1034-3.6*

Impact of a 12-Month Extension

Figure 3.7 displays the distribution of responses to the following question:[9]

> What impact, if any, would a 12-month extension to your [current/most recent] overseas assignment [have/have had] on . . . ?

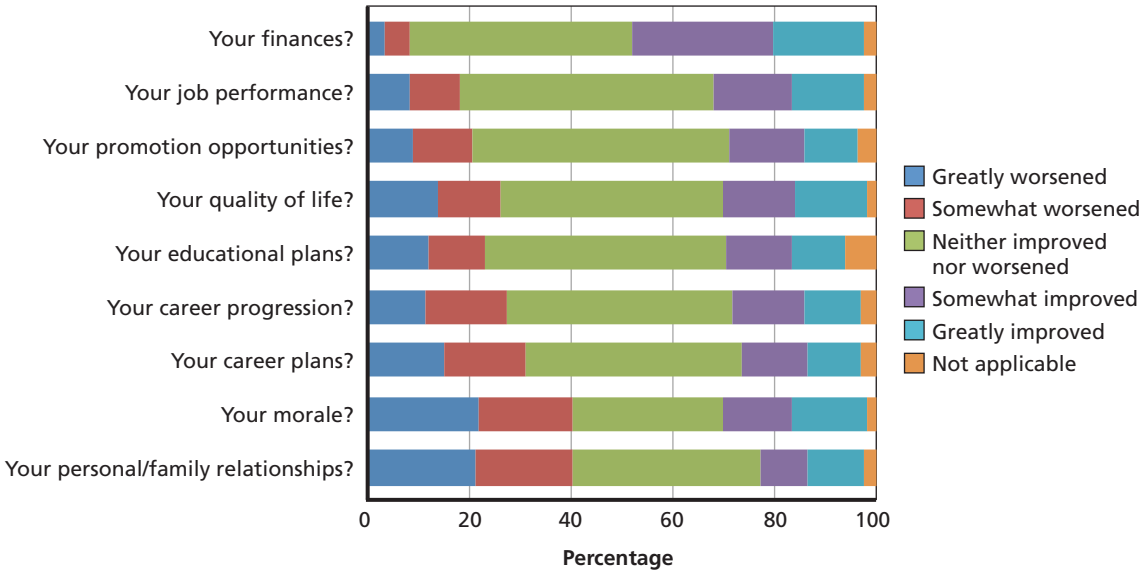
where 1 = greatly worsened, 2 = somewhat worsened, 3 = neither improved nor worsened, 4 = somewhat improved, and 5 = greatly improved. There was also a "not applicable" category. This question was asked to all respondents prior to asking whether or not they would extend.

Responses tended to cluster around a neutral response, indicating a 12-month extension would neither improve nor worsen each factor, respectively. Exceptions include finances, for which a plurality of respondents perceived potential improvements (this was also the highest ranked in terms of means), and morale and personal/family relationships, for which pluralities perceived a negative impact (and these also ranked lowest in terms of means).

Three of the impact questions related to servicemembers' career prospects. Approximately half of the sample perceived no impact on promotion opportunities, with an additional one-quarter expecting an improvement. Similarly, just over half the sample perceived positive or negative impacts on career progression, split nearly equally with a small majority toward the

[9] Appendix G reports the same information, along with means, standard deviation, and sample size, in table form.

Figure 3.7
Distribution of Perceived Impact of Overseas Tour Extension on Career, Well-Being, Finances, Educational Plans, and Job Performance



NOTES: Values of answers were 5 = greatly improved, 4 = somewhat improved, 3 = neither improved nor worsened, 2 = somewhat worsened, and 1 = greatly worsened, plus a not applicable category. Each colored bar shows the proportion of sample who answered each question with each categorical response. Not all respondents answered every question. The figure is sorted by mean response, with higher means at the top of the figure. Appendix G tables the same information split by "yes" and "no" response to the voluntary extension question, as well as information about means, standard deviations, and sample size.

RAND *RR1034-3.7*

negative tail. Forty-two percent were neutral on impact on career plans, with 31 percent perceiving a worsening of plans. Less than 4 percent perceived these questions as not applicable to them in each case.

Satisfaction with Military

Figure 3.8 displays the distribution of responses to the following question:[10]

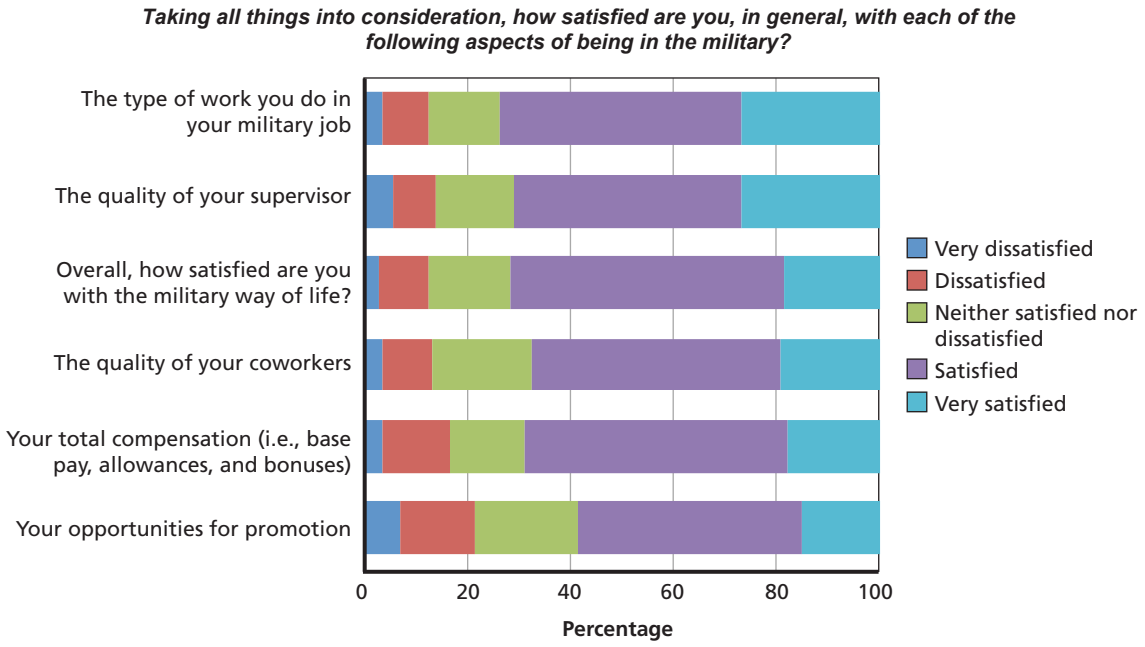
> Taking all things into consideration, how satisfied are you, in general, with each of the following aspects of being in the military?

where 1 = very dissatisfied, 2 = dissatisfied, 3 = neither satisfied nor dissatisfied, 4 = satisfied, and 5 = very satisfied.

Survey respondents were generally either satisfied or very satisfied with aspects of military life, with nearly three-quarters satisfied or very satisfied overall. Dissatisfaction over various aspects ranged from as little as 12 percent to 21 percent at the highest. Those aspects for which dissatisfaction was highest included total compensation and opportunities for promotion. But even in these cases, majorities were still either satisfied or very satisfied.

[10] Appendix G reports the same information, along with means, standard deviation, and sample size, in table form.

Figure 3.8
Distribution of Satisfaction with Military Service



NOTES: Values of Likert-scale questions ranged from 1 = very dissatisfied, 2 = dissatisfied, 3 = neither satisfied nor dissatisfied, 4 = satisfied, and 5 = very satisfied. Each colored bar shows the proportion of the sample who answered each question with each categorical response. Some respondents did not answer every question. The figure is sorted by mean response, with higher means at the top of the figure. Appendix G tables this information and includes additional information about means, standard deviations, and sample size.

RAND *RR1034-3.8*

Multivariate Statistical Model of Voluntary Extension

The combined effects of both demographic and attitudinal factors on the decision of servicemembers to voluntarily extend their overseas tours are explored using an appropriate multivariate statistical model. We found that the following factors were associated with a negative view toward extending tour length:

- those with fewer years of service
- those who were currently married
- those without any college experience
- those with a graduate/professional degree
- non-Hispanic blacks and Asian/Pacific Islanders
- those who served unaccompanied tours or dependent-restricted tours
- those serving shorter tours
- those who had served/were serving in Puerto Rico, Turkey, Guam, and South Korea
- those who tended to relatively emphasize family (dis)inclination to extend, the opportunity for families to visit at no cost, "other" unlisted reasons, and who emphasized no particular reason at all
- those that tended to view the potential impacts on career and well-being as negative.

The details of the analysis are presented below. We first discuss the multivariate model used in the analysis, the explanatory variables used in the model, and the need to cluster the responses from the attitudinal questions and define the baseline category. This is followed by a brief discussion of estimation and the correct way to interpret the results. We then formally present the results summarized above.

The Probit Model

We use a probit model to explain the decision to extend, which models the probability of an affirmative response as a function of the explanatory variables. This is appropriate because the dependent variable is binary (extend or not extend).

Formally, the model is

$$\Pr\left(\text{"}yes\text{"} \mid \mathbf{x}, \boldsymbol{\beta}\right) = \Phi(\mathbf{x}'\boldsymbol{\beta}),$$

where $\mathbf{x}$ is a vector of exogenous explanatory variables, $\boldsymbol{\beta}$ is a vector of coefficients to be estimated via maximum likelihood, and $\Phi(\cdot)$ is the cumulative standard normal distribution, and

$$\mathbf{x}'\boldsymbol{\beta} = \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_K x_K,$$

with each x_k being an indicator variable for a demographic characteristic, tour characteristic, or membership in the cluster associated with that variable.[11]

Explanatory Variables

The major categories of explanatory variables used to model the decision to extend or not are:

- service component
- pay grade
- years of service
- marital status
- dependent status
- education
- ethnicity
- family accompaniment on overseas tour
- length of tour (current tour only)
- length of tour (most recent tour only)
- year of arrival (not on current tour only)
- country of tour
- attitudes related to reasons for extending or not
- attitudes related to expected extension impacts
- attitudes related to aspects of being in the military.

[11] We utilize the probit instead of logit for symmetry with the interval regression model presented in the following chapter. The results are largely unaffected.

Attitudes are included via indicator variables that represent membership in exactly one reason, impact, and military cluster to avoid problems with unobservable latent variables. We next briefly discuss the problem and the clustering methodology used to overcome it.

Clustering Observations by Attitudes

Recent econometric literature has criticized the direct use of answers to survey questions about attitudes and preferences as explanatory variables in statistical analyses, primarily because they only partially represent unobserved latent attitudes and preferences.[12] Nevertheless, these attitudes are almost certainly contributing factors in the stated extension preferences of each respondent. As such, additional methods are needed in order to incorporate the attitudinal data into statistical models of the decisions to extend overseas tours.

The solution to these problems was to group the observations into clusters such that the observed data (i.e., the answers to the attitudinal questions) are similar within a group but different between groups. We group individuals into clusters within three broad categories of the attitudinal factors, with each category corresponding to one set of the attitudinal questions:

- the reasons for the extension decision, called the "reason" clusters
- the perceived impact of a tour extension, called the "impact" clusters
- general satisfaction with military service, called the "military satisfaction" clusters.

Each observation (i.e., set of responses from a respondent) in the data is assigned to one cluster in each category using a mathematical formula that assigns membership on the basis of similar stated attitudes and preferences.[13] Thus, each observation (i.e., respondent) is assigned to exactly three clusters (one in each category). The number of groups within each cluster is determined by the analyst using statistics associated with the methodology.

By design, each resulting group has similar attitudes and can be incorporated into multivariate statistical analyses with indicator variables that represent membership in a particular attitude group. Because membership in a group represents, in principle, a broad set of attitudes common to the group, we avoid the statistical problems associated with direct incorporation of answers to the attitudinal questions.[14]

To aid the reader in interpretation, we describe the average attitudes within each statistically significant cluster in reporting the regression results. Additional details and explanation of the clustering methodology are provided in Appendix H, where we describe the ways in which we grouped attitudes regarding the expected impact of an overseas tour extension on servicemembers' careers, well-being, and other dimensions; the reasons for stating that they would extend or not; and their general attitudes toward military service. While we used one particular methodology to create the clusters and relied on qualitative analysis, such as the

---

[12] Hess and Beharry-Borg (2012) review the literature regarding the direct incorporation of Likert-scale attitudinal questions in statistical models and identify two major issues: (1) Answers to these questions are not direct measures of attitudes but rather functions of them and are thus subject to measurement error; and (2) if answers to the questions are correlated with the error term of the statistical model, then the coefficient estimates are inconsistent.

[13] More specifically, the algorithm groups the data such that the means of the data within a cluster are similar, while means across the clusters are different. As such, each cluster groups individuals with similar attitudes and preferences. Appendix H provides additional details.

[14] In essence, the cluster indicators are proxy variables representing unobserved latent attitudes and are assumed to be uncorrelated with the errors.

signs and significance of cluster membership variables in the probit models, to validate the cluster assignments, readers should be aware that specific quantitative results may be affected by alternative assignments.

Baseline Category

All explanatory variables enter the model as indicator (or dummy) variables representing the presence or absence of a particular trait (demographic, tour characteristic, or cluster membership). The baseline is the category of respondent indicated by all variables set equal to zero. The relationships between variables in the model do not depend on the baseline category.

The baseline values used in this report were as follows:

- service component: Army
- pay grade: E-4
- years of service: six to less than ten years
- marital status: married
- dependent status: dependents
- education: no college experience
- ethnicity: non-Hispanic white
- family accompaniment on overseas tour: family accompanied
- length of tour (current tour only): 36 months
- length of tour (most recent tour only): 24 months to less than 36 months
- year of arrival (not on current tour only): 2013
- country of tour: Germany
- attitudes related to reasons for extending or not: reason cluster 7
- attitudes related to expected extension impacts: impact cluster 6
- attitudes related to aspects of being in the military: military satisfaction cluster 3.

The baseline cluster variables are chosen to represent the clusters to which the largest number of respondents to the choice questions belong; that is, they are representative of the majority or plurality of respondents. Appendix H provides more details.

Estimation and Interpretation of the Results

Unlike the standard linear regression model, coefficient estimates of the probit model do not represent the marginal effect of a change in the explanatory variable; this difference is due to the structure of the model. Thus, we report the marginal effect of a change in the indicator variable (from 0 to 1) on the probability of answering "yes," evaluated at the baseline category.[15] The marginal effect is the change in the probability of a "yes" answer to the extension question, relative to the baseline category, given a change in the indicator variable from 0 to 1. For example, a marginal effect of 0.10 implies that the probability of a "yes" increases by 10 percentage points, relative to the baseline category, if the indicator variable in question changes from 0 to 1.

[15] Using calculus, Thus, the marginal effects of x_j are not constant and depend on the values of the other covariates.

The model was first estimated with all variables included in the specification.[16] After initial estimation, insignificant coefficients were set to zero, and statistical tests were performed to check for a loss of explanatory power. If testing indicated a significant change, the coefficients were retained at their estimated level. To ensure against incorrectly setting coefficients to zero, we used a relatively weak standard of statistical evidence; that is, we retained all coefficients that were (jointly) significant at an 80-percent level of confidence. This tends to increase the efficiency of the remaining coefficient estimates and aids in interpretation of the results.[17]

Several sets of coefficients were ultimately set to zero in the final specification. These included service component, current pay grade, year of arrival at most recent overseas tour location, and military satisfaction cluster variables. As such, no results are reported for these variables below.

The following subsections report the results of the final model. For purposes of exposition, we split the reported marginal effects into major variable categories.

Results Using the Probit Model

Using the final probit model, the mean predicted share of the sample not willing to voluntarily extend is 58.8 percent, virtually identical to the observed proportion of 59 percent.[18] The effects of demographic, tour characteristic, and cluster membership variables are reported below.

Years of Service

Table 3.1 provides the results of the most significant variables from the final model of voluntary tour extension that relate to years of service. All else equal, those with less than six years

Table 3.1
Effects of Years of Service on Decision to Voluntarily Extend Overseas Tours

Variable	Marginal Effect
0–less than 3 years of service	–0.145*** (0.0283)
3–less than 6 years of service	–0.0754*** (0.0201)
6–less than 10 years of service	baseline
More than 10 years of service	n/s

NOTES: Standard errors are in parentheses, calculated via Delta method. *** p < 0.01, ** p < 0.05, * p < 0.1. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

[16] For each statistical model presented in this report, observations for which there was not a complete set of covariates (i.e., data for each included independent variable) were dropped. This is equivalent to assuming that missing information is "missing at random." If this were not the case, coefficient estimates in the models may be biased.

[17] The p-value associated with a likelihood ratio test of excluded coefficients jointly equaling zero was 0.85. Coefficient estimates may be affected by the inclusion or exclusion of variables.

[18] The standard deviation across the sample is 0.352, with a minimum of 0.8 percent and a maximum of 99.2 percent. These measures are calculated by predicting the probability that each individual in the sample would not voluntarily extend and using these predictions to calculate descriptive statistics.

of service are less likely to voluntarily extend their tour than those serving longer. This effect is more pronounced for those serving less than three years.

Current Marital and Dependent Status, Education, and Ethnicity

Table 3.2 provides the results of the most significant variables from the final model of voluntary tour extension with respect to marital and dependent status, educational attainment, and ethnicity. Respondents who are currently unmarried are more likely to voluntarily extend than those who are married. In addition, those currently with some college experience or a four-year degree are less likely to voluntarily extend than those with no college experience or those with a graduate or professional degree.[19] Finally, Asian/Pacific Islanders and non-Hispanic African Americans are less likely to voluntarily extend than other ethnicities.

Table 3.2
Effects of Current Marital and Dependent Status, Educational Attainment, and Ethnicity on Decision to Voluntarily Extend Overseas Tours

Variable	Marginal Effect
Not married	0.0606*** (0.0157)
Married	baseline
No dependents	n/s
Has dependents	baseline
No college experience	baseline
Some college experience	–0.115*** (0.0288)
4-year degree	–0.0673*** (0.0181)
Graduate/professional degree	n/s
American Indian/Alaska Native	n/s
Asian/Pacific Islander	–0.115*** (0.0288)
Non-Hispanic black	–0.0673*** (0.0181)
Non-Hispanic white	baseline
Hispanic	n/s
Multiracial	n/s

NOTES: Standard errors in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

[19] It should be noted that the variables included in this section are defined as of the taking of the survey; they do not necessarily reflect status at the time of service overseas if the respondent was not currently overseas (see subsection below on Family Accompaniment on Overseas Tour).

Family Accompaniment on Overseas Tour

Table 3.3 provides the results of the most significant variables from the final model of voluntary tour extension with respect to the ability of families to accompany the servicemember on the overseas tour.

The family accompaniment variable takes one of four levels:

- *Family accompaniment* indicates that the respondent's family accompanied him or her on the current or most recent overseas tour.
- *No dependents* indicates that the respondent does/did not have dependents (children and/or spouse).
- *Unaccompanied* indicates that the respondent served an unaccompanied tour.
- *Dependent-restricted tour* indicates that the respondent served a dependent-restricted tour (also referred to as an unaccompanied hardship overseas tour or remote tour).

Relative to those who were accompanied by their families or who did not have dependents at the time of their overseas tour, those respondents who elected to serve an unaccompanied tour or served a dependent-restricted tour were approximately 7 to 8.6 percentage points less likely to state that they would voluntarily extend.[20]

Tour Length

Table 3.4 provides results of the most significant variables from the final model of voluntary tour extension with respect to the length of the overseas tour. Longer tours tend to be associated with a larger probability of voluntarily extending, conditional on all other variables remaining constant. This holds true for both respondents currently overseas and those reporting about their most recent overseas tour. The reason for this preference is unknown; however,

Table 3.3
Effects of Family Accompaniment on Decision to Voluntarily Extend Overseas Tours

Variable	Marginal Effect
Family accompaniment	baseline
No dependents	n/s
Unaccompanied	−0.0708*** (0.0270)
Dependent-restricted tour	−0.0861*** (0.0239)

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

[20] The variable *No dependents* equals 1 when the respondent self-reported having no dependents at the time of the most recent overseas tour. For cases in which the respondent is not currently serving an overseas tour and obtained at least one dependent since that last overseas tour, this variable may differ from the demographic variable describing current dependent status discussed in the previous subsection.

Table 3.4
Effects of Tour Length on Decision to Voluntarily Extend Overseas Tours

Variable	Marginal Effect
Current, 12 months	–0.168*** (0.0367)
Current, 15 months	–0.251*** (0.0687)
Current, 18 months	n/s
Current, 24 months	–0.0640** (0.0251)
Current, 30 months	n/s
Current, 36 months	baseline
Current, 48 months	n/s
Recent, < 12 months	–0.137*** (0.0267)
Recent, 12 – < 15 months	–0.155***
Recent, 15 – < 18 months	n/s
Recent, 18 – < 24 months	n/s
Recent, 24–36 months	baseline
Recent, > 36 months	n/s

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

one explanation may be that the costs (in terms of disruption from routine) of ending an overseas tour increase as the length of the original tour increases. It also may be that those with a preference for longer tours are more disposed to voluntarily extend due to their underlying preferences for overseas service.

Country Where Last Overseas Tour Was Served

Table 3.5 provides results of the most significant variables from the final model of voluntary tour extension with respect to the country of service. While geographic location was the primary reason given for both positive and negative responses to the question of voluntarily extending their overseas tours for a 12-month period, the probit model results suggest that, other than some small number of particular cases, individual perceptions of the desirability of particular locations can vary significantly.

This conclusion results from the insignificance of many of the location coefficients in the model, coupled with the high ranking of geographic location as a reason for the answers

Table 3.5
Effects of Tour Location on Decision to Voluntarily Extend Overseas Tours

Variable	Marginal Effect	Variable	Marginal Effect
Afghanistan	n/s	Italy	n/s
Alaska	n/s	Japan	n/s
Australia	n/s	Jordan	n/s
Bahrain	n/s	South Korea	−0.0771*** (0.0217)
Belgium	n/s	Kuwait	n/s
British Indian Ocean Territory	n/s	Netherlands	n/s
Canada	n/s	Pakistan	n/s
Columbia	n/s	Panama	n/s
Cuba	n/s	Philippines	0.271** (0.118)
Djibouti	0.208*** (0.0759)	Portugal	n/s
Egypt	n/s	Puerto Rico	−0.209* (0.113)
Germany	baseline	Qatar	n/s
Greece	n/s	Saudi Arabia	n/s
Guam	−0.118*** (0.0401)	Singapore	n/s
Hawaii	n/s	Spain	n/s
Honduras	n/s	Turkey	−0.208*** (0.0524)
USAF/USMC not assigned	n/s	United Kingdom	n/s
		Other locations	n/s

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent. The other locations category (countries for which no more than ten respondents served) includes Albania, Algeria, American Samoa, Argentina, Armenia, Aruba, Austria, Azerbaijan, Bahamas, Bangladesh, Belize, Benin, Bermuda, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Cambodia, Chad, Chile, Commonwealth of the Northern Mariana Islands, Costa Rica, Croatia, Cyprus, Czech Republic, Democratic Republic of Congo, Denmark, Ecuador, El Salvador, Eritrea, Estonia, Ethiopia, France, Georgia, Ghana, Gibraltar, Guatemala, Guyana, Haiti, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Jamaica, Johnston Atoll, Kazakhstan (Astana), Kenya (Nairobi), Kyrgyzstan, Laos, Latvia, Liberia, Libya, Lithuania, Luxembourg, Macedonia, Madagascar, Malaysia, Marshall Islands, Mexico, Midway Island, Moldova, Mongolia, Montenegro, Morocco, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Peru, Poland, Romania, Russia, Rwanda, Saint Helena, Senegal, Serbia, Seychelles, Slovakia, Slovenia, Sudan, Suriname, Sweden, Tajikistan, Thailand, Tunisia, Turkmenistan, Ukraine, United Arab Emirates, Uruguay, Uzbekistan, Venezuela, Vietnam, Virgin Islands, Wake Island, West Indies, and Yemen.

given.[21] In other words, as we observed earlier in this chapter, it is hard to reconcile the relatively high importance respondents gave to geographical location with the apparent lack of influence the model assigns to most locations, unless we conclude that because individuals may perceive each location differently, one cannot meaningfully label a particular country as desirable or not desirable.

The above notwithstanding, there are six countries in which respondents served that appear to affect the probability of voluntary extension on average, as compared with the baseline country, Germany. Countries that negatively affected the likelihood of extending relative to the others include (in order of strength of the effect) Puerto Rico (31 observations), Turkey (195 observations), Guam (286 observations), and South Korea (1,460 observations).[22] Magnitudes range from –21 percentage points for Puerto Rico to –8 percentage points for South Korea. The two countries identified that resulted in a greater likelihood of extension relative to the other locations were the Philippines (14 observations) and Djibouti (39 observations).[23]

Reason Clusters

As noted above, attitudes and perceptions of respondents enter the statistical model through variables that indicate membership in a "cluster." By construction, members of a *given* cluster tend to answer a set of questions in a similar manner, but patterns of response *across* clusters tend to be different. In this report, we cluster three sets of questions: the importance of a set of reasons for voluntarily extending or not extending (see Figures 3.4–3.6), the perceived impact of a tour extension on various aspects of life (see Figure 3.7), and the overall satisfaction with aspects of military life (see Figure 3.8). Appendix H provides additional details about the clustering methodology and results.

Table 3.6 provides results of the statistically significant variables from the final model of voluntary tour extension with respect to the reason clusters.

Cluster 7 was the baseline category, with cluster members tending to view career considerations as slightly more important to their decision than average and assigning average importance to the other reasons. Membership in clusters 6 and 8 through 10 is associated with a decline in the probability of voluntary extension relative to the baseline, with orders of magnitude varying between 15 and 28 percentage points. Membership in these clusters is characterized by having either no strong reason for the decision, a strong relative importance on family visitation or family (dis)inclination to extend relative to other reasons, or a strong relative importance of an unlisted reason not to extend.

Individuals in clusters 1 through 5 were more likely to extend than baseline, with magnitudes ranging from 18 to 35 percentage points. Average attitudes within these clusters are quite different from each other, with varying weights on different reasons for the decision (see Appendix H for additional details). The most likely group to voluntarily extend was cluster 5, which tended to view all listed reasons as more important than the sample's average.

These results are conditioned on demographic variables, tour characteristics, and membership in the impact and military clusters, unlike the unconditional results in Appendix H. In general, we conclude that not having an important reason for one's decision or emphasizing

---

[21] The marginal effect is the average effect across all individuals represented by that variable. Variation across individuals can result in marginal effects that are imprecisely estimated and/or tend toward zero.

[22] The coefficient on Puerto Rico is less precisely estimated than the others.

[23] The coefficient on the Philippines is less precisely estimated than that of Djibouti.

Table 3.6
Effects of Reason Clusters on Decision to Voluntarily Extend Overseas Tours

Variable	Marginal Effect
Reason cluster 1	n/s
Reason cluster 2	0.252*** (0.0221)
Reason cluster 3	0.180*** (0.0197)
Reason cluster 4	0.270*** (0.0189)
Reason cluster 5	0.354*** (0.0180)
Reason cluster 6	–0.153*** (0.0235)
Reason cluster 7	baseline
Reason cluster 8	–0.173*** (0.0271)
Reason cluster 9	–0.226*** (0.0342)
Reason cluster 10	–0.276*** (0.0210)

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent. For quantitative information about clusters, see Appendix H.

family considerations as important results in a smaller proportion of individuals volunteering to extend.

Impact Clusters

Table 3.7 provides the statistically significant results for the final model of voluntary tour extension with respect to the clusters associated with perceived impact on various elements of a servicemember's career and life.

Consistent with the unconditional findings in Appendix H, signs on each impact cluster variable are as expected, with negative perceived impacts on career, well-being, and the other aspects associated with a lower probability of voluntarily extending. Magnitudes ranged from –52 percentage points for cluster 1 (individuals who tended to view strong negative impacts of extensions on career, well-being, finances, education plans, and job performance) to –21 percentage points for cluster 5 (individuals who tended to view extensions as negatively affecting career and education plans but were more average in their perceptions on other life elements).

Table 3.7
Effects of Impact Clusters on Decision to Voluntarily Extend Overseas Tours

Variable	Marginal Effect
Impact cluster 1	–0.523*** (0.0193)
Impact cluster 2	–0.497*** (0.0180)
Impact cluster 3	–0.496*** (0.0184)
Impact cluster 4	–0.354*** (0.0193)
Impact cluster 5	–0.209*** (0.0186)
Impact cluster 6	baseline
Impact cluster 7	n/s
Impact cluster 8	0.225*** (0.0202)
Impact cluster 9	0.254*** (0.0220)
Impact cluster 10	0.302*** (0.0269)
Impact cluster 11	0.234*** (0.0201)

NOTE: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

Conversely, perception of a positive impact of tour extensions results in a larger probability of extension, ranging from 23 to 30 percent.

Overall, we conclude that perceptions of impact on career, well-being, educational plans, job performance, and finances will definitely affect the willingness of servicemembers to voluntarily extend an overseas tour, with more negative perceptions resulting in greater likelihood of not volunteering. The magnitude of the effect tends to be larger for negative perceptions than for positive perceptions.

Statistically, there is no difference in probabilities between clusters 6 and 7, clusters 9 and 10, clusters 8 and 9, and clusters 2 and 3. This suggests that the probabilities of voluntary extension cannot be distinguished between these clusters.

Summary and Policy Implication of Results of the Survey of Servicemembers

Summary of Findings

Overall, 59 percent of the sample was unwilling to voluntarily extend, with the primary stated reasons being geographic location, the expense of family visitation, and the nature of the job itself. The effects of geographical location tend to be individual-specific, rather than location-specific. That is, with the exception of certain locations discussed below, service members do not consider most locations as universally desirable or not desirable.

Of the 41 percent of respondents who stated that they would be or would have been willing to extend their tour voluntarily for a 12-month period, the principal reasons were the desirability of the geographic location, the nature of the job itself, and any special pay and allowances that were received. The perceived impacts of tour extension were generally split, with about one-quarter of the sample perceiving positive impacts on career, job performance, and educational plans and one-quarter perceiving negative impacts. Expected impacts on morale and personal/family relationships were generally more negative, while expected impacts on finances were perceived as more positive.

A probit model was used to explain the stated decision to voluntarily extend without an additional financial incentive. Results suggested that while attitudes and perceptions about the overall effects of extension were explanatory factors in the decision, differences in individual preferences regarding the desirability of geographic location resulted in only six countries that statistically stood out. Major findings include the following, all else being equal:

- those with less than six years of service were less likely to voluntarily extend
- those who were currently married were less likely to voluntarily extend
- those with some college experience or a college degree were more likely to extend than those without any college experience or with a graduate/professional degree
- non-Hispanic blacks and Asian/Pacific Islanders were less likely to voluntarily extend than other ethnicities
- those who elected to serve unaccompanied tours or dependent-restricted tours were less likely to voluntarily extend
- those serving longer tours were more likely to voluntarily extend
- those who had served/were serving in Puerto Rico, Turkey, Guam, and South Korea were less likely to voluntarily extend
- those who had served/were serving in the Philippines and Djibouti were more likely to voluntarily extend
- those who tended to emphasize family (dis)inclination to extend, the opportunity for families to visit at no cost, or other unlisted reasons and who emphasized no particular reason at all were less likely to voluntarily extend
- those who tended to emphasize the quality of their dependents' schooling, living conditions and quality of medical care, financial concerns, comfort with the locality, the job itself, workload, and geography, as well as those who tended to rank all reasons highly, were more likely to voluntarily extend
- those who tended to view the potential impacts on career and well-being as negative were less likely to voluntarily extend, and those who tended to view the potential impacts on career and well-being as positive were more likely to voluntarily extend.

Policy Implication

The Appropriations Committee of the United States Senate asked the Under Secretary of Defense (Personnel and Readiness) to "lay out a plan for the Department of Defense to increase the length of tours." It expressed particular concern about the impact that increased tour lengths might have on families, quality of life, and job performance. Results of a representative survey of servicemembers indicate that a majority of those currently serving overseas and those who have recently served overseas would not volunteer for such an extension. Their responses suggest that a mandatory program would adversely impact their quality of life and could negatively impact morale and possible job performance. There are, however, many servicemembers who would volunteer for such an extension of their current tours. As we will discuss in the following chapter, a sizeable group of those who would not volunteer could be induced to do so with an appropriate financial incentive.

CHAPTER FOUR

Estimating the Supply of Voluntary Overseas Tour Extensions with Incentives

Introduction

Nearly 60 percent of individuals in the sample did not want to extend their overseas tour. We hypothesized—and economic theory suggests—that more servicemembers would volunteer if financial incentives were offered. We tested this theory using a stated preference experiment. Using the data we collected, we estimated a multivariate statistical model that predicts the proportion of the 60 percent who would not extend without a financial incentive who would extend at increasing levels of additional pay, given the effects of demographic variables, tour characteristics, and cluster membership.

Results from the model show that respondents are more willing to extend with greater financial incentive levels (i.e., the supply curve for tour extensions is upward sloping). There were, however, no statistically significant differences in the responses on the basis of overseas tour location, and we conclude that individuals in many of the clusters behave similarly. More specifically, we find that the following groups are less likely to extend even when financial incentives are offered, other things being equal:

- those in the Navy and the Marines
- those who have served less than six years
- those who are married and are non-Hispanic Whites, American Indians/Alaska natives, or Asian/Pacific Islanders
- those with a graduate or professional degree
- those who elected to serve unaccompanied tours or dependent-restricted tours
- those who served/are serving tours shorter than one and a half years
- those who tended to have unlisted reasons or no reasons at all for their decision
- those who perceive impacts on career and well-being as generally negative
- those who tend to be dissatisfied with military life relative to their peers.

Note the similarity of these effects with those presented in the previous chapter on propensity to extend in the absence of any financial incentives.

We next discuss the data collected for the experiment and the statistical model used, followed by the results.

Financial Incentive Survey Questions

Respondents who answered "no" to the question that asked about voluntarily extending their most recent overseas tour were subsequently asked up to two additional questions in the following format:

> [Would you voluntarily extend an additional 12 months at your current overseas assignment / At the time your most recent overseas assignment concluded, would you have voluntarily extended an additional 12 months] for a monthly financial incentive of $***X***?

Varying the incentive levels ***X*** across the sample allows for estimation of a "supply curve" for tour extensions, with the probability of individual acceptance serving as the quantity and the financial incentive serving as price. The incentive levels shown to respondents were derived from the individual's base pay and were randomly drawn at discrete levels ranging from 1 percent to 45 percent of base pay. Drawing the financial incentives at random provides the variation necessary to properly estimate the model without introducing any bias. Linking the incentive to pay grade eliminates the relative effect of a fixed dollar amount across pay grades. Respondents saw the dollar amount associated with their own pay grades when taking the survey—i.e., respondents selected to be offered a 10-percent incentive saw a dollar figure equal to 10 percent of their own base pay but were not told that this number was 10 percent.

If the respondent said "no" to the first incentive, a subsequent question offered a higher incentive and the question was asked again. This was done to obtain more information about the willingness to extend for individuals refusing the first financial incentive, which improves the precision of the model.

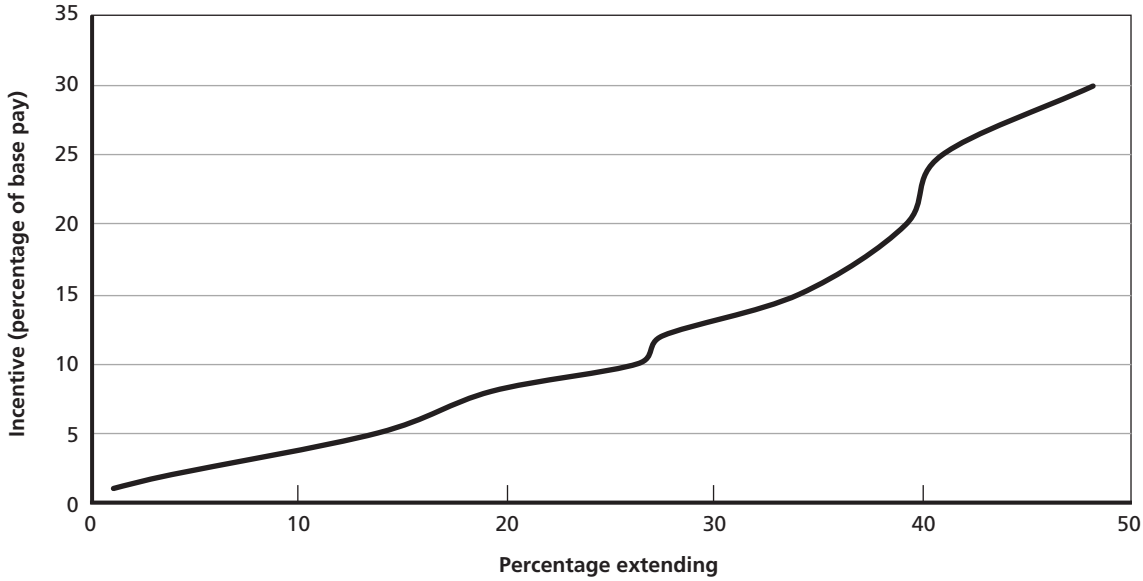
Figure 4.1 provides a visual representation of the proportion of eligible respondents (the 60 percent who declined the initial question) who answered "yes" to the first financial incentive offered. Economic theory suggests that as the incentive level increases, the proportion of respondents saying "yes" at each incentive level should increase—i.e., the responses should yield an upward-sloping supply curve for overseas extensions.

As can be seen in the figure, in aggregate, the sample clearly responded to the first incentive in a manner consistent with economic theory. The curve shows, for example, that for all respondents who were offered a first financial incentive of 15 percent of base pay, approximately 34 percent would have agreed to extend at their current/most recent location. In addition, there is some evidence that as the percentage of the sample willing to extend at a given financial level goes up, the additional incentive needed to get a greater percentage to extend also increases. In other words, the total cost of going from, say, 5 to 6 percent of the sample extending is less than the total cost of going from, say, 35 to 36 percent of the sample extending.

The Interval Regression Model

A simple probit model discussed in Chapter Three does not make full use of the data collected. As such, we use a complementary technique, called interval regression, to estimate the multivariate statistical model representing the relationship between incentive levels and the proportion of the sample willing to extend. Rather than directly modeling probabilities, the interval regression model estimates the minimum incentive level needed to induce tour extension. Probabilities of extension can then be calculated from the estimates.

Figure 4.1
Relationship Between Percentage Extending Overseas Tours and Financial Incentive, First Incentive Level



NOTES: Only respondents who would not extend without a financial incentive were asked this question. The total sample size was thus 6,328. The line represents the actual data, interpolated between first financial incentive levels (1, 2, 5, 8, 10, 12, 15, 20, 25, and 30).

RAND *RR1034-4.1*

Formally, the model is

$$\Pr(lb \le inc \le ub) = \mathbf{\Phi}(inc),$$

where *inc* is the minimum incentive necessary to induce an individual to extend, $\Phi(\cdot)$ is the cumulative standard normal distribution, and *lb* and *ub* are the lower and upper bounds of this incentive as implied by the data. For example, suppose an individual was shown a first incentive of 10 percent of base pay and stated that she or he would extend. In this case, we know that the minimum incentive level needed for extension for this individual lies between zero and 10 percent, though the exact magnitude is unknown.

If the individual would not extend, then we know that the lower bound is 10 percent, and she or he would be asked to extend at a greater incentive level (say, 20 percent) with the second question. If the answer to this question is "yes," then the lower bound is 10 percent, and the upper bound is 20 percent. If not, then the lower bound is 20 percent, and we have no upper bound. Given the information about the bounds, the minimum incentive level needed to induce an extension can be estimated.

The model is completed by letting

$$inc = \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_K x_K,$$

where the *x*'s are the same demographic, tour characteristics, and cluster membership variables as in the previous model, and the β's are coefficients to be estimated. This allows for differences

in minimum incentive levels (or, equivalently, probabilities of extending or not extending) across the sample. Appendix I provides additional methodological details.

Explanatory Variables

The explanatory variables used to model the decision to extend given a financial incentive are identical to those used in the extension-without-financial-incentive model. They include

- service component
- pay grade
- years of service
- marital status
- dependent status
- education
- ethnicity
- family accompaniment on overseas tour
- length of tour (current tour only)
- length of tour (most recent tour only)
- year of arrival (not on current tour only)
- country of tour
- attitudes related to the intensity of factors
- attitudes related to expected extension impacts
- attitudes related to aspects of being in the military.

As in our earlier model, the attitudinal variables are included via indicator variables that represent membership in exactly one reason, impact, and military satisfaction cluster.

Baseline Category

As in the model without financial incentives, all variables enter the model as indicator (or dummy) variables representing the presence or absence of a particular trait (demographic, tour characteristic, or cluster membership). The baseline is identical to that of the previous model and is defined as follows:

- service component: Army
- pay grade: E-4
- years of service: six to less than ten years
- marital status: married
- dependent status: dependents
- education: no college experience
- ethnicity: non-Hispanic white
- family accompaniment on overseas tour: family accompanied
- length of tour (current tour only): 36 months
- length of tour (most recent tour only): 24 months to less than 36 months
- year of arrival (not on current tour only): 2013
- country of tour: Germany
- attitudes related to reasons for extending or not: reason cluster 7 (*Career* + / *All* –)
- attitudes related to expected extension impacts: impact cluster 6 (*Career* / *Well-Being*)

- attitudes related to aspects of being in the military: military satisfaction cluster 3 (*MilSat 3*).

Estimation and Interpretation of the Results

Coefficient estimates of the interval regression model reflect the marginal change in the minimum incentive necessary to induce an extension. To make the results comparable to those of the model of extension without financial incentive, we report the marginal effect of a change in the indicator variable on the probability of answering "yes," evaluated at the baseline category and at a given incentive level. The marginal effect is the change in the probability of a "yes" answer given a change in the indicator variable from 0 to 1.

We calculate the marginal effects at the mean incentive level estimated to induce half of the baseline category to extend. Equivalently, this is the incentive level at which a baseline respondent would have a 50-percent probability of accepting. This level is an appropriate measure of the minimum financial incentive, or minimum "willingness to accept," necessary for an overseas tour extension (see, e.g., Champ et al., 2003).

As in the previous model, the interval regression was first estimated with all variables included in the specification, and then insignificant coefficients were set to 0 to aid interpretation and increase efficiency. Again, a low threshold of statistical evidence was used in this decision; coefficients that were jointly significant at the 80-percent level of confidence were retained.

In the final interval regression model, neither pay grade nor location was a significant determinant of the stated decision to extend overseas tours at a given incentive level. As such, coefficients related to these variables were ultimately set to 0. However, unlike in the previous model, the military satisfaction cluster associated with the least satisfaction for each aspect of military life was significant and thus retained.

The following subsection reports the results of the final model. For purposes of exposition, we again split the reported marginal effects into major variable categories.

Results Using the Interval Regression Model

The minimum incentive necessary to induce an individual *with the baseline characteristics* (and who was not willing to extend without a financial incentive) is 18.39 percent of base pay. Figure 4.2 shows the location of this incentive level on the predicted probability of extension curve for the baseline respondent.

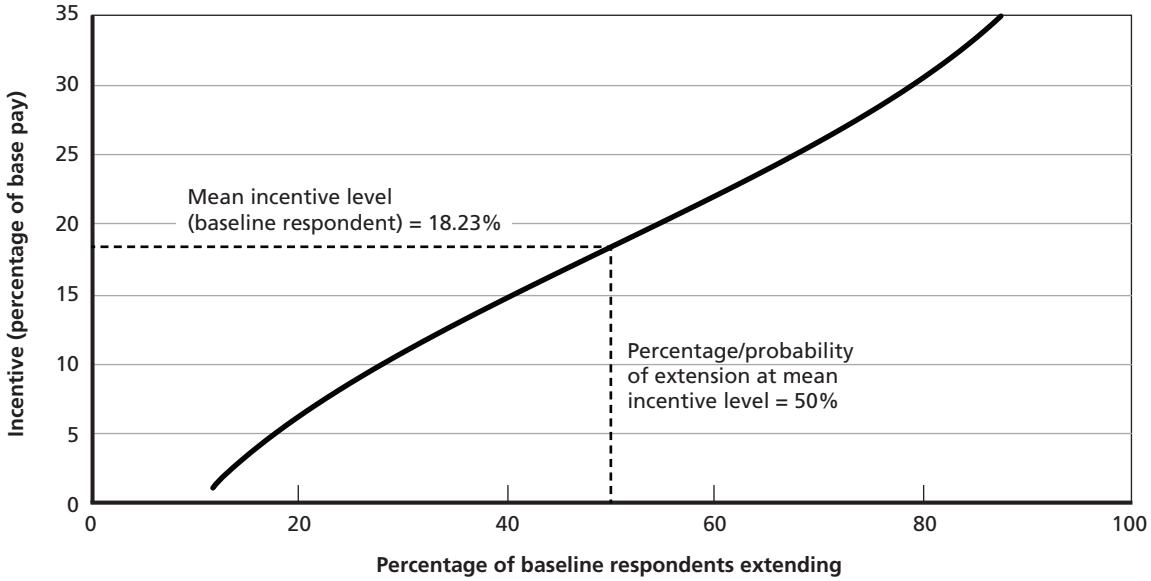
However, there are differences in characteristics across individuals in the sample. Taking these differences into account, the average minimum incentive necessary to induce an extension for all individuals unwilling to extend without an incentive was approximately 23 percent of base pay. This figure is the mean of the predicted minimum incentive level for each individual in the sample.

Service Component

Table 4.1 provides the statistically significant results[1] of the final model for variables related to service component. Relative to the baseline Army category, there is evidence that respondents in the Navy and the Marines are less likely to voluntarily extend at each incentive level, suggesting the need for higher financial incentives to achieve identical proportions of volunteers.

[1] In subsequent subsections, we refer to "statistically significant" results, though, in each case, both significant and nonsignificant variables are included in the tables.

Figure 4.2
Mean Incentive Level and Probability of Extension, Baseline Respondent Unwilling to Extend Overseas Tours Without Incentive



NOTES: The line shows the estimated percentage of baseline respondents extending at each positive financial incentive level (or, equivalently, the probability that a baseline respondent would extend at each financial incentive level) for the final model. Only respondents who would not extend without a financial incentive were asked these questions. The mean incentive level is the incentive associated with a 50-percent share/probability. Baseline respondents were not willing to extend with no financial incentive. Changes in demographic categories, tour characteristics, or cluster membership would shift the curve.

RAND *RR1034-4.2*

Table 4.1
Effects of Service Component on Overseas Tour Extension with Financial Incentive

Variable	Marginal Effect
Army	baseline
Navy	−0.0494*** (0.0165)
Marines	−0.0344** (0.0169)
Air Force	n/s

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

Navy personnel were 5 percentage points less likely to indicate that they would extend at the 18 percent of base pay incentive level, while those in the Marines were approximately 3.5 percent less likely. The difference between the Air Force and Army respondents was not statistically significant.

Years of Service

Table 4.2 provides the statistically significant results of the final model for variables related to years of service. As in the voluntary extension model, those servicemembers with less than six years of service are significantly less likely to accept a given financial incentive than those who served longer. The effect is intensified for those who have served the shortest amount of time (13 percentage points for 0–3 years of service as opposed to 8 percent for 3–6 years of service). Those serving longer than 6 years are more likely to accept an identical offer of percentage of base pay. However, it should be noted that these servicemembers will have a greater base salary for each pay grade.

Current Marital and Dependent Status, Education, and Ethnicity

Table 4.3 provides the statistically significant results of the final model for variables related to current marital/dependent and educational status and ethnicity. There is evidence to suggest that currently unmarried respondents are more likely to accept a given financial offer than their married counterparts but that those with graduate or professional degrees are less likely to extend. However, it should be noted that the variables included in this section are defined as of the taking of the survey; they do not necessarily reflect status at the time of service overseas if the respondent was not currently overseas (see subsection below on Family Accompaniment on Overseas Tour).

Relative to baseline non-Hispanic whites, those respondents identifying themselves as non-Hispanic black, Hispanic, or multiracial are more likely to accept a given financial incentive to extend their overseas tour, with magnitudes ranging from approximately 4.5 to 7 percentage points.

Table 4.2
Effects of Years of Service on Overseas Tour Extension with Financial Incentive

Variable	Marginal Effect
0–less than 3 years service	−0.132*** (0.0264)
3–less than 6 years service	−0.0817*** (0.0199)
6–less than 10 years service	baseline
More than 10 years service	n/s

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

Table 4.3
Effects of Current Marital and Dependent Status, Educational Attainment, and Ethnicity on Overseas Tour Extension with Financial Incentive

Variable	Marginal Effect
Not married	0.0322** (0.0148)
Married	baseline
No dependents	n/s
Has dependents	baseline
No college experience	baseline
Some college experience	n/s
4-year degree	n/s
Graduate/professional degree	–0.0423*** (0.0141)
American Indian/Alaska Native	n/s
Asian/Pacific Islander	n/s
Non-Hispanic black	0.0530*** (0.0174)
Non-Hispanic white	baseline
Hispanic	0.0444** (0.0198)
Multiracial	0.0731** (0.0311)

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

Family Accompaniment on Overseas Tour

Table 4.4 provides the statistically significant results of the final model for variables related to family accompaniment on the current or most recent overseas tour. The family accompaniment variable takes one of four levels:

- *Family accompaniment* indicates that the respondent's family accompanied him/her on the current or most recent overseas tour.
- *No dependents* indicates that the respondent does/did not have dependents (children and/or spouse).
- *Unaccompanied* indicates that the respondent elected to serve an unaccompanied tour.
- *Dependent-restricted tour* indicates that the respondent served a dependent-restricted tour (also referred to as an unaccompanied hardship overseas tour or remote tour).

Table 4.4
Effects of Family Accompaniment on Overseas Tour Extension with Financial Incentive

Variable	Marginal Effect
Family accompaniment	baseline
No dependents	n/s
Unaccompanied	−0.0613*** (0.0229)
Dependent-restricted tour	−0.0976*** (0.0202)

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

Relative to the joint baseline category of either family accompaniment or no dependents, servicemembers on overseas tours in which dependents were either voluntarily left at home or were restricted from accompaniment tend to require a larger incentive to accept voluntary extensions. Probabilities of acceptance at the mean minimum incentive level for the baseline category were lower by approximately 6 to 10 percentage points.[2]

Tour Length

Table 4.5 provides the statistically significant results of the final model for variables related to overseas tour length. Indicators are defined for specified tour lengths for those currently serving overseas tours and for tour length ranges for those not currently serving overseas. In general, shorter tours of less than one and a half years appear to reduce willingness to accept, as compared with longer overseas tours.

Year of Arrival of Most Recent Overseas Tour

Table 4.6 provides the statistically significant results of the final model for variables related to year of arrival of the most recent overseas tour for those not currently overseas. There is little evidence of any pattern in responses related to year of arrival for those that are not currently serving an overseas tour. Nonetheless, relative to arrival in 2013, those respondents who arrived at their tours in 2005, 2006, and 2012 were less likely to extend at a given financial level, while those who arrived in 2004 and 2011 were more likely to answer in the affirmative.[3] Given the lack of a strong temporal pattern, this is likely just a quirk in the data without any policy implications.

---

[2] The variable *no dependents* equals 1 when the respondent self-reported having no dependents at the time of the most recent overseas tour. For cases in which the respondent was not currently serving an overseas tour and had obtained at least one dependent since that last overseas tour, this variable may differ from the demographic variable describing current dependent status discussed in the previous subsection.

[3] The coefficient on 2011 is significant at only the 10-percent level.

Table 4.5
Effects of Tour Length on Overseas Tour Extension with Financial Incentive

Variable	Marginal Effect
Current, 12 months	–0.119*** (0.0301)
Current, 15 months	–0.178*** (0.0493)
Current, 18 months	n/s
Current, 24 months	n/s
Current, 30 months	–0.133* (0.0683)
Current, 36 months	baseline
Current, 48 months	n/s
Recent, < 12 months	–0.0952*** (0.0249)
Recent, 12 – < 15 months	–0.0505** (0.0197)
Recent, 15 – < 18 months	n/s
Recent, 18 – <24 months	n/s
Recent, 24–36 months	baseline
Recent, > 36 months	n/s

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

Reason Clusters

Table 4.7 provides the statistically significant results of the final model for cluster variables that represent reasons for answering "yes" or "no" to the question that asked respondents to voluntarily extend. Clusters are defined in Appendix H.

The coefficient on the marginal effect for cluster 3 (those who tend to view most reasons as more important than the average respondent) indicates that these individuals are about 7.5 percentage points more likely to accept the mean baseline incentive level. This is consistent with an interpretation of this cluster as those respondents for whom financial concerns were a major reason for answering "no" to the voluntary extension without financial incentive question. Cluster 9 is characterized by those who stated that a reason other than the ones included in the list was important. As the coefficient on this cluster is negative, it appears that the effect of this potentially individual-specific reason is to discourage extension. Examples of such reasons from write-in comments include "curfew," "restrictions," and being close to friends and family, among many others. Finally, cluster 10 (those for which none of the possibilities is

Table 4.6
Effects of Arrival Time on Overseas Tour Extension with Financial Incentive

Variable	Marginal Effect
Arrived in 2013	baseline
Arrived in 2012	−0.0999*** (0.0242)
Arrived in 2011	0.0487* (0.0252)
Arrived in 2010	n/s
Arrived in 2009	n/s
Arrived in 2008	n/s
Arrived in 2007	n/s
Arrived in 2006	−0.106*** (0.0369)
Arrived in 2005	−0.0998*** (0.0378)
Arrived in 2004	0.0834** (0.0369)
Arrived in 2003 or earlier	n/s

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

marked as important) members are also less likely to accept the financial incentive, though it is unclear why.

Impact Clusters

Table 4.8 provides the statistically significant results of the final model for cluster variables related to the perceived impact of an overseas extension on various elements of a servicemember's career and life. Clusters are defined in Appendix H.

Only the three clusters least likely to voluntarily extend have a statistically significant impact on the probability of acceptance of a financial offer to extend. Clusters 1–3 generally view the perceived impact of a tour extension as negative on both career and well-being. It is not surprising that those who believed that a tour extension would strongly negatively impact their careers or well-being have a higher minimum incentive level (or, equivalently, are less likely to extend at the mean incentive level). But it is interesting that there is no evidence that the converse is true—i.e., those that believed the extension would positively impact their lives do not necessarily extend in greater proportions at a given incentive level. This suggests that clusters 4–11 behave in the same manner with respect to financial incentives and that unobserved attitudes about the impact of tour extension are not relevant in predicting responses to an incentive for these groups.

Table 4.7
Effects of Reason Clusters on Overseas Tour Extension with Financial Incentive

Variable	Marginal Effect
Reason cluster 1	n/s
Reason cluster 2	n/s
Reason cluster 3	0.0746*** (0.0204)
Reason cluster 4	n/s
Reason cluster 5	n/s
Reason cluster 6	n/s
Reason cluster 7	baseline
Reason cluster 8	n/s
Reason cluster 9	–0.120*** (0.0260)
Reason cluster 10	–0.0925*** (0.0177)

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

Military Satisfaction Clusters

Table 4.9 provides the statistically significant results of the final model for cluster variables related to general perceptions of military service. Of the four clusters of respondents grouped by satisfaction with their military service, those that tend to be the most dissatisfied compared to the average in the sample (military satisfaction clusters 1 and 2) are less likely to extend at a given financial incentive level. Thus, similar to the impact clusters, differences in response to the financial incentives are evident only for those who tend to have answers to the questions related to military satisfaction that are much lower than average.

Overall Supply of Overseas Tour Extensions

A predicted supply curve for overseas tour extensions, including a "price" of 0, can be constructed from the two multivariate statistical models. There is a unique supply curve for every possible combination of variables that appear in both models, representing differences in demographics, tour characteristics, and attitudes across respondents. In other words, the likelihood of each individual servicemember to extend at a given financial incentive level depends on his or her demographic, most recent tour, and attitudinal characteristics. Appendix I pro-

Table 4.8
Effects of Impact Clusters on Overseas Tour Extension with Financial Incentive

Variable	Marginal Effect
Impact cluster 1	–0.253*** (0.0267)
Impact cluster 2	–0.147*** (0.0145)
Impact cluster 3	–0.191*** (0.0183)
Impact cluster 4	n/s
Impact cluster 5	n/s
Impact cluster 6	baseline
Impact cluster 7	n/s
Impact cluster 8	n/s
Impact cluster 9	n/s
Impact cluster 10	n/s
Impact cluster 11	n/s

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

Table 4.9
Effects of Military Satisfaction Clusters on Overseas Tour Extension with Financial Incentive

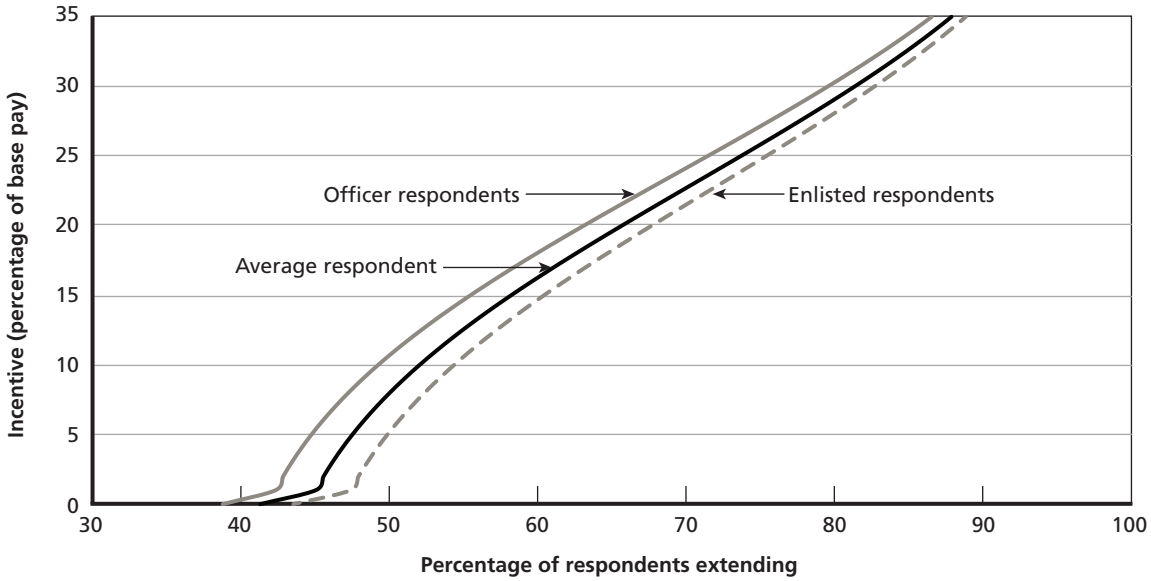
Variable	Marginal Effect
Military satisfaction cluster 1	–0.0577** (0.0265)
Military satisfaction cluster 2	n/s
Military satisfaction cluster 3	baseline
Military satisfaction cluster 4	n/s

NOTES: Standard errors are in parentheses, calculated via the Delta method. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. n/s = not significant. All variables are indicator (dummy) variables. Marginal effects show the change in the probability of a "yes" response evaluated at the baseline respondent.

vides additional details about the effect of changing the value of an explanatory variable on the probability of extension.

This information is useful for obtaining the probability of extension at various incentive levels for policies that differentiate on the basis of demographic and/or tour characteristics. For example, Figure 4.3 displays three supply curves: one for all enlisted personnel in the sample (pay grades E-1 through E-9), one for all officers in the sample (pay grades O-1 through O-6), and one for the "average" respondent in the sample.[4] The position of each curve can be explained as follows. First, officers are less likely to extend at an incentive level of 0 than enlisted personnel (39 percent versus 43 percent, respectively).[5] As such, the supply curve for officers lies to the left of that of enlisted personnel. This results in a smaller probability of extension (or, equivalently, proportion of officers extending) at each incentive level for officers relative to enlisted personnel.[6] Second, the difference between the two curves is not the same at each incentive level. This implies that the additional incentive needed to increase the probability of extending by 1 percentage point is not constant at all incentive levels.[7] As a result, the

Figure 4.3
Supply Curves Implied by Multivariate Models for Enlisted Personnel, Officers, and the Average Respondent for Overseas Tours



NOTES: This figure includes both respondents willing to extend for 0 financial incentive and those unwilling to extend without a financial incentive. The vertical axis crosses the horizontal axis at 30 percent to illustrate differences between curves.

RAND *RR1034-4.3*

---

4 The average respondent is defined by the means of the explanatory variables. Note that this average respondent is a hypothetical individual, as the means of the indicator variables will lie between 0 and 1, yet any real individual will only be characterized by indicator variables taking on values of 0 or 1. Mathematically, however, using the average respondent is equivalent to taking the average across all (real) individuals in the sample.

5 Note that these differences are obtained due to differences in the included explanatory variables for each personnel class; pay grade itself was not a significant explanatory variable in either model.

6 As the incentive level is defined as a proportion of base pay, this difference is not due to greater officer base pay levels.

7 This is a direct consequence of the nonlinearity of the multivariate models.

minimum cost (in terms of percentage of base pay) of obtaining a fixed number of volunteers likely differs between these groups of individuals.[8]

This example is only representative. Each category of respondent, as defined by the variables included in the multivariate statistical models, will have a different supply curve. Regardless of the values of these variables, however, the estimated supply curve is upward sloping.

Summary and Policy Implication of Results of the Survey of Servicemembers

Summary

As previously noted, the majority of respondents were unwilling to extend. Based on additional questions concerning financial incentives, individuals in the sample responded in a manner consistent with economic theory—namely, that a larger financial incentive would induce an increasing number of respondents to "voluntarily" extend their tour of service. As such, the analysis yields an upward-sloping supply curve for tour extensions.

Using an interval regression model, the average incentive level necessary to induce an affirmative response across all sample respondents who were unwilling to extend for no additional incentive was estimated to be approximately 23 percent of base pay per month for a 12-month extension.[9] Across the entire sample, including those who would extend with no additional incentive, about half of the sample would extend for an incentive equal to 8 percent of base pay per month.[10] Variables that significantly affect the probability of extension at the mean incentive level, all else being equal, include the following:

- Those in the Navy and the Marines were less likely to extend than those in the Army or Air Force.
- Those who had served less than six years were less likely to extend than those who had served longer.
- Those who were unmarried and were non-Hispanic black, Hispanic, or multiracial were more likely to extend than non-Hispanic whites, American Indians/Alaska Natives, or Asian/Pacific Islanders.
- Those with a graduate or professional degree were less likely to extend than those without such a degree.
- Those who had elected to serve unaccompanied tours or dependent-restricted tours were less likely to extend.
- Those who had served or were serving tours shorter than one and a half years are less likely to extend than those who had served or were serving longer tours.
- Geographic location did not appear to systemically affect extension rates.
- Those who tended to cite financial concerns (as well as many of the other reasons) as an important reason for not extending without an incentive were more likely to extend than other clusters.

---

8 Note that this is *in addition* to differences in base pay.

9 Due to the stratified sample design, this statistic does not necessarily match the incentive necessary to induce 50 percent of the active servicemember population because an equally weighted sample does not necessarily match the overall force structure.

10 Given differences in base salary, the dollar amount of an 8-percent incentive would vary across rank.

- Those who tended to have unlisted reasons or no reasons at all for their decision were less likely to extend.
- Those who perceived impacts on career and well-being as generally negative were less likely to extend.
- Those who tended to be dissatisfied with military life, relative to their peers, were less likely to extend.

Except for those with strong negative views about tour extension and the military in general and those with a reason other than those listed for not extending, individuals tended to respond similarly to financial incentives. This suggests that while attitudes are important drivers of volunteering to extend, they are less important than financial considerations when an incentive system is in place. However, while these conclusions follow directly from the model results, it is important to note that responses to the hypothetical scenario are based on stated, rather than revealed, preferences. Additional information about observed behaviors from real-world voluntary extension scenarios may produce different estimates.

Policy Implications

The major policy implications implied by the multivariate models are thus:

- Demographics, tour characteristics, and individual attitudes affect the supply of overseas tour extensions at an incentive level of 0.
- These same variables affect the supply of overseas tour extensions, though in potentially different ways.
- Individuals have different propensities to extend at any incentive level, depending on their demographics, tour experiences, and attitudes.
- Regardless of characteristics, including strongly negative perceptions of the impact of tour extensions on various aspects of life, individuals tend to be more likely to extend at higher incentive levels (i.e., the supply of tour extensions is upward-sloping).
- The minimum cost of obtaining a fixed number of voluntary extensions likely differs between personnel classes defined on the basis of demographic and tour characteristics.

Analysis of responses from a sample of servicemembers clearly suggests that the majority of those serving overseas would be willing to extend their tour of service if an appropriate incentive package was offered. The following chapter explores how DoD could implement such a program to the advantage of the servicemembers and at the same time potentially reduce the current budget.

CHAPTER FIVE

Implementing a Program to Extend Overseas Tours of Service

Introduction

In the previous chapters, we noted that each of the military services has programs to induce servicemembers to voluntarily extend their current tours of service. Based on our analysis of data from the DMDC 2013 SOFS-A, we concluded that a majority of those who are currently serving overseas or have recently served overseas would not volunteer for a 12-month extension without additional incentives. The responses suggest that a mandatory program would adversely impact quality of life and could negatively impact morale, job performance, and promotion prospects. However, a sizable minority (over 40 percent) of the servicemembers surveyed reported they would volunteer for a 12-month extension of their current tours, and a sizable fraction of those who would not volunteer could be induced to do so if a financial incentive were offered. This chapter considers how to design an incentive program that works to the advantage of servicemembers while reducing the number of PCS moves and the costs associated with them.

The Problem with Existing Incentive Programs

As detailed in Chapter Two, the services currently use incentive programs that offer special pays or bonuses as inducement for servicemembers to extend their tours of service. Other programs offer incentives in kind, such as round-trip air transportation for servicemembers and their families. Most of these programs offer the incentive (pay or in kind) on a take-it-or-leave-it basis. For instance, OTEIP offers a $2,000 lump sum payment in exchange for a 12-month extension. Eligible servicemembers may accept or reject the pay and terms OTEIP offers, but they may not make a counteroffer or attempt to negotiate.

There are three problems inherent in the take-it-or-leave-it structure of these programs. First, incentive pays are difficult to set correctly because the government cannot accurately observe the amount of additional compensation each servicemember requires in order to extend his or her tour voluntarily. Errors in setting the incentive pay can be costly. Offering too little results in few or no servicemembers stepping forward to extend their tours. Offering too much results in many servicemembers stepping forward—more than can be accommodated by the budget available for incentive pays, and quite possibly exceeding the savings that could be achieved through slowing down the moves. Some servicemembers must be turned away, while those whose tours are extended receive incentive pays that are likely to exceed what was required to induce them to voluntarily extend.

Second, offering the same incentive pay to any eligible servicemember results in overpayment—even when the government does set the pay level appropriately.[1] Consider once again the $2,000 payment offered by OTEIP. At that level, the takers will likely include servicemembers who would have extended their tours for less than the $2,000 offered—recall that some 40 percent of SOFS-A respondents indicated that they would have extended for free. In short, the government is paying too much to some, given their willingness to extend.

The third problem is that programs offering incentive pay on a take-it-or-leave-it basis are not responsive to changes in servicemember preferences over time. The level of incentive pay is set at a fixed point in time, and any adjustments made in response to changes in the popularity of extending tours in a given location are implemented at scheduled intervals rather than in real time. Moreover, as noted in our discussion of the first problem, these adjustments are difficult to implement correctly due to the government's lack of knowledge regarding the size of the incentive that would induce each servicemember to extend his or her tour.

Programs that offer incentives in kind pose an additional problem, namely cost control. Consider the in-kind incentive offered by OTEIP: round-trip transportation at government expense between the overseas location and the port of debarkation in CONUS. The cost of this benefit varies with the distance traveled and the size of the servicemember's family. A Marine Corps program manager reported that he had authorized travel payments ranging from $815 to $28,613 for a single tour extension.[2] Because of these issues, the current set of incentive programs are likely striking a poor balance between inducing the desired number of voluntary tour extensions and minimizing the cost of achieving them.

An Alternative Approach That Addresses the Problem with Existing Incentive Programs

Unlike a take-it-or-leave-it incentive program, an auction mechanism could allow servicemembers to bid for extensions to their current overseas tours. Here is how a simple tour extension auction might work:

1. Each servicemember approaching the end of his or her current overseas tour has the option to bid on the incentive pay he or she would receive in exchange for extending his or her tour for 12 months. Every interested servicemember submits a single bid within a fixed period of time.
2. At the end of the period, the government ranks the bids submitted from lowest to highest. The servicemember submitting the lowest bid has his or her tour extended and collects an incentive pay equal to the amount of his or her bid.
3. The government then moves down the ranked list. If sufficient funds remain in the budget, the servicemember submitting the second lowest bid has his or her tour extended and collects an incentive pay equal to the amount of his or her bid.

---

[1] In this context, an appropriate pay level is one that is just high enough to exhaust the available budget without having to turn anyone away.

[2] Data provided by HQMC M&RA, Manpower Management Integration Branch, Manpower Management Integration & Administration. See also Table 2.1.

4. The government then moves down the ranked list. If sufficient funds remain in the budget, the servicemember submitting the third lowest bid has his or her tour extended and collects an incentive pay equal to the amount of his or her bid.
5. The process continues in this fashion until either the budget is exhausted or no bids remain on the ranked list.[3]

There are a number of alternative auction designs, some of which account for considerations other than incentive pay, such as PCS costs and servicemember qualifications. We discuss these briefly in the latter half of this chapter and in greater detail in Appendix J.

Auction Theory

Auction theory predicts that each servicemember will weigh two factors in determining how much to bid. On the one hand, servicemembers want to bid low in order to maximize the probability of being selected for a tour extension. They understand that they are competing for these *compensated* extensions: Once the budget is exhausted, any additional extensions will come without incentive pay. On the other hand, servicemembers want to bid high in order to maximize the incentive pay earned. They may be willing to raise their risk of not being selected for an extension in exchange for an increase in the incentive pay earned if they are in fact selected. These two pressures are in tension with one another. Auction theory predicts that the tension is resolved when each servicemember submits a bid that exceeds the minimum incentive pay he or she requires but not by too much, lest he or she lose the opportunity to be selected for an extension.[4]

To illustrate these issues, consider the example depicted in Figure 5.1. Hypothetical servicemembers A, B, C, and D are willing to extend their tours by 12 months in exchange for lump sum payments represented by the blue columns. That is, servicemembers A, B, C, and D are willing to extend their tours for incentive pays equal to $0, $5,000, $8,000, and $13,000 respectively. The red bars represent the amounts by which servicemembers "pad" their bids due to the pressures described. The sum of the blue and red bars represents the bid submitted by each servicemember. For instance, servicemember C is willing to extend his or her tour for an incentive pay of $8,000, but he or she bids $17,500.

Auction theory predicts that every servicemember will pad his or her bid to some extent.[5] The magnitude of the pads depends on several factors, including the number of servicemembers bidding, the size of the budget, and the risk attitudes of the bidding servicemembers. The greater the number of servicemembers bidding, the greater the competitive pressure and the smaller the pads. A larger budget for incentive pays relieves some of the competitive pressure, which results in larger pads.[6] Servicemembers who are more averse to risk are less inclined to pad their bids and jeopardize their chances of being selected for a tour extension.

---

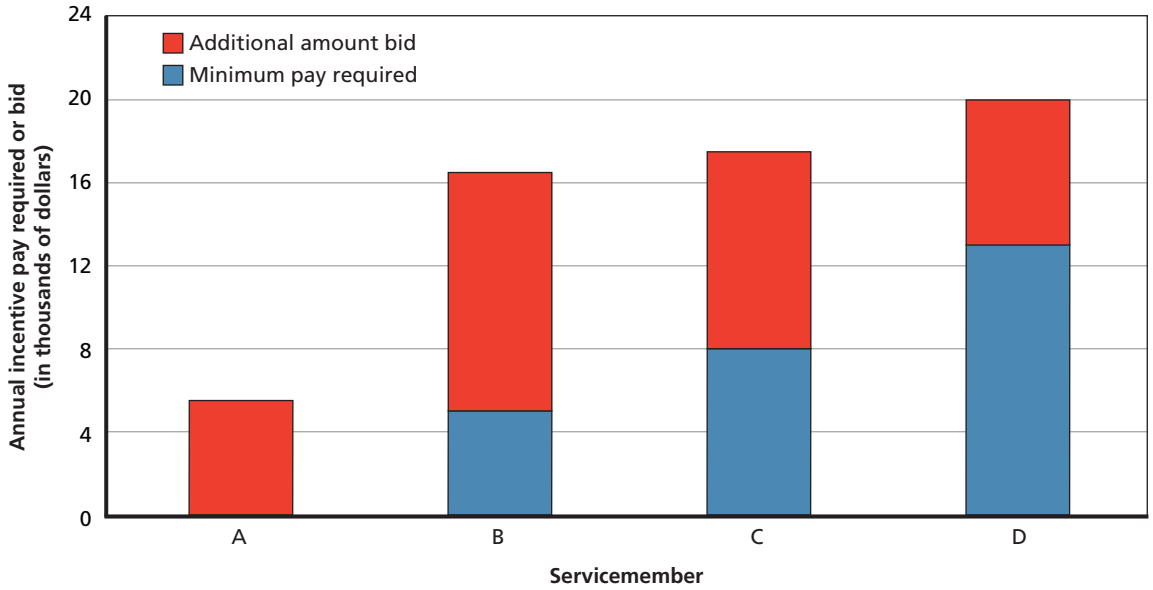
[3] This auction type is known as a discriminatory-price auction. It is the extension of a first-price auction to a setting in which multiple units (i.e., tour extensions) are offered, but each bidder (i.e., servicemember) demands only one unit. For more on discriminatory-price auctions, see Krishna, 2002.

[4] For more on bidding strategies in first-price and discriminatory-price auctions, see Krishna, 2002.

[5] There is one exception: servicemembers whose minimum required pay equals the reservation cap. Since the stylized example presented here does not include a reservation cap, the exception does not apply.

[6] Setting the budget for incentive pays requires careful consideration of the following trade-off. Choosing a larger budget provides the means to support a greater number of extensions but reduces the competitive pressure, which results in higher

Figure 5.1
Bidding for Incentive Pays



RAND *RR1034-5.1*

Theory also predicts that the ordering of the bids will track the ordering of the minimum required pays. That is, the servicemember with the lowest required minimum will submit the lowest bid, the individual with the second lowest required minimum will submit the second lowest bid, and so on (see Figure 5.1). This property implies that the auction selects those servicemembers who are most willing to extend their tours.

Finally, auction theory has shown that, on average, no program with a take-it-or-leave-it structure will outperform the auction (Myerson, 1981; Riley and Samuelson, 1981). That is, no take-it-or-leave-it program will, on average, secure a greater number of voluntary extensions for a lower sum of incentive pays than the auction will. This relation holds despite the fact that servicemembers participating in the auction pad their bids. No program—be it auction-based or not—can drive incentive pays down to the minimum required pays because these minimums are known only to the servicemembers.[7] Auctions perform better than other programs because the competitive pressure inherent in the auction format reduces incentive pays beyond what other programs can achieve.

bids. Choosing a smaller budget raises the competitive pressure and drives down bids, but the reduction in funds restricts the number of extensions that can be supported.

[7] Uniform-price auctions, such as those used by eBay, push bids down to the minimum required pays. However, they do not push *incentive pays* down to the required minimums. Like the discriminatory-price auction described here, uniform-price auctions select those servicemembers who submit the lowest bids. However, unlike the discriminatory-price auction, uniform-price auctions set the incentive pays equal to the lowest losing bid, which necessarily exceeds the bid of any servicemember selected for extension. On average, the sum of the pays set by a uniform-price auction equals the sum of the pays set by a discriminatory-price auction (Krishna, 2002).

The Benefits of Using an Auction

Having described how auctions operate and how servicemembers formulate their bids, we now explain how auctions mitigate the problems associated with existing incentive programs. For convenience, we list the three problems inherent in programs offering incentive pay on a take-it-or-leave-it basis:

1. Setting the incentive pay at the appropriate level is difficult because it requires knowledge of the minimum incentive pay each servicemember requires.
2. Offering the same incentive pay to any eligible servicemember results in overpayment relative to the minimum pays necessary to secure the extensions.
3. Existing programs do a poor job of adjusting incentive pays in response to changes in servicemember preferences over time.

Auctions mitigate the first problem because they set incentive pays using information reported by servicemembers via their bids. Auctions set incentive pays appropriately without requiring that the government know or estimate the minimum pay each servicemember requires in order to voluntarily extend his or her tour. We grant that the incentive pays set by the auction exceed the minimum pays servicemembers require. However, on average, no incentive program with a take-it-or-leave-it structure delivers a greater number of voluntary extensions for a lower sum of incentive pays than the auction does.

Auctions mitigate the second problem by allowing incentive pays to vary across servicemembers and by leveraging competitive pressures to reduce incentive pays. The overpayment problem persists in that the incentive pays set by the auction exceed the minimum pays necessary to secure the extensions. However, the sum of the incentive pays set by the auction is less, on average, than the sum of the incentive pays set by any take-it-or-leave-it program that delivers at least as many voluntary tour extensions. Moreover, economic theory predicts that the incentive pays set by the auction track the ordering of the required minimums such that servicemembers who are willing to extend their tours for less are paid less and servicemembers who require larger sums to extend are paid more.[8]

Auctions eliminate the third problem entirely. As servicemember preferences over locations and extensions change over time, so do the bids submitted and the resulting incentive pays. Auctions are inherently responsive to changes in the demand for extensions. Incentive pays are automatically adjusted in real time.

Tailoring Auctions to Account for Factors Other Than Incentive Pay

The auction mechanism described above assigns tour extensions and incentive pays based solely on the bids submitted. It was offered for its simplicity to facilitate our presentation of how auctions work and why they provide benefits over incentive programs with a take-it-or-leave-it structure. In many cases, however, the government may want to account for considerations other than incentive pay, such as PCS costs or servicemember qualifications, in determining whose tours to extend. Fortunately, auctions can be modified to account for such considerations. We offer a few examples here.

---

[8] This result relies on a *ceteris paribus* assumption, meaning that bidders are assumed to differ only with respect to the minimum incentive pay they require to voluntarily extend their tours. The result may not hold if bidders differ along other dimensions, such as their tolerance for risk.

One option is to use one or more of these factors to screen servicemembers before permitting them to participate in the auction. For instance, the government may require servicemembers to meet certain requirements relating to rank, years of experience, or special skills before permitting them to bid for a tour extension.[9] Once the set of qualified servicemembers is identified, an auction ensues. The advantage of this approach is that it ensures that the auction selects servicemembers whose tours the government would like to extend.

Another option is to relax the rule stipulating that tours be extended for servicemembers who submit the lowest bids. Instead, the auction rules can be set so that once bids are submitted, the government assesses each servicemember using a number of factors, including the servicemember's qualifications, PCS costs, and bid for incentive pay. Those servicemembers deemed to possess the most attractive combination of factors are selected for tour extensions. The advantage of such an approach is that it reduces the risk of eliminating servicemembers with relatively weaker (but still acceptable) qualifications who would have bid aggressively enough to make extending their tours desirable.

Accounting for factors other than incentive pay carries a cost: It reduces the pressure to compete over incentive pay, which results in higher bids—and higher pays—on average. Prescreening potential bidders dampens the competitive pressure by reducing the number of servicemembers participating in the auction. Relaxing the requirement that tours be extended for servicemembers submitting the lowest bids dampens the competitive pressure by extending an advantage to servicemembers with favorable characteristics: Servicemembers with superior qualifications or low PCS costs can (and do) submit higher bids and still have their tours extended (Che, 1993; Lamping, 2010; Rezende, 2009).

Alternative auction mechanisms are explored in greater detail in Appendix J. Our objective here was to demonstrate that the government is not limited to auction forms that select servicemembers on the basis of incentive pay alone but that accounting for factors other than incentive pay requires a more complex process that may result in higher average pays.

Practical Applications of Auctions to Workforce Management

Auctions for workforce management are not a mere hypothetical. There are several examples of bidding systems currently in place for assigning personnel to positions. In the private sector, auctions have been used to assign nurses to shifts, to allocate seats in oversubscribed law school and business school courses, and to assign pilots and other crew members to flights. The military has only one auction-based program: the Navy's Assignment Incentive Pay (AIP) program. AIP has been used for over a decade to assign sailors to hard-to-fill billets. Detailed information on the Navy's AIP program and private sector applications of auctions for workforce management is provided in Appendixes L and K, respectively.

Since the Navy's AIP program is the only auction-based program for managing military personnel, we contend that it has the greatest relevance to the tour length extension problem. As such, we spend the remainder of this section discussing the lessons learned from the AIP experience.

The Navy's experience with the AIP program suggests that using auctions to make assignments generates four classes of benefits. First, permitting servicemembers to bid has the effect of increasing the rate of volunteerism. According to a 2009 CNA report, AIP has been effec-

[9] In addition, the government may want to preclude extensions that would impede the professional development of the extending servicemember or hinder the development of a servicemember waiting to fill the vacated position.

tive in improving manning in less desirable locations: Manning rose from 76 percent to 83 percent in Misawa between 2003 and 2008, from 85 percent to 97 percent for *USS Kitty Hawk* between 2004 and 2007, and from 91 percent to 99 percent in Lemoore between 2004 and 2007 (Golfin et al., 2009). One might reasonably expect that permitting servicemembers to bid on tour length extensions would increase the number of servicemembers who volunteer to extend their tours in exchange for incentive pay.

Second, using auctions to make assignments can generate cost savings relative to existing programs for inducing voluntary tour extensions. Much of the cost savings credited to the AIP program are due to replacing a pre-existing incentive program—sea duty rotational credit for hard-to-fill shore duty assignments—with AIP. CNA estimates that offering this credit cost the Navy an average of $2,200 per month per Sailor (Golfin et al., 2004). In contrast, the average winning bid for shore duty billets that previously carried sea duty credit was $424 per month (Golfin et al., 2009).[10] One might reasonably expect that using auctions to assign tour length extensions would also generate cost savings relative to existing programs. For instance, one of the options offered by OTEIP is a $2,000 lump-sum payment in exchange for a 12-month tour extension. Our survey results, which we presented in Chapters Three and Four, indicate that 44 percent of servicemembers would voluntarily extend their current overseas tour for less. Assuming that the stated preferences of the survey respondents hold in practice, an auction-based program would identify these servicemembers and set their incentive pays appropriately.

Third, permitting servicemembers to bid for assignments has been shown to increase retention, which may generate additional cost savings. A 2002 CNA study found that "[s] ailors matched, or assigned, to their preferred billets [had] higher continuation rates" and that alleviating the adverse effect of involuntary assignments on retention "could require about $39 million in Selective Reenlistment Bonuses" (Christensen et al., 2002). One might reasonably expect that involuntarily extending current overseas tours would also have an adverse effect on retention. An auction-based system for assigning tour extensions would mitigate such an effect by expanding the opportunity for servicemembers to determine the nature of their next assignment.

Fourth, using auctions to make assignments provides the flexibility to adjust incentive pays in response to changing preferences over time. For instance, assignments to *USS Kitty Hawk* became less popular in the years preceding its decommissioning in early 2009. By using an auction to set incentive pays, the AIP program allowed incentive pays to increase as needed to maintain requisite manning levels (Golfin et al., 2009).[11] Similarly, using auctions to assign tour length extensions would permit incentive pays to vary in response to changes in demand over time. Our survey analysis, while informative, provides only a snapshot; our estimates of the financial incentives needed to induce voluntary extensions are valid for the survey period only. Servicemember preferences may change over time, which may affect the financial incentives they require. An auction-based program would respond to these changes automatically and set incentive pays accordingly.

In sum, the Navy's experience with the AIP program has been successful along a number of dimensions, and there are reasons to believe that the benefits that accrued to the Navy would also apply if auctions were used to assign tour length extensions across all services.

---

[10] The average is taken over the period beginning in June 2003 and ending in May 2008.

[11] Incentive pays were permitted to rise up to the reservation cap of $300 or $450 per month, depending on pay grade and rating. The average winning bid between August 2004 and December 2007 was $384 per month (Golfin et al., 2009).

There are, however, a number of potential drawbacks worth considering. The cost of setting up and administering a bidding system may be larger than the cost of administering existing incentive programs for extending tour lengths. In addition, collusive behavior among servicemembers is a greater risk when bidding for tour length extensions than when bidding for AIP-eligible billets. To date, colluding to bid up incentive pays has not been a problem for the Navy's AIP program. Sailors bidding on AIP-eligible billets are distributed across the globe and, for the most part, do not interact regularly, which hinders the formation and persistence of collusive arrangements. In contrast, servicemembers bidding on extending their current overseas tours reside in the same location for a number of years and likely interact on a regular basis, which facilitates the formation of collusive arrangements and reduces the cost savings associated with using an auction.[12]

If DoD were to move forward with an auction-based program, it could take a few lessons from AIP with respect to the program's implementation. For instance, DoD might begin by launching a pilot program in the first year. The pilot program would implement the bidding mechanism on a limited basis, serving as a feasibility experiment or test case. Bidding could be limited to one of the services, particular ranks or occupational specialties, and a few locations. With these limitations in place, DoD could launch the pilot program with a fairly modest budget for incentive pays. The AIP program operated with a budget of only $1 million in its first year (Golfin, 2006). If the pilot were to show promise, the bidding program could be expanded and modified, drawing from the lessons learned in the first year. If the pilot were to fail, the bidding program could be canceled, and business would proceed as usual. Appendix M provides a more detailed account of how one might design such a pilot program.

The Future of Market-Based Approaches to Assignment Problems: Two-Sided Matching Markets

Auctions have been used effectively as a workforce management tool in both the private sector and the military. In the previous section, we detailed the benefits generated by the Navy's AIP program and argued that these benefits would likely apply to a bidding program that selects servicemembers for tour extensions. These benefits arise from letting markets work. Auctions harness competitive pressures to induce servicemembers to reveal their willingness to extend their tours. Tour extensions are granted to those servicemembers who value them most, and incentive pays are set at appropriate levels.

However, issues may arise when auctions are applied to a particular "slice" of the labor market with little regard for the fact that the slice in question exists within a larger market. The

[12] There are a number of measures that can be taken to mitigate collusion. Reservation caps can be used to limit the extent to which colluding servicemembers can inflate their bids. Sanctions can be imposed on servicemembers who are found to have participated in a collusive arrangement. The auction format can be changed to a uniform-price auction, in which extensions are awarded to the servicemembers submitting the lowest bids but incentive pays are set equal to the lowest *losing* bid. By weakening the link between how much a servicemember bids and how much he or she receives in incentive pay, the uniform-price auction makes it more difficult to sustain collusive arrangements. The government might also consider opening the bidding to service members who are not currently assigned to the tour (i.e., servicemembers for whom the tour up for bid would be a new tour rather than a tour extension). These servicemembers are less likely to participate in the collusive arrangement, thereby applying pressure to the colluding group to reduce their bids. Preference would be given to servicemembers who are currently assigned to the tour, but it would still be possible for an outsider with an aggressive bid to be selected.

Navy, for instance, limits bidding to billets it identifies as AIP-eligible and designs the auctions to maximize the likelihood of filling them.[13] The myopia inherent in this approach can give rise to some unintended consequences: Manning improvements for AIP-eligible billets may come at the cost of a higher vacancy rate among billets that are not eligible for AIP.

Fortunately, the past 15 years have seen a number of advancements in the theory *and application* of systemwide, market-based approaches to assignment problems. Research in the areas of economics and operations research has led to the development of algorithms for assigning students to schools (Gale and Shapley, 1962; Abdulkadiroğlu and Sönmez, 2003), doctors to hospitals (Roth and Peranson, 1999), and human organs to patients in need of transplant (Roth, Sönmez, and Ünver, 2004). These algorithms reflect a more systemwide approach in that assignments to the entire set of vacant positions are made simultaneously so that interactions among the various assignments can be fully accounted for.

The general structure of these algorithms is the same across applications. For the sake of concreteness, we will describe the process used by the National Resident Matching Program (NRMP) to assign medical residents to hospital residency programs. Every February, the NRMP asks each candidate to submit an ordered list of his or her preferences over hospital residency programs. At the same time, the NRMP asks each residency program to submit an ordered list of its preferences over candidates. The NRMP then applies an algorithm to these lists to match the candidates to the programs. The algorithm is designed to (a) incentivize truthful reporting of preferences from both sides of the market and (b) deliver a "stable" matching. A matching is stable if there is no candidate and program that prefer each other over the counterparts assigned to them.

Applying such algorithms to personnel management would require the service to designate certain periods of the year for assignment changes and to establish a centralized clearinghouse. Each servicemember up for reassignment during that period would report his or her preference ordering over assignments (including extensions, IPCOTs, home-basing, and other forms of assignments that might be available), and various units would report their manpower requirements and their preference orderings over servicemembers (or over servicemember characteristics, such as skills). To encourage tour extensions, units might report a higher preference for personnel currently assigned to them than for personnel assigned elsewhere. In addition, to reduce PCS costs, units might report a higher preference for personnel currently at nearby duty stations than for those at faraway locations. An algorithm would be designed to deliver the most favorable assignment of servicemembers to positions. The algorithm could be modified to set incentive pays as well (e.g., Bulow and Levin, 2006).

Like auctions, matching algorithms can be tailored to address a number of practical complications. For example, in the market for medical residents, many medical school graduates are married couples who wish to be matched to nearby jobs. To deal with this issue, the NRMP allows couples to form pairs of program choices on their preference lists. These pairs are considered in rank order when the matching algorithm is processed. A number of other practical considerations have been addressed in the literature (e.g., Roth, 2002), some of which may be relevant for dealing with the particular quirks of military life. Matching algorithms offer endless possibilities for a reimagined military assignment process, one that takes a systemwide perspective and leverages market forces to deliver more satisfying assignments at a lower cost.

---

[13] See Appendix L for further details.

CHAPTER SIX

The Relationships Among Tour Lengths, Moves, and Costs

Introduction

In this chapter, we examine the connections between tour lengths, average tour lengths, the number of PCS moves, and the potential savings to the PCS program resulting from extending tours. We consider a simple steady-state case, making the example more robust as we introduce additional factors, and then apply the insights gained to the current PCS programs of the services. We note again, as we have earlier in this report, that the PCS program is not a closed system, but rather a tool used in the personnel management process to meet operational and professional development requirements in ways that preserve or enhance the morale and well-being of the force.

Tour Lengths, Extensions, and Moves: A Steady-State Example

There are whole ranges of factors that can impact the number of PCS operational and rotational moves in any year. For purposes of exposition and to provide a first-order estimate of long-run costs and savings, we constructed a simple case and simulated it though time. In this steady-state example, we assume (1) the population in any location, and the underlying requirements that generate it, remain the same over time; and (2) the increase in average tour lengths portrayed in the model comes only from induced changes as portrayed in the model, and the changes remain stable unless we change them further. In other words, we are assuming no other factors affect the results—a necessary assumption if we are to compare the effects of the changes we are making.

The basic relationship between tour lengths and moves shown here becomes more complicated when we allow for some to opt to extend their tours and then consider restrictions on tour extensions because of operational and career development needs of the services and servicemembers. The steady-state example becomes even more complex when we introduce the possibilities for incentives to encourage voluntary tour extensions. We start with a basic formulation and then build on that to illustrate these additional factors.

A Simple Steady-State Example of PCS Moves

Consider an example in which a population of 3,000 servicemembers is required at a certain location. To begin, we assume *all* tours are three years. The annual number of PCS moves

required to support this population is 2,000: 1,000 going home and 1,000 replacing the departures. Mathematically, this is 2 × population ÷ tour length = moves per year. For practical purposes, however, in a system as large as one of the military services, it is impossible to determine whether a prospective replacement would have moved elsewhere in the event of someone extending at a given location. Accordingly, we concentrate only on moves *out*.[1] Thus, the 1,000 moves recorded in Table 6.1: 1,000 reach the end of tour and move away. This relationship holds as shown for fractional (e.g., average) tour lengths and thus for populations with variable tour lengths. Table 6.1 illustrates this simple example over a three-year period.

In this example, 1,000 people are in each of the three yearly cohorts (columns). Those serving in their third year leave at the end of that year (1,000 moves) and would be replaced by people coming in to start their first year (another 1,000 moves); again, for our purposes we count only the moves *out*. In essence, the cohorts move diagonally down to the right as time (the left column) progresses. In this example, each year is the same as the last, and each year's number of budgeted moves is the same as the number in last year's budget.

The example becomes more complicated when we introduce the possibility that some fraction of those completing their tour—say, 40 percent[2]—decides to extend for one year, as noted in Table 6.2. At this point, the mechanism used to persuade and allow servicemembers to extend is immaterial; we simply use the model here to show the result of extended tours over time. For purposes of continuity in the analysis, we start with the first year the same as in the previous table—i.e., the extensions start at the end of that first year. As above, the entries in the year of tour columns are populations serving that year of their tour.

Notice that extending tour lengths for a fraction of the population causes the total number of moves per year to oscillate, as shown in the right-hand column. The number will oscillate around—and finally settle on—a steady-state number of about 882 moves, which is a steady-state savings of 118 moves annually. This is because the number departing (i.e., contributing to the total moves) is a combination of those finishing their third year and those finishing their fourth. Both these numbers depend on the number in the preceding year's cohort—i.e., on the number of those who go on from the second to the third year, or the third to the fourth year, diagonally down to the right in the table. Thus, the numbers depend ultimately on the

Table 6.1
Simple Example of PCS Moves with No Tour Extensions

Time (Years)	First Year	Second Year	Third Year	Total Moves per Year
1	1,000	1,000	1,000	1,000
2	1,000	1,000	1,000	1,000
3	1,000	1,000	1,000	1,000

[1] In a theoretical steady-state example, moves out of one location automatically result in secondary reductions in moves from other locations because if a person does not leave a location, the prospective replacement also does not have to move. That might be true if there were only two locations, but there are numerous locations and other requirements to meet. In the subsequent analyses, we conservatively account only for the moves avoided by the persons whose tours are lengthened, noting that some additional savings may accrue from secondary effects.

[2] We use this number in many of our illustrations because it ties to an approximation of the percentage in the survey sample that indicated willingness to extend. Our use of that figure in this and following analyses should not be construed to mean that it would be realistic to assume such a percentage could be achieved across the board.

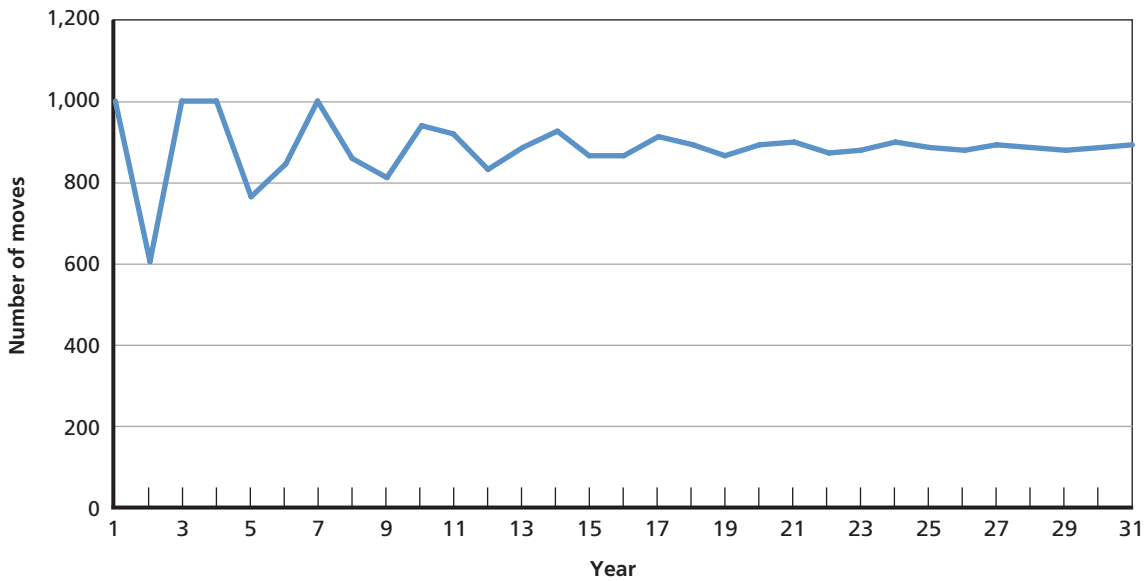
Table 6.2
Simple Example of PCS Moves with Tour Extensions

Time (Years)	First Year of Tour	Second Year of Tour	Third Year of Tour	Fourth Year of Tour	Total Moves per Year
1	1,000	1,000	1,000	0	1,000
2	600	1,000	1,000	400	600
3	1,000	600	1,000	400	1,000
4	1,000	1,000	600	400	1,000
5	760	1,000	1,000	240	760
6	840	760	1,000	400	840
7	1,000	840	760	400	1,000
8	856	1,000	840	304	856
9	808	856	1,000	336	808
10	936	808	856	400	936

numbers entering their first year in the location two or three years earlier—the replacements for those who depart. These replacements move diagonally down to the right as time progresses and thus become the sources of extensions or moves out at the end of the third year of their tour. So, at the end of the first year in our example (first row), 400 in the third year go on to serve a fourth year, and thus only 600 leave at the end of the second year (second row). In the next year, 600 are serving in their first year, and 400 are serving in their fourth year on station. At the end of that year, the 400 leave, but 400 more stay from the third-year cohort. The rest (600) of that cohort leaves, so there are again 1,000 (= 600 + 400) departures. The next year follows the same pattern. But the following year (5) sees only 240 extensions, because the cohort providing those extensions is only 600 strong (third year, fourth row). The remainder of that cohort departs and contributes 360 moves (60 percent of 600); 400 from the previously extended cohort also leave, so the total is 760 moves out (total moves, fifth row). This oscillating pattern continues; the new steady-state tour length is 3.4 years, compared with 3 years at the beginning of the table.

It is important to note, however, that even in this simple example, especially at the beginning, there is substantial year-to-year variation and an uneven pattern of avoided moves, and thus the cost of the program we are illustrating in our table will also change each year. This is clearly shown in Figure 6.1, which extends the preceding table and illustrates the oscillatory behavior of the PCS moves over time as the extensions play out through the system. The instability of avoided moves will be even greater if there is year-to-year variation in the numbers assigned to a base and the proportion of those willing to extend, as there almost certainly will be in practice. As such, it will be impossible to make exact forecasts of the numbers of moves that can be avoided in any given year or the yearly amount by which the budget can be reduced as a result of any policy, voluntary or otherwise, to extend the lengths of tours.

Figure 6.1
Annual PCS Moves Over Time, Basic Model



RAND *RR1034-6.1*

Generalizing the Example: The Model for PCS Moves

The general relationship of total moves per year to tour lengths and extensions at the steady state is

$$M = P \div (T_o + XZ), \tag{6.1}$$

where
M = moves
P = population in supported location
T_o = original average tour length
X = fraction extending
Z = length of the extension as a fraction of a year.

Note that the change in the average number of moves comes from two factors—the fraction of a cohort extending and the length of that extension. For simplicity, we will assume the extensions are for one year—i.e., $Z = 1$.

The number of moves avoided per year in the steady state, M_a, given that X percent of each cohort decides to extend for a year (i.e., starting from an average tour length of T_o), will be

$$M_a = PXZ \div [T_o \times (T_o + XZ)]. \tag{6.2a}$$

The steady-state number of servicemembers on extended tours is $M_e = PX \div (T_o + XZ)$. This is also the steady-state number of extended tours.

Because of the complicated dynamics of the system (as illustrated in Figure 6.1) and the associated inability to forecast savings from year to year, as discussed in the previous subsection, we focus on long-run outcomes when evaluating the benefits and costs of tour extensions. The annual long-run benefits of the fraction X extending by Z years are the value of avoided

moves, M_a, as given by (6.2a). The annual long-run costs are the payments necessary to sustain this fraction of extensions at the new steady-state level of moves, or M_e. As such, the normalized ratio

$$M_a/M_e = M_{a(n)} = 1 \div T_o, \tag{6.3}$$

or annual steady-state moves avoided per long-run extension, provides the average long-run move benefit per long-run extension. Valuing each of these components in dollar terms provides the opportunity to compare annual long-run financial benefits with long-run financial costs.

Modifications to the Extension Factors

Chapters Three and Four discussed the supply of tour extensions and the numerous factors that can influence that supply. We use the extension rate factor, X, to represent that supply and changes in it. We can adjust extension factors (X and Z in the equations above) to reflect different expectations regarding, for example, the effects of incentives and operational and professional development considerations. For the sake of simplicity, we will continue to assume Z is one year, so changes in average tour lengths and any resulting savings would come from changes in the expected extension rate, X.[3]

The "Supply" of Extensions and the Effects of Incentives

The basic voluntary extension rate is the major component of X. In our SOFS-A sample, this averaged out to about 40 percent; we used that figure in the earlier steady-state example. Recall that this figure is a composite of stated preferences; it has not been validated by revealed preferences (i.e., behavior), and it has not been constrained by any operational or professional development considerations that could prevent extensions in some assignments. These figures thus should be considered as valuable primarily for illustrative purposes.

Based on the analysis explained in Chapter Four, we will also introduce a factor that we add to X to represent extensions induced by financial incentives, X_i. The results summarized in Figure 4.2 indicate that the range of responses to various financial incentives could go from 0 to about 50 percent for those not willing to voluntarily extend without an incentive; we concentrate our analyses on financial incentives that induce extensions from between 10 and 20 percent of this population. We will use a lower range when we discuss service-specific data toward the end of this chapter.

Operational and Professional Development Constraints

We also modify X to account for constraints that could grow out of professional development and operational considerations. Operational considerations can, if necessary, take precedence over stability goals, and they almost certainly will have some effect on the degree to which personnel managers will be able to allow voluntary extensions. Similarly, professional development requirements can lead to additional moves. One example explicit in the services' PCS program tables is the training moves that comprise a significant portion of the PCS program, but moves can also arise from operational requirements and from the need to place a person in a key assignment for developmental purposes.

---

[3] Z was one year in the SOFS-A, from which we obtained all the data regarding preferences. A useful excursion for a pilot program would be to explore the effectiveness of offering (smaller) incentives for extensions of less than a year.

We should note here that developmental assignments can work both ways, a point not always understood and certainly not obvious in the program data: The person who goes to a key assignment for developmental purposes gets a developmental opportunity by replacing a person leaving that assignment after having completed the developmental experience. Lengthening the time people spend in developmental assignments slows the process and thus saves moves, but over time it will also reduce the pool of people with these key experiences. For example, if battalion commanders serve four years instead of two, over time there will be half as many officers with battalion command experience. They will have twice as much experience, but there will be half as many available to apply that experience elsewhere and to use that experience as a basis for their further professional development. Moreover, a person extended in a key billet will remain unavailable for other positions until the end of the extension, which means that personnel managers will have to fill those other positions with other possibly less qualified or less experienced individuals. At this point the discussion has moved into the realm of human resource management requirements, further supporting the argument that PCS programs and possible changes to them should be viewed in the context of their systemwide implications. Striking a balance among stability, operational requirements, and professional development is and should be among the forcing functions for PCS policies and programs, not a derivative of them.

We account for possible operational and professional development constraints by using factors to limit the expected extension rate, X. We selected a range for these possible constraints from 30 to 50 percent of available officers and 10 to 30 percent for enlisted persons.

Revised Formulations

Given the above, a new equation for moves avoided, analogous to (6.2a), is

$$M_a = PX_mZ \div [T_o \times (T_o + X_mZ)], \tag{6.2b}$$

where
M_a = moves avoided
P = population
T_o = original average tour length
X_m = fraction extending, modified by factors discussed above
Z = length of extension, theoretically variable but for simplicity 1.0 henceforth in this analysis.

An expression for X_m is

$$X_m = X \times (1 - IF) + X_i, \tag{6.4}$$

where
X = base extension rate, which we allow to vary from 10 to 50 percent
IF = impact factor for professional development and operational constraints, ranging as described above[4]

[4] Note that we apply the impact factor only to the "base rate" voluntary extensions, and not to the induced extensions. We assume any extension incentive program would be managed so that servicemembers whose extensions would get in the way of operational or professional development considerations are simply not allowed to apply for the incentives in the first place—i.e., that the impact factor is applied implicitly in the process. See also the discussion of screening in the previous chapter.

X_i = the induced additional extensions, which we vary from 10 to 20 percent.

Applying this construct to the simple model we described in the preceding subsection and assuming a base extension rate of 40 percent ($X = 0.4$) gives us, for example, a steady-state value for moves avoided of

$$(6.5) \qquad M_a = 3{,}000 \times (0.4 \times (1 - 0.4) + 0.15) \div (3 \times \{3 + [(1 - 0.4) \times 0.4 + 0.15]\}) = 115,$$

with IF = 40 percent and the induced extensions X_i entering at 15 percent.

Taking these factors into consideration, the steady-state M_a is 115; compare this with the unconstrained value of 118 from the earlier theoretical example. Long-run extensions are M_e = 345, for an average long-term savings of 0.33 (1 ÷ the original average tour length of 3) moves avoided per long-run extended tour.

Table 6.3 illustrates a range of steady-state moves avoided in our exemplar population of 3,000 with a 40-percent "base" voluntary extension rate, induced extensions ranging from 10 to 20 percentage points beyond that,[5] and impact of development and operational requirements ranging from 30 to 50 percent.

Considerations Bearing on Savings

From the perspective of the services, steady-state savings, or benefits, from the extended tours can be estimated as the average cost per avoided move multiplied by the number of moves avoided. The preceding table indicates a range for moves avoided, as a percentage of the original steady-state moves, of between 9 (91 / 1,000) and 14 (138 / 1,000) percent.

In practice, the savings per move vary considerably along some individual dimensions. For example, officer moves cost more on average than enlisted moves, and accompanied moves are more expensive than unaccompanied moves. Moreover, savings also depend on the cost of incentives necessary to induce any level of extensions: costs implied in the supply curves shown in Figure 4.10. Thus, it is evident that the services should not offer an incentive greater than the steady-state savings (not the short-term one-off savings) that would result from the avoided moves, and that, in fact, they should be conservative in estimating these incentives and the savings from reduced moves.[6] Information presented in Table 2.1 suggests that, at least in some

Table 6.3
Steady-State Avoided Moves with 40-Percent Base Extension Rate and Various Developmental and Operational Impacts and Inducements

	Induced Extensions Factor		
Impact Factor	**0.1**	**0.15**	**0.2**
0.3	112	125	138
0.4	102	115	128
0.5	91	104	118

[5] I.e., from the 60 percent who would not have extended.

[6] The more the services can differentiate among the costs of individual moves, the more closely they will be able to estimate savings and thus determine whose extensions will lead to savings. This point is an important element in the argument for auction-based extension incentives.

instances, there is some conservatism reflected in current programs. But recall also that in FY 2013, the range of payments under the Marine Corps IPCOT program ranged from $1,390 to $28,613; the range for the COT program was $815 to $23,910.

Accordingly, the incentive range we would recommend derives from *the annual net steady-state savings* of each extension. Consider Equation 6.3, which tells us avoided moves per long-run extended tour are inversely related to the original average tour length. Average tour lengths of 2.5 to 4 years thus suggest a long-run break-even incentive range of between 0.25 and 0.4 (maximum) times the expected value of the move avoided. Further hedging against risk suggests lower caps.

If we assume the theoretical cost of a move is $10,000, applying this logic to our example above suggests high-end gross annual savings of about $1.4 million (138 avoided moves, or the top right entry in Table 6.3 multiplied by $10,000). On the cost side, the steady-state number of extended tours is 414. With a hypothetical incentive payment of $3,000, total net savings per year would drop to just under $140,000 if the incentive had be to paid to all of the servicemembers who extend. Paying this incentive only to about 170 servicemembers who would be financially induced to extend (i.e., paying no incentive at all to the 240 or so who would voluntarily extend with no incentive) would yield steady-state savings of about $860,000 in this theoretical construct.[7]

Application of Steady-State Analysis to Current PCS Programs

We can scale up the steady-state example by applying it to current PCS programs. To do this, we used data from the FY 2015 Budget Justification Books (J-Books; Military Personnel, 2014a, 2014b, 2014c, and 2014d) that the services submitted to Congress. This enables a rough estimate of the long-term steady-state outcomes of extending tour lengths. Note that these are steady-state outcomes and they do not reflect the actual budgets needed to operate the PCS program in an actual year. The data in the J-Books cover actual execution in FY 2013, projections for FY 2014, and estimates for 2015 and are thus a comprehensive picture of the current and near future of each service's PCS program.

Deriving Average Tour Lengths

The J-Books provide data on six types of moves: accession, training, operational, rotational, unit, and separation. Our research concentrates on operational and rotational moves, the types of moves highlighted by the Senate Appropriations Committee. Table 6.4 shows data from the Army's J-Book for operational and rotational moves, our estimates of the average moves per servicemember, and the resulting average tour lengths for officers and enlisted personnel. On average, Army officer tour lengths, based on calculations and adjustments,[8] are about 2.5 years, and the average for enlisted personnel is about 3.1 years.

---

[7] In essence, this last observation assumes a significant ability on the part of the government to discriminate and select among bidders. A greater ability, in all likelihood, than would be attained in practice. Recall the discussion in Chapter Five regarding discriminatory-price auctions.

[8] The calculations leading to these estimates include adjustments for first-year attrition and an allowance for the fact that training move figures include the same person moving twice, in many cases. These adjustments are an attempt to avoid double counting and thus result in more reasonable estimates of the populations subject to operational and rotational moves.

Table 6.4
Army PCS Moves

	FY 2013		FY 2014		FY 2015		Average	
PCS Moves	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted
Net operational	8,214	32,728	7,867	30,607	8,621	32,094		
Net rotational	9,098	42,475	8,302	39,152	8,710	41,200		
Calculated average moves/person	0.405	0.346	0.385	0.311	0.409	0.320	0.40	0.33
Calculated average tour lengths	2.472	2.889	2.597	3.215	2.447	3.127	2.51	3.08

SOURCE: Military Personnel, *Army Justification Book*, March 2014b, pp. 113–130.

Tables 6.5 through 6.7 show similar derivations of tour length averages for the other services.

Interestingly, estimated average tour lengths for the Navy are very similar to those for the Army.

Table 6.5
Navy PCS Moves

	FY 2013		FY 2014		FY 2015		Average	
PCS Moves	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted
Net operational	7,343	21,934	6,479	22,166	6,379	21,828		
Net rotational	5,718	23,943	4,848	20,302	4,780	20,019		
Calculated average moves/person	0.419	0.321	0.382	0.332	0.289	0.336	0.40	0.33
Calculated average tour lengths	2.387	3.111	2.616	3.013	2.568	2.973	2.52	3.08

SOURCE: Military Personnel, *Navy Justification Book*, March 2014d, pp. 113–131.

Table 6.6
Air Force PCS Moves

	FY 2013		FY 2014		FY 2015		Average	
PCS Moves	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted
Net operational	7,500	11,900	7,800	11,500	7,009	11,380		
Net rotational	6,450	29,810	6,400	30,100	6,228	30,588		
Calculated average moves/person	0.340	0.213	0.360	0.226	0.367	0.242	0.36	0.33
Calculated average tour lengths	2.938	4.702	2.779	4.427	2.725	4.138	2.81	4.42

SOURCE: Military Personnel, *Air Force Justification Book*, March 2014a, pp. 109–123.

Table 6.7
Marine Corps PCS Moves

	FY 2013		FY 2014		FY 2015		Average	
PCS Moves	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted
Net operational	3,848	14,213	4,175	14,840	4,336	15,000		
Net rotational	1,385	10,916	1,372	9,890	1,342	9,890		
Calculated average moves/person	0.368	0.231	0.416	0.230	0.440	0.260	0.41	0.24
Calculated average tour lengths	2.715	4.326	2.403	4.346	2.274	3.847	2.46	4.17

SOURCE: Military Personnel, *Marine Corps Justification Book*, March 2014c, pp. 77–93.

Estimated Air Force tour lengths for officers are a little longer than those for the other services (about 2.8 years versus 2.5 years); those for enlisted personnel exceed four years.

Marine Corps officer tours are closer to the average for Army and Navy, around 2.5 years; as with the Air Force, their enlisted tours average over four years.

Tour Lengths, Extensions, and Reductions in Average Numbers of Moves

Using the modeling techniques presented above, we can examine the effects of tour extensions on the numbers of rotational and operational moves for each service. As noted in Table 6.4, the projected number of rotational moves for Army officers in 2015 is 8,710. This implies 4,355 moves out; recall that moves out form the basis for our calculations of avoided moves. Applying this to equation 6.1, accounting for estimated population adjustments, and assuming a 40 percent extension rate, we can calculate a new number of steady-state moves of about 3,755—a reduction of about 600, or just under 14 percent. According to Equation 6.3, the average moves avoided per extension would be 0.4. Similar calculations for rotations of enlisted personnel suggest moves of about 18,175, a reduction of about 2,425; moves avoided per extension would be about 0.33.

Given the same 40-percent extension rate, the same calculations can be made for the Navy, Air Force, and Marine Corps to yield similar reductions in moves:

- Navy: 330 officer moves and 1,178 enlisted moves reduced
- Air Force: 340 officer moves and 1,275 enlisted moves reduced
- Marine Corps: 93 officer moves and 440 enlisted moves reduced.

Table 6.8 shows the *steady-state* number of moves that could be avoided, given various extension rates.

Cost and Savings Implications

The cost estimates deriving from the preceding analysis are straightforward. Table 6.9 provides average costs per move for rotational moves of officers and enlisted personnel, taken from the FY 2015 J-Books.

Taking the moves avoided from Table 6.8, applying the average costs per move from Table 6.9, and then adjusting to reflect the constraint we imposed on the optimistic assump-

Table 6.8
Steady-State Moves Avoided with Various Extension Rates

	Army		Navy		Air Force		Marine Corps	
Extension Rate	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted
0.1	168	665	92	323	107	340	26	118
0.2	323	1,288	177	626	208	665	50	230
0.3	467	1,873	256	910	301	976	72	337
0.4	601	2,424	330	1,178	389	1,275	93	440
0.5	726	2,943	398	1,430	472	1,561	112	538

SOURCE: Authors' calculations.

Table 6.9
Costs Per Move, Composite, 2015 (dollars)

Army		Navy		Air Force		Marine Corps	
Officers	Enlisted	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted
$23,626	$14,399	$17,755	$9,310	$22,206	$12,062	$17,886	$7,677

SOURCE: Calculated from J-Book entries.

tion regarding moves avoided,[9] Table 6.10 shows the estimated steady-state savings from various tour-length extension rates. Assuming it could be achieved uniformly, the 40-percent extension rate we have been using in our examples to this point would yield yearly *steady-state* savings estimated around $95 million across all four services.

It is important, however, to note that these are steady-state values that would ideally be achieved over time, assuming the extension rates shown above could be achieved and sustained. Thus, these figures do not reflect the short-term budget savings that would accrue in any given year because, as we have shown in Figure 6.1, the number of moves will oscillate

Table 6.10
Estimated Steady-State Savings by Extension Rate (thousands of dollars)

	Army		Navy		Air Force		Marine Corps	
Extension Rate	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted	Officers	Enlisted
0.1	3,957	9,569	1,632	3,006	2,384	4,099	462	904
0.2	7,621	18,539	3,143	5,824	4,610	8,021	889	1,766
0.3	11,024	26,966	4,547	8,472	6,692	11,775	1,286	2,588
0.4	14,192	34,897	5,853	10,964	8,644	15,373	1,655	3,375
0.5	17,148	42,375	7,073	13,313	10,477	18,824	2,000	4,127

[9] The original steady-state assumption was that each extension stops both a move out and a move in. For reasons we discussed above, we pared this assumption back to one for one.

significantly in the near term. Oscillating savings are not a useful basis for budget entries, nor are they a good foundation for estimating the potential of incentive programs. We therefore recommend, as discussed above, that incentives—and decisions regarding the establishment and structure of incentive programs—be based on the long-term average savings illustrated here. We also recommend—here and elsewhere—that the services use voluntary programs to incentivize extensions and/or increased TOS, rather than arbitrarily lengthening tours and TOS. The following discussion examines possible impacts of incentive programs.

Refining the Approach: Expanded Model Applied to Data from PCS Programs

Except for the brief excursion in the development of the theoretical model at the beginning, the analyses in this chapter up to this point have generally assumed the extensions at whatever rate were all completely voluntary. We now relax that assumption and examine more realistic cases in which at least some extensions would come as the result of paid incentives, possibly along the lines discussed in Chapter Five. We also apply the previously discussed refinements to our steady-state analysis, portraying the estimated impacts of both incentive-induced extensions and constraints deriving from operational and professional development considerations.

Discriminatory-Price Auction

As we discussed in Chapter Five, a bid system using a discriminatory-price auction would pay an incentive to each person submitting a bid based upon that person's bid and subject to any restrictions placed upon the auction, such as not accepting a bid higher than the value of the savings to the service. This assumes that those interested in extending will bid their assessment of what it would take for them to extend. In other words, in one limiting case we could assume as many as 40 percent would submit a bid of zero, and the remaining personnel would receive a graduated payment based on their bid.

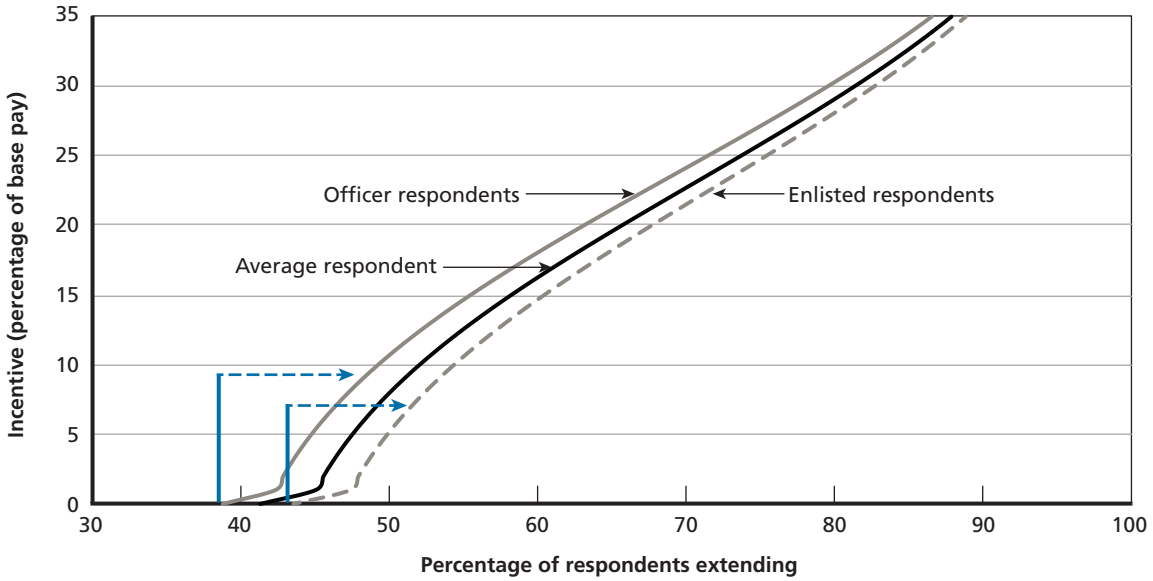
For purposes of presenting a midrange but reasonably conservative estimate of the savings that could accrue from such a discriminatory-price auction, we assume a base extension rate of about 39 percent for officers and 43 percent for enlisted.[10] To these base extension rates, we apply assumed moderate impacts from operational and professional development considerations. Figure 6.2 illustrates how this auction would work.

Readers will recognize this diagram as a replica of the overall extension supply curves in Figure 4.10. We have added vertical lines at the average voluntary extension rates for officers and enlisted (39 and 43 percent) and horizontal lines to represent the effects of extension bonuses of about 9 and 7 percent of base pay, respectively, which are typical values for the maximum incentives based on the potential savings value of extensions.[11] This diagram thus illustrates the approach to calculating responses to incentives and, thus, effects on potential savings. The distance from the left line to the officer supply curve is about 9 percentage points, meaning that at this incentive level we would expect about a 9-percent increase in officers willing to extend. Similarly, the increase for the average enlisted person would be about 8 percent, the distance from the right vertical line to the enlisted supply curve. We did calculations like

[10] These are the mean rates drawn from our analysis of the DMDC survey data.

[11] We capped these at 80 percent of the average savings value. Recall Equation 6.3 tells us savings per extension are inversely related to the original average tour length. Enlisted tours, on average, are longer than those for officers; average tour lengths also vary by service. See also the discussion of considerations bearing on savings that follows Table 6.3.

Figure 6.2
Offering Incentives Along the Extension Supply Curve



RAND *RR1034-6.2*

these for enlisted persons and officers in all four services, accounting for differences in the savings value of extensions and in responses to incentives.

In a discriminatory-price auction, officials would theoretically be able to offer an incentive at each point along the curve and thus capture extensions from people at the lowest incentive level that would induce them to extend. In other words, officials in the example here would pay no incentive to those who would have extended for free and would pay the minimum needed incentive to induce extensions from those on the upward-sloping part of the supply curve, up to the previously determined cap.

The first row of Table 6.11 provides the estimated steady-state savings that would accrue in such a case; the second row is a comparison case with a uniform-price auction, which we will discuss immediately after the table. Note that this example does not allow for the potential padding of bids, as discussed in Chapter Five, and is therefore potentially a higher estimate of the cost savings that might result.

A Uniform-Price Auction

In the above example, different people get different incentives. We assumed that the officials administering the program would have complete information that would enable them to match incentives with bids, and also that the bids would not be padded.[12] Therefore, the savings estimated above are almost surely unachievable. At the other end of the range of possible cases, we can also estimate what the results would be if the services wanted to make the same payment to all receiving an incentive. The second row of Table 6.11 illustrates this case, showing the estimated annual steady-state savings assuming that all[13] who extend receive an exten-

[12] Another way to view this is that the officials can identify those who would have extended for free and that they also know exactly how much it would take to induce additional extensions, individual by individual.

[13] Thereby including those who would have extended for free.

Table 6.11
Estimated Steady-State Savings (thousands of dollars with base extension rates and additional induced extensions)

	Army		Navy		Air Force		Marine Corps	
Pricing	**Officers**	**Enlisted**	**Officers**	**Enlisted**	**Officers**	**Enlisted**	**Officers**	**Enlisted**
Discriminatory	12,084	32,759	4,663	9,815	7,065	13,666	1,323	2,961
Uniform	2,431	7,862	963	2,195	1,436	2,968	244	667

NOTES: Savings are based on average costs of rotational moves, calculated from J-Book entries, as in Table 6.9. Extension rates are calculated using assumed 40-percent voluntary extensions, adjusted for operational and developmental requirements, and additional induced extensions calculated based on an incentive offer amounting to 80 percent of the long-term average cost per extension. We further assume, in the discriminatory pricing case, that incentives are paid only to those who would not have extended voluntarily; in the uniform pricing case, we assume all who extend, including those who would have extended for free, are paid uniformly.

sion incentive payment, using a uniform-price auction, such as those used by eBay. As with our discriminatory pricing case, the incentive payment is keyed to the normalized savings per extension: the same payment we used in the discriminatory-price example just above, except that in this second case the same payment goes to everyone who extends.

Not surprisingly, the savings are considerably smaller in the second case, ranging around 20 percent of the savings that might accrue in the discriminatory pricing case.[14] So it is important to note that while the perfectly discriminating price system might not be appealing even if feasible, it is possible some level of price discrimination might be in order. A lesser degree of selective pricing would certainly not yield savings like those in the first row of the table but would most likely improve on those calculated in the second row. For example, DoD could offer a smaller incentive—or a nonmonetary incentive, such as a school or station-of-choice option[15]—to those willing to extend voluntarily. There is a wide range of possible combinations of approaches that would yield savings within the bounds shown in our table.

Regardless of the method chosen, the incentives should be capped at a fraction of the estimated average savings per extension, as we have done (at 80 percent) in the calculations portrayed above. This caution applies to nonmonetary incentives as well—note that the school or station options suggested above could be managed in ways that would involve little or no cost to DoD. In determining these caps, while it may not be possible to know what the "hidden" minimum incentive would be for any given individual, it is possible to get a reasonable estimate of his or her PCS cost. That cost enables an estimate of the contribution of that person's extension to long-term average savings; comparing that estimate with the incentive being considered (proposed or bid) then determines whether or not any prospective extension would result in savings.

[14] The fact that there are any savings at all derives primarily from our cap on incentives at 80 percent of the potential average savings per extension.

[15] Data on the responsiveness of the force to these kinds of incentives are not available. Collecting such data would be a good element to include in any pilot program.

Concluding Thoughts on Savings

We have illustrated both a theoretical construct using a steady-state example and an illustrative means for applying that construct, using program data, to develop a comprehensive picture of possibilities for extensions, extension incentives, and potential savings. In closing, we emphasize these points:

- The cyclical nature of near-term effects of extensions on move patterns makes estimation of year-to-year savings difficult.
- That feature and the dynamic nature of the overall system complicate estimation of long-term savings, which must therefore be considered approximations.
- Consistent with observations in previous chapters, particularly Chapters Three and Four, the estimation of moves avoided and thus potential savings is a highly individual process. It is made more so by the nature of the costs associated with each move.
- Depending on the type of pricing scheme chosen, the range of savings that could be achieved with incentives structured as we discussed is somewhere between $19 million and $84 million annually, totaled across all four services.
- Those savings compare with an illustrative $95 million[16] that might be achieved with an arbitrary policy that adds one year to overseas tours for 40 percent of the population, without regard to morale or quality-of-life impacts.
- Any move forward should start with a pilot program, as discussed in Chapter Five. Such a program should include provisions for gathering more specific data on costs, savings, and proclivities to extend, given the various inducements the services might offer.

[16] Table 6.10 has other comparable figures, arranged by the percentage of servicemembers affected by this hypothetical policy.

CHAPTER SEVEN

Conclusions and Recommendations

The complex interactions of PCS programs, their various elements, and other influencing factors make it difficult, if not impossible, to justify across-the board changes in tour lengths or other policies that would impact major segments of the PCS population. Policies—like incentive programs—whose impacts can be managed selectively stand a better chance of success in accomplishing the goal of achieving greater stability without adversely impacting morale, quality of life, or professional development programs. Our portrayals of some of the complexities provide a flavor for them, but the workings of the PCS system are, in many ways, more complex than what we have presented here. This leads to a second important point—more of a perspective than a conclusion per se, but highly relevant to our work and the conclusions we present here: DoD's PCS programs are not ends in themselves, and they are not systems that operate on their own, independently of other elements of manpower and operational programs. Rather, they are reflections of the means the services employ to manage the people in the force: bringing them into the force, training and educating them, progressing them through their careers while meeting operational requirements, and transitioning them out of the force. Personnel managers must also be concerned with trying to achieve equity and balance in the processes of meeting operational and developmental requirements. In this sense, the PCS programs should properly be viewed as *derivatives* of the manning programs and their requirements, and not as drivers of those programs. But this does not mean there is no flexibility available for those seeking greater stability and savings in the PCS programs. Our work reveals considerable potential flexibility and presents means for capitalizing on that potential. We will summarize the most important conclusions from our work and then offer some recommendations and cautions.

Key Conclusions from Our Research

There Are Essentially Two Ways Available to Reduce PCS Costs

The two ways to reduce PCS costs are to reduce the costs per move or to reduce the number of moves. While this is somewhat trivial, we bring it up because our research further supports the conclusion many others have drawn: that the greatest potential for savings lies in reducing the number of moves. This idea was the motivation for this report and was essentially the sole focus of our work. Reducing the number of moves requires either reducing the size of the force that moves or increasing the amount of time between moves, which effectively reduces the number of moves in any given year. We focused on the second of these, taking the overall size of the force as a given from the perspective of PCS programs. The means we discuss for influencing the time between moves would apply to a force of any size. Time between moves—average

TOS or tour length—is subject to four policy levers: the prescribed tour length or TOS goal, policies and guidance regarding exceptions to those specified times, policies and guidance for encouraging servicemembers to extend their current tours, and policies and guidance for inducing servicemembers to accept back-to-back tours in the same location. The last two of these are essentially the same in practice, although their policy origins are different. Noting that voluntary extensions can enable savings and, at the same time, improve soldier and family assessments of quality of life, we concentrated much of our work on examining how such inducements could be structured and the effects they could have.

There Are Several Programs Designed to Encourage Voluntary Tour Extensions

We discuss examples of such programs in Chapter Two. They all feature an up-front establishment of the incentive offered, limiting flexibility on the part of both the servicemembers and the personnel managers, and also the connection with savings or efficiency goals. While there are certainly other reasons for encouraging servicemembers to extend their tours, larger-scale programs like the ones we discuss in this report would need to be tied to the ability of the programs to achieve savings. Many of the programs currently in place could be adapted and included in the incentive structures we present. DoD may also want to leave some of these programs intact because of their value in achieving other goals, such as stability or keeping selected people with badly needed skills in a particular location, regardless of whether or not doing so reduces overall PCS program costs.

A Significant Majority of the Force Indicated They Are Not Predisposed to Extend Their Tours . . .

About 59 percent of the sample surveyed in late 2013 in DMDC's SOFS-A indicated they would not be willing to extend their tours voluntarily. This proclivity varied somewhat across services and by demographic group, but the implication is clear: Across-the-board increases in prescribed overseas tour lengths would meet with a largely negative reaction. Chapter Three elaborates on this point in considerable detail and establishes as well that preferences in this regard are highly individual and thus difficult to discern *a priori*, as one would want to do, for example, in targeting a particular group with a proposed incentive.

. . . But a Nontrivial Minority Said They Would Be Predisposed to Extend

Consistent with the logic above, about 41 percent would be willing to extend voluntarily. Again, the results are highly individualistic, but the presence of this many potential extenders in the sample population suggests a judiciously designed incentive program would induce a noticeable increase in extensions at rather low costs; note that these particular respondents, in essence, stated they would have extended for free. Increased extensions and tour lengths within this group would result in an associated decrease in moves and, thus, move costs without adversely affecting the morale or perceived well-being of those concerned.

Another Significant Portion of the Force Would Extend in Return for a Financial Incentive

The DMDC survey design asked a series of supplemental questions to the members of the 59-percent segment that indicated they would not extend their tours. In essence, these questions offered them a gradated series of possible incentive levels; their responses enabled us to develop statistically robust relationships between willingness to extend and the incentives themselves, controlling for relevant demographic and attitudinal factors. This analysis leads us

to conclude that monetary incentives would positively affect extension rates within the force, with the size of the effect depending on the demographic and attitudinal factors, as well as the size of the incentive itself. These results support our analyses of savings potential. However, we note again that stated behavioral responses may not always match revealed (real-world) behaviors.

Take-It-or-Leave-It Incentive Programs Have Many Disadvantages

Briefly, these disadvantages are as follows:

- Those administering the system cannot determine the amount of incentive needed to induce a particular individual to accept the offer. See also the discussion above and in Chapters Three and Four regarding the individualistic nature of preferences and willingness to accept incentives. This is a particular problem when a chief goal is to produce savings by offering the incentive. It can operate in either direction—paying too much (more than the savings the extensions produce), or paying too little and thus closing out potential recipients whose extensions could yield net savings.
- Even if the above problem is solved, offering a fixed incentive uniformly to all eligible recipients means some recipients will be overpaid. One easily recognizable example is that anyone who would have extended for free would be overpaid by the amount of the incentive.
- Establishment of the incentives in advance does not enable responsiveness to changes in servicemember inclinations, or, at best, it will lag in adjusting to those inclinations, further complicating the first two problems.

Appropriately Structured Auction Programs Can Avoid the Problems Outlined Above and Can Lead to Savings

Such programs would solicit bids from eligible servicemembers and thereby determine the financial incentive that would induce a given number of extensions. The officials administering the program can then match the bids against the calculated savings potential of each extension and accept or reject the bids accordingly. Auctions mitigate the first problem above by collecting information on incentive levels directly. They mitigate the second by allowing payments to vary; they also can take advantage of competitive pressures that would help to keep bids lower. Auctions eliminate the third problem entirely. Auctions are inherently responsive to changes in the demand for extensions, adjusting incentive pays in real time and allowing the government to adjust incentive limits to avoid paying more for an extension incentive than the extension would save in PCS costs. They can also be designed and administered so as to account appropriately for any operational or professional development requirements that would bear on the desirability of an extension for any given servicemember.

There are several possible auction mechanisms, and there is a precedent for auction-based incentives in the military services: the Navy's AIP program. Although this program is designed to get sailors to take on assignments and not necessarily to extend their tours, its existence as a precedent is notable, and its structure offers a foundation for an incentive system for tour extensions.

Determining the Costs and Savings from PCS Program Changes Is Complex

Determining costs and savings is both complex and fraught with possibilities for error. Estimating savings based on the single-year, near-term results of an increase in tour lengths (regardless of how induced) risks periodically overestimating and then underestimating the savings. We therefore hold—as Chapter Six makes clear—that the best way to examine and compare the potential effects of extensions is to estimate their long-term average effects. Our comparisons also demonstrate that voluntary and incentive-based programs to encourage extension have considerable savings potential without running the risk of damaging servicemember and family well-being and morale. In our analyses, we concentrated on two basic incentive approaches—a uniform-price auction and a discriminating-price auction—to provide illustrative comparisons of their savings potential. Both alternatives offer significant savings—on the order of tens of millions of dollars annually over the long term. In theory, the discriminating-price auction offers about four to five times as much in savings, but this theoretical limit is unlikely to be achieved in practice.

Recommendations

Implement an auction-based incentive program for tour extensions.
We recommend examination of an auction-based program, possibly as a pilot program to test the feasibility of this approach. Appendix M discusses in detail how an auction pilot might be designed. Properly structured, such a pilot program is likely to yield PCS savings fairly quickly. These savings will enable better longer-term estimates of program effectiveness, using analyses analogous to those we presented, and thus form the basis for decisions on the program's expansion, modification, or both.

Evaluate existing incentive programs more fully, both financial and in kind.
Short of implementing an auction-type program, possibly as a pilot, we recommend that existing extension incentive programs be evaluated in terms of their net costs (or savings) to enable better-informed decisions regarding whether they are worth the cost. The services should not be paying an incentive for an extension that is greater than the long-term savings value of that extension. Note that this means more differentiation among the costs of PCS moves along demographic and other lines;[1] note also that an auction or similar mechanism could enable such differentiation.

Continue to provide the flexibility to balance between personnel management goals and the goal of achieving PCS savings.
We have stressed the value of programs that will induce more extensions, more stability, and more savings without disrupting professional development patterns, limiting ability to meet operational requirements, or damaging the morale and well-being of servicemembers and their families. The PCS program should be a reflection, not a determinant, of personnel management strategies.

---

[1] One important example is accompanied versus unaccompanied moves. Accompanied moves generally cost a good deal more than unaccompanied moves, so deferring accompanied moves will save more in almost all cases.

APPENDIX A

Description and Cost of PCS Moves

Table A.1
Descriptions of the Different Types of PCS Moves

Types of Moves	Description
Accession moves	Moves that occur when individuals go from their homes to their first duty stations
Training moves	Moves that occur when individuals attend a formal course of study, except if it involves transoceanic travel, in which case it is categorized as a rotational move
Operational moves	Moves that occur when individuals are transferred within the continental United States or within an operational theater when transoceanic travel is not involved
Rotational moves	Transoceanic moves either to or from an overseas duty station; accessions directly to an overseas location, separations from overseas, and unit moves to and from overseas are excluded from this category
Separation moves	Moves that occur when individuals leave active duty
Unit moves	Moves that occur when individuals move as members of an organized unit, either within the United States or overseas

Table A.2
Permanent Change of Station Travel Costs (FY 2014 Total Enacted) (dollars in thousands)

	Army	Navy	Marine Corps	Air Force
Accession Travel	152,711	95,366	45,933	86,485
Training Travel	136,797	96,869	23,061	70,127
Operational Travel	578,874	246,494	182,934	298,577
Rotational Travel	677,466	273,812	95,129	461,684
Separation Travel	233,791	126,200	97,770	198,183
Travel of Organized Units	10,324	36,790	784	16,123
Non-Temporary Storage	10,283	1,212	6,888	23,132
Temporary Lodging Expense	33,658	8,545	14,918	30,183
Other	0	3,514	3,312	0
TOTAL	1,833,904	888,802	470,729	1,184,494

SOURCE: Department of Defense, FY 2015 President's Budget, Exhibit M-1 Total Obligational Authority.

APPENDIX B

Prescribed Lengths for OCONUS Tours

Table B.1
Prescribed Lengths for OCONUS Tours

	Accompanied Tours (months)	Unaccompanied Tours (months)	Date Effective
Afghanistan			
Kabul	N/A	12	8/10/2007
Alaska (except as indicated)	36	36	
Adak	N/A	12	
Clear	N/A	12	
Eareckson	N/A	12	
Fort Greely	24	12	5/1/2004
Galena	N/A	12	
King Salmon	N/A	12	
Marine Corps Security Forces	24	12	
Albania			
Tirana	24	12	
Algeria	24	12	12/7/2004
American Samoa	N/A	12	
Argentina	36	24	
Armenia			
Yerevan	24	18	7/6/2006
Aruba	24	18	
Australia (except as indicated)	36	24	
Exmouth	24	24	
Learmonth	24	15	
Woomera	24	15	
Austria	36	24	

	Accompanied Tours (months)	Unaccompanied Tours (months)	Date Effective
Azerbaijan			
Baku	24	18	7/6/2006
Bahamas			
Andros Island	24	24	
Bahrain	24	12	
Bangladesh	24	18	
Belgium (except as indicated)	36	24	
Bertrix	N/A	12	
Belize	24	18	9/17/2004
Benin	24	12	
Bermuda	36	24	
Bolivia	24	18	
Bosnia-Herzegovina			
Banja Luka	24	18	6/30/2008
Sarajevo	24	18	7/6/2006
Botswana	24	12	
Brazil	36	24	
British Indian Ocean Territory			
Diego Garcia Island	N/A	12	
Bulgaria			
Sofia	24	12	
Burkina Faso	24	12	
Cambodia	N/A	12	
Phnom Penh	24	12	6/21/2010
Canada (except as indicated)	36	24	
Newfoundland and Labrador	24	12	
Argentia	24	12	
Goose Bay	24	12	
Chad	24	12	5/2/2008
Chile	36	24	
Columbia	24	18	
Commonwealth of the Northern Mariana Islands	24	12	
Costa Rica	36	24	

	Accompanied Tours (months)	Unaccompanied Tours (months)	Date Effective
Croatia			
Zagreb	24	12	
Cuba			
Guantanamo Bay	30	18	4/5/2007
JTF-GTMO	24	12	4/5/2007
Marine Barracks	24	12	
Cyprus (except as indicated)	24	18	
Akrotiri	24	12	
Czech Republic			
Prague	36	24	
Vyskov	24	12	8/11/2011
Democratic Republic of Congo	24	12	
Denmark	36	24	
Kalaallit Nunaat (formerly Greenland)	N/A	12	
Djibouti			
Djibouti City	24	12	4/11/2007
Dominican Republic	36	24	
Ecuador	36	18	
Manta	N/A	12	
Egypt (except as indicated)	24	18	
Beni Suef	N/A	12	
Cairo	N/A	12	
Ismailia	24	12	
Jiyanklis	N/A	12	
Sinai	N/A	12	
El Salvador	N/A	12	
Personnel assigned to Security Assistance Office (SAO)	24	18	
Eritrea	24	12	
Estonia			
Tallinn	24	24	
Ethiopia			
Addis Ababa (personnel assigned to SAO)	24	12	4/11/2007

	Accompanied Tours (months)	Unaccompanied Tours (months)	Date Effective
France	36	24	
Georgia			
Tbilisi	24	18	
Germany	36	24	
Donaueschingen	24	12	
Geilenkirchen	36	36	
Ghana			
Accra (personnel assigned to Office of Defense Cooperation [ODC])	24	18	3/19/2007
Gibraltar	36	24	
Greece (except as indicated)	36	24	
Argyroupolis	N/A	12	
Athens	24	15	
Crete	24	18	
Souda Bay	N/A	12	4/18/1997
Drama	N/A	12	
Elefsis	N/A	12	
Horiatis	N/A	12	
Larissa	24	12	
Lefkas	N/A	12	
Parnis	30	18	
Patras	30	18	
Perivolaki	N/A	12	
Thessalonki	24	15	
Yiannitsa	N/A	12	
Guam	36	24	10/12/2004
Guatemala	36	24	
Guyana	24	18	
Haiti			
Port au Prince (personnel assigned to ODC)	24	12	11/20/2007
Hawaii (except as indicated)	36	36	
Kauai	30	18	
Pohakuloa Training Area	24	18	

	Accompanied Tours (months)	Unaccompanied Tours (months)	Date Effective
Honduras (except as indicated)	24	18	
Soto Cano AB	N/A	12	
Hong Kong	36	24	
Hungary			
Budapest	36	24	
Papa	24	15	11/25/2008
Iceland (except as indicated)	30	18	10/4/1999
USAF (not assigned to a joint activity)	24	12	
USMC (not assigned to a joint activity)	24	12	
India (except as indicated)	24	12	
New Delhi (personnel assigned to ODC)	36	24	11/9/2012
Indonesia	24	12	
Ireland	36	24	
Israel	24	12	
Italy (except as indicated)	36	24	
Crotone	24	15	
Ghedi	36	24	5/31/2013
Martina Franca	24	18	
Mt. Corna	24	18	
Mt. Finale Ligure	N/A	12	
Mt. Limbara	N/A	12	
Mt. Nardelo	N/A	12	
Mt. Paganella	N/A	12	
Mt. Venda	24	18	
Mt. Vergine	24	15	
Piano di Cors	N/A	12	
Poggio Renatico	24	12	
Rimini	24	18	
Sardinia			
Decimomannu Air Base (AB)	24	15	
La Maddalena	24	24	
Sicily			

	Accompanied Tours (months)	Unaccompanied Tours (months)	Date Effective
Comiso	24	12	
Jamaica	24	12	
Japan (except as indicated)	36	24	
Akizuki Kure	24	12	12/7/2004
Itami (Sapporo)	24	12	12/7/2004
Kumamoto	24	12	12/7/2004
Kuma Shima	N/A	12	
MCAS Iwakuni	36	12	
Okuma	N/A	12	
Osaka	24	12	12/7/2004
Ryukyu Islands (except as indicated)	36	24	
Okinawa			
Ie Shima	N/A	12	
MCAS Futenma	36	12	
MCB Butler	36	12	
Seburiyama	N/A	12	
Sendai	24	12	12/7/2004
Shariki	N/A	12	11/5/2008
Johnston Atoll	N/A	12	
Jordan (except as indicated)	24	12	
Amman	24	18	
Kazakhstan			
Astana (personnel assigned to SAO)	24	12	8/10/2007
Kenya	24	12	
Nairobi	24	18	
Korea (except as indicated)	36/24	12	3/2/2009
Chongju AB	N/A	12	
Dongducheon (Camps Casey, Hovey, Mobile, Castle)	24	12	
Gwangju AB (ROK)	N/A	12	
Joint Security Area	N/A	12	
Kunsan AB (U.S.)	N/A	12	
Mujak/Pohang	N/A	12	

	Accompanied Tours (months)	Unaccompanied Tours (months)	Date Effective
Uijongbu (Camps Jackson, Red Cloud, Stanley)	24	12	
Kuwait	24	12	
Kyrgyzstan	24	12	
Laos	N/A	12	
Vientiane	24	12	12/21/2006
Latvia			
Riga	24	12	
Liberia	24	18	6/30/2008
Libya			
Tripoli (personnel assigned to security cooperation organization [SCO])	N/A	12	10/19/2011
Lithuania			
Vilnius	24	12	
Luxembourg	36	24	
Macedonia	24	18	
Skopje	24	12	
Madagascar	24	12	
Malaysia	36	24	
Marshall Islands			
Enewetok	N/A	12	
Kwajalein	24	18	
Mexico	24	18	
Midway Islands	N/A	12	
Moldova			
Chisinau	24	18	
Mongolia	24	24	
Montenegro			
Podgorica (personnel assigned to ODC)	24	24	1/28/2008
Morocco (except as indicated)	24	15	
Casablanca	24	12	
Errachidia	N/A	12	
Netherlands	36	24	

	Accompanied Tours (months)	Unaccompanied Tours (months)	Date Effective
Netherlands Antilles			
Curacao	N/A	12	
New Zealand	36	24	
Nicaragua	24	18	
Niger	24	12	
Nigeria			
Abuja (personnel assigned to ODC)	24	24	4/11/2007
Norway	36	24	7/7/2004
Oman	24	12	
Pakistan	24	12	
Panama (except as indicated)	36	24	
Galeta Island	N/A	12	
Paraguay	24	18	
Peru	36	24	
Lima Military Assistance Advisory Group (MAAG)	30	18	
Philippines (except as indicated)	N/A	12	
Metropolitan Manila	24	18	
Manila			
Joint U.S. Military Assistance Group—Poland (JUSMAG-P)	36	24	12/1/2011
Poland			
Bydgoszcz	24	24	10/21/2005
Sczcecin	24	24	10/21/2005
Warsaw	36	24	
Portugal (except as indicated)	36	24	
Lajes AB	N/A	12	8/9/2013
Puerto Rico	36	24	
Caguas	36	18	
Isabela	36	18	
Juana Diaz	36	18	
Ponce (Ft Allen)	36	18	
Vieques Island	N/A	12	
Yauco	36	18	

	Accompanied Tours (months)	Unaccompanied Tours (months)	Date Effective
Qatar	24	12	
Romania			
Bucharest	24	24	
Oradea	24	12	9/30/2011
Russia			
Moscow (personnel assigned to Defense Attaché Office [DAO])	24	24	2/15/2007
Rwanda			
Kigali	24	24	10/17/2011
Saint Helena (Ascension Island)	24	12	
Saudi Arabia (except as indicated)	24	12	
Eskan Village, Riyadh	24	12	7/18/2008
Senegal			
Dakar (personnel assigned to ODC)	24	24	3/21/2007
Serbia			
Belgrade (personnel assigned to ODC and Bilateral Affairs Officer [BAO])	24	24	6/11/2007
Seychelles	24	12	
Singapore	36	24	
Slovakia			
Bratislava	36	24	
Trencin	24	12	9/16/2011
Slovenia			
Ljubljana	24	12	
Spain (except as indicated)	36	24	
Adamuz	N/A	12	
Albacete (Los Llanos Air Base—USAF only)	24	24	
Alcoy	30	18	
Balearic Islands	N/A	15	
Ciudad Real	N/A	12	
Constantina	30	18	
Elizondo	30	18	
El Ferrol	24	24	

	Accompanied Tours (months)	Unaccompanied Tours (months)	Date Effective
Estaca De Vares	N/A	12	
Gorremandi	N/A	15	
Moron AB	24	15	
Rosas	30	18	
Santiago	N/A	18	
Sonseca	24	15	
Villatobas	30	18	
Sudan	24	12	
Suriname	24	18	
Sweden			
Stockholm	36	24	
Tajikistan	24	12	
Thailand (except as indicated)	24	18	
Bangkok	36	24	
Tunisia	N/A	12	3/15/2013
Turkey (except as indicated)	24	15	
Balikesir	N/A	12	
Cakmakli	N/A	12	
Corlu	N/A	12	
Elmadag	24	12	
Erhac	N/A	12	
Erzurum	N/A	12	
Eskisehir	N/A	12	
Incirlik	24	15	8/1/2012
Iskendrum	N/A	12	
Istanbul	N/A	12	
Izmir	N/A	12	
Izmit	N/A	12	
Karatas	24	12	
Malatya	24	12	
Murted	N/A	12	
Oratakoy	N/A	12	
Pirinclik	N/A	12	

	Accompanied Tours (months)	Unaccompanied Tours (months)	Date Effective
Sahihtepe	N/A	12	
Sinop	N/A	12	
Yumurtalik	N/A	12	
Turkmenistan	24	12	
Ukraine			
Kiev	24	12	
United Arab Emirates	24	12	
United Kingdom (except as indicated)	36	24	
Royal Air Force (RAF) Fylingdales	24	18	
RAF Machrihanish (Scotland)	24	18	
Uruguay	36	24	
Uzbekistan	24	12	
Venezuela	24	18	
Vietnam	24	12	12/1/2003
Virgin Islands	36	24	
Wake Island	N/A	12	
West Indies			
Anguilla	24	18	
Antigua	24	12	
Barbados	36	24	
St. Lucia	N/A	12	
Yemen, Republic of	N/A	12	9/1/2011

NOTES: Tour lengths are established in accordance with DoDI 1315.18, paragraph E.3.1, and are effective January 12, 2005, unless otherwise noted.

SOURCE: U.S. Department of Defense, Per Diem, Travel and Transportation Allowance Committee, "Joint Federal Travel Regulations," Appendix Q, revised August 2013.

APPENDIX C

Existing Programs for Encouraging Tour Extensions, In-Place Consecutive Overseas Tours, and Stabilized Basing

Table C.1
Existing Programs for Encouraging Tour Extensions, In-Place Consecutive Overseas Tours, and Stabilized Basing

Program	Service	Description
Overseas Tour Extension Incentive Program (OTEIP)	All services	Offers eligible Army, Navy, Air Force, and Marine Corps members the opportunity to extend their overseas tours by 12 months or more and to choose one of three incentive options: (1) a $2,000 lump sum payment on the first day of the 12-month extension, (2) 30 days of nonchargeable leave during the period of extension, or (3) 15 days of nonchargeable leave plus round trip transportation at government expense between the overseas location and the port of debarkation in CONUS (20 days for extensions longer than 12 months). It is authorized under Section 314 of Title 37, U.S. Code, passed in December 1980.
Assignment Incentive Pay (AIP)[a]	All services	Offers eligible Army, Navy, Air Force, and Marine Corps members the opportunity to serve in assignments designated by the service secretary concerned and to receive additional pay. AIP originated as part of the 2003 National Defense Authorization Act as an effort to offer service secretaries greater flexibility to incentivize assignments for hard-to-fill positions. The services develop and recommend AIP programs to OSD for approval based on their identification of mission critical shortfalls. The maximum monthly rate of incentive pay payable to any member under AIP is $3,000. Several AIP programs offer incentives for tour extensions. Examples of AIP programs are provided in Appendix D.
In-place consecutive overseas tours (IPCOTs), or intratheater consecutive overseas tours (COTs)	All services	Encourages Army, Navy, Air Force, and Marine Corps members who complete their initial tours, plus any voluntary extensions, to remain at their same permanent duty stations for an IPCOT—a second complete prescribed overseas tour in the same location—or a COT—a second complete prescribed overseas tour in another location. Servicemembers submit requests for intra- or intertheater COTs, and requests must be approved by overseas commanders. They are subject to approval by the relevant service secretaries.
Voluntary and involuntary foreign service tour extensions (FSTEs and IFSTEs)	Army	Encourages eligible soldiers to request to extend their overseas tours voluntarily. A soldier's chain of command may also request authorization to extend a soldier's overseas tour involuntarily to meet critical operational requirements or for administrative reasons.
Active Duty Enlisted Voluntary Stabilized Base Assignment Program (VSBAP)	Air Force	Offers airmen the option to volunteer for tours at CONUS bases that have historically experienced high turnover. The benefit for the volunteer is a stabilized tour of either four or five years depending on the location. The eligible locations under this program are Cannon AFB, N.M.; Grand Forks AFB, N.D.; Minot AFB, N.D.; and Los Angeles AFB, Calif. (including Fort MacArthur). Members selected for Grand Forks or Minot under this program will serve five years; those selected for Los Angeles AFB or Cannon AFB will serve four years.

Program	Service	Description
Home basing	Air Force	Allows airmen selected for a short tour (a dependent-restricted or unaccompanied tour of 15 months or less) to apply for advance consideration to return to Alaska, Hawaii, or the same CONUS base they left after completing the short tour.
Follow-on program	Air Force	Allows airmen selected for a short tour to apply for advance consideration of a CONUS assignment (that is not their home base) or an overseas tour after completing the short tour.

[a] See Appendix D for the full list of AIP programs enacted to date.

SOURCES: Under Secretary of Defense (Comptroller), Department of Defense Financial Management Regulation, DoD 7000.14-R, Volume 7A: "Military Pay Policy—Active Duty and Reserve Pay," updated June 2014; Armed Forces, 37 U.S.C. § 314: Special Pay or Bonus: Qualified Members Extending Duty at Designated Locations Overseas; Armed Forces, 10 U.S.C. § 705: Rest and Recuperation Absence: Qualified Members Extending Duty at Designated Locations Overseas.

APPENDIX D

Assignment Incentive Pay Programs Implemented Since 2003

Table D.1
Assignment Incentive Pay Programs Implemented Since 2003

Program	Service	Description
Involuntary Extensions in Iraq, Afghanistan, or Certain Theater Units Program	All services	Entitles Army, Navy, Air Force, and Marine Corps members in certain career fields deployed to Iraq (to include staging time in Kuwait), Afghanistan, or certain theater units, who have been involuntarily extended by the Secretary of Defense beyond 12 consecutive months boots on ground (BoG; i.e., time deployed) or 12 months within a 15-month period (365 days of 450 days) to $800 in AIP and $200 for hardship duty pay (HDP) for each month or portion of a month served longer than 12 months BoG. The total monthly entitlement of HDP will not exceed $300. The program was first authorized on June 15, 2007. The Principal Deputy Under Secretary of Defense (Personnel and Readiness) (PDUSD [P&R]) changed the monthly $800 AIP and $200 HDP entitlements to a single monthly $1,000 AIP entitlement for involuntary extensions effective December 1, 2008.
Special Operations Forces (SOF) Incentive Pay Program	All services	Offers Army, Navy, Air Force, and Marine Corps members with more than 25 years of service who are designated by the combatant commander of SOCOM as SOF operators the opportunity to remain on active duty for an additional period of at least 12 months and receive AIP of $750 per month. The program was authorized on January 1, 2005.
Joint Special Operations Command (JSOC) Program	All services	Offers Army, Navy, Air Force, and Marine Corps members who hold an SOF specialty and are serving in one of up to 20 U.S. Special Operations Command (SOCOM) designated senior enlisted (E-7 to E-9) billets in JSOC the opportunity to serve 12 to 36 months in the assigned billet and receive AIP of $750 per month, or $1,000 per month for those who previously served three or more years in an operator billet. The program was authorized on June 29, 2009.
Assignment Incentive Pay in lieu of Post-Deployment/ Mobilization Respite Absence (PDMRA) Program	All services	Offers Army, Navy, Air Force, and Marine Corps members who mobilize or deploy more frequently than established rotation policy goals AIP in lieu of PDMRA administrative absence days. The AIP pay rate is set at $200 for each PDMRA day earned, up to the monthly limit of $3,000. The program was authorized on May 24, 2007.
Korea Assignment Program	Army	Offers members the opportunity to volunteer for a 36-month initial assignment to Pyeongtaek, Osan, Daegu, Chinhae, or Seoul—or a 24-month initial assignment to Uijongbu or Dongducheon—and receive AIP of $300 per month. Offers members who accept an initial tour to Korea in any location the opportunity to extend their assignment length for 12 or 24 months later and receive AIP of $300 per month. The program was authorized on April 6, 2009.

Program	Service	Description
Voluntary Extension in Iraq, Afghanistan, or Certain Theater Units Program	Army	Offers soldiers who agree to serve beyond 12 months BoG in Iraq (including Kuwait staging areas), Afghanistan, or certain theater units (defined as units that routinely conduct operations in or support units in Iraq but are not based in Iraq) the opportunity to extend their tours and receive AIP. Pay is set at $300 per month for an extension of three months and $500 per month for an extension longer than three months. The program became effective June 15, 2007.
Explosive Ordnance Disposal (EOD) Program	Army	Entitles soldiers in the military occupational specialty (MOS) of 89D who graduate from the Naval School Explosive Ordnance Disposal (NAVSCHOLEOD) the opportunity to be assigned to EOD billets performing EOD duties and receive AIP. The monthly payment of AIP is determined by pay grade and time accredited to working in the EOD field. It ranges from $50 for an E-1 with one year of qualified EOD service to $750 for an E-6 with eight years of qualified EOD service. The program was authorized on March 7, 2007.
Voluntary Extension Program for Army Intelligence Assets Program	Army	Offers Army members deployed to Iraq and/or Afghanistan the opportunity to voluntarily extend their assignment for three months and receive AIP of $300 per month. The program was authorized on February 9, 2005.
Military Occupational Specialty (MOS) 09L Interpreter Translator Program	Army	Offers Army Reserve and National Guard members who are qualified in MOS 09L and are deployed to Iraq, Afghanistan, or certain theater units the opportunity to voluntarily extend their tours of service beyond 12 months BoG and receive AIP of up to $3,000 per month. The program became effective on September 27, 2007. In December 2013, the payment rate was reduced to $1,500 per month.
Deployment Extension Stabilization Pay (DESP) Incentive Program	Army	Offers eligible mobilized Army National Guard members the opportunity to extend their mobilizations by an additional 12 to 21 months of service and receive AIP of $500 per month. The program was authorized on May 19, 2009.
Asymmetric Warfare Group (AWG) Incentive Program	Army	Offers members the opportunity to volunteer to serve an assignment, or accept an assignment, for 12 to 36 months in an AWG billet and receive AIP of $400 per month. The program was authorized on November 16, 2006.
780th Military Intelligence (MI) Brigade Incentive Program (formerly the 704th MI Brigade)	Army	Offers enlisted personnel and warrant and commissioned officers the opportunity to volunteer to serve in an assignment or accept an assignment for 36 months in a valid operator billet within the 704th MI Brigade and receive AIP of $300 per month. The program was authorized on October 23, 2006.
Special Mission Units (SMU) Incentive Program	Army	Offers enlisted personnel and warrant officers who have served in an SMU operator billet for less than three years the opportunity to agree to continue to serve in an SMU operator billet for 12 to 36 additional months and receive AIP of $750 per month. Personnel who have served in an SMU operator billet for more than three years are offered $1,000 per month. The program was authorized on January 9, 2006.
Deployment Extension Incentive Pay (DEIP) Program	Army	Offers soldiers the opportunity to voluntarily extend their deployments and receive AIP of $500 per month if they execute their extension between six and nine months prior to the end of their deployment or $350 per month if they execute their extension less than six months prior to the end of their deployment. The program became effective on March 30, 2009.
Army Special Operations Aviation (ARSOA) AIP Program	Army	Offers eligible Aviation Warrant Officers (AWOs) with an MOS of 152C, 153E, or 154E or the Army Skill Indicator K4 the opportunity to volunteer for an assignment or extension with the 160th Special Operations Aviation Regiment (Airborne) (SOAR) and receive AIP of $1,000 per month. The program was authorized on March 4, 2010.

Program	Service	Description
Career Management Field (CMF) 18 Program	Army	Offers CMF 18 Command Sergeant Majors (CSM) and Sergeant Majors (SGM) the opportunity to remain on active duty for 12 additional months beyond their service requirement and receive AIP. Pay levels depend on experience and pay grade and range from $500 per month to $1,250 per month. The program was authorized on January 1, 2013.
Pilot Program for AIP	Navy	Offers eligible enlisted members the opportunity to serve in a designated billet or extend a tour in a designated billet and receive additional compensation determined through an auction mechanism. As a result, payment rates may be different for members in the same location. The pilot program was authorized on May 29, 2003.
Naval Special Warfare Development Group (NSWDG) AIP Program	Navy	Offers eligible enlisted personnel the opportunity to remain voluntarily in an NSWDG billet for an additional 12 months, and receive AIP at $750 per month. The NSWDG AIP program was authorized on February 9, 2007.
Sea Duty Incentive Pay—Extension (SDIP-E)	Navy	Offers eligible sailors the opportunity to sign a written agreement to voluntarily extend their sea duty assignments on ships, submarines, or aviation squadrons by a minimum of six months and a maximum of 24 months (36 months for an assignment outside the continental United States, including Hawaii) and receive AIP. Payment of SDIP-E combined with any other AIP allowance will not exceed $3,000 per month or $36,000 per year. SDIP was first authorized on December 6, 2006.
Sea Duty Incentive Pay—Curtailment (SDIP-C)	Navy	Offers eligible sailors the opportunity to voluntarily curtail their shore duty assignments a minimum of six months prior to their original planned rotation date and return to sea duty assignments on a ship, on a submarine, or at an aviation squadron for a minimum of 12 months and receive AIP. Payment of SDIP-C combined with any other AIP allowance will not exceed $3,000 per month or $36,000 per year. SDIP was first authorized on December 6, 2006.
Bahrain Officer Continuity Billet Program	Navy	Offers commissioned and warrant officers who are eligible to serve a 12-month continuity tour billet the opportunity to extend their tour for a minimum of 18 months and receive AIP. The program was authorized on January 5, 2006. Pay was initially set at AIP of $500 per month but was later raised to up to $2000 per month.
Korea Assignment Incentive Program (KAIP)	Air Force	Offers airmen the opportunity to volunteer to serve a 24-month unaccompanied or 36-month accompanied tour in Korea or to volunteer to extend their tours in Korea by 12 or 24 months and receive AIP of $300 per month.
Creech Air Force Base Assignment Incentive Program	Air Force	Offers active-duty Air Force, Air Reserve, and Air National Guard members who are permanently assigned to Air Force units or Air Force elements at Creech AFB AIP of $300 per month for the first 36 months of their assignments and $750 each month thereafter. The program was authorized on June 29, 2008.
24th Special Tactics Squadron (24th STS) Incentive Program	Air Force	Offers enlisted members of the 24th STS who have already served 12 months in operator billets the opportunity to serve an additional 12–36 months in an SMU assignment and receive AIP of $750 per month. The program was authorized on September 25, 2007.
724th Special Tactics Group (24th STG) (formerly the 24th Special Tactics Squadron) Incentive Program	Air Force	Offers enlisted SMU members who have a cumulative assignment time of 48 months or more AIP of $1,000 per month. The program was authorized on December 30, 2011.

Program	Service	Description
Air Force Remote Piloted Aircraft (RPA) Aviation Incentive Pay (AVIP) (formerly Air Force RPA Incentive Program)	Air Force	Entitles active-duty, Air Reserve, and Air National Guard members with an 18XX-rated Air Force Specialty Code (AFSC) assigned as RPA pilots performing RPA pilot duties or members assigned to RPA training in order to receive the 18XX AFSC to receive AIP. The pay level is calculated based on years of aviation service and ranges from $125 per month for two years or less to $650 for over six years. The program was authorized on November 27, 2009.
Air Force Remote Piloted (RPA) Career Enlisted Aviation Incentive Pay (CEVIP) (formerly the Air Force RPA Sensor Operator Incentive Program)	Air Force	Entitles active-duty Air Force and Air Reserve Component enlisted personnel with an 10X1-rated AFSC assigned as RPA sensor operators performing RPA sensor duties or members assigned to RPA training in order to receive the 10X1 AFSC to receive AIP. The pay level is calculated based on years of aviation service and ranges from $150 per month for four years or less to $400 for over 14 years. The program was authorized on January 29, 2010.
Deployment Extension Program	Marine Corps	Offers Marines the opportunity to extend their expiration of active service (EAS) in order to complete a deployment with a unit involuntarily extended in support of Operation Iraqi Freedom, Operation Enduring Freedom, or another Global War on Terrorism mission and receive AIP of $500 for every month of their extension. The program was authorized on February 14, 2007.
Combat Extension Program	Marine Corps	Offers Marines the opportunity to extend their EAS to complete a seven-month deployment in support of Operation Iraqi Freedom, Operation Enduring Freedom, or another Global War on Terrorism mission and receive AIP of $3,000 or to complete a 12-month deployment and receive $6,000.
Involuntary Extension of Tour Length in Iraq, Afghanistan, or Certain Theater Units Program	Marine Corps	Offers Marines whose deployments are involuntarily extended beyond normal durations AIP of $250 per month for an extension of 7–12 months, or $800 per month for an extension of more than 12 months. The program was authorized on May 17, 2007.
FY 07 End Strength Incentive Program	Marine Corps	Offers enlisted Marines with less than 27 years of service the opportunity to reenlist for a minimum period of 36 months and receive AIP of $10,000. AIP rates are lower for Marines who had longer periods of broken active component service before reenlisting. The program was authorized on February 14, 2007.
Recruiter Extension Program	Marine Corps	Offers Marines in MOS 8411 positions the opportunity to extend their tour by 6–12 months beyond the required 36 months and receive $500 per month of extension. The program was authorized on February 14, 2007.
Special Mission Unit (SMU) Program	Marine Corps	Offers Marines who have served in an SMU operator billet for less than three years the opportunity to agree to continue to serve in an SMU operator billet for 12 to 36 additional months and receive AIP of $750 per month. Personnel who have served in an SMU operator billet for more than three years are offered $1,000 per month. The program was authorized on November 28, 2007.
Voluntary Extension Beyond 365 Days Boots on Ground in Iraq, Afghanistan, or Other Theater Units Program	Marine Corps	Offers Marines who agree to serve beyond 12-months BoG in Iraq (including Kuwait staging areas), Afghanistan, or certain theater units the opportunity to extend their tours for a minimum of 90 days and receive AIP of $500 per month for the length of the voluntary extension. The program was authorized on October 11, 2007.

SOURCE: Under Secretary of Defense (Comptroller), Department of Defense Financial Management Regulation, DoD 7000.14-R, Volume 7A: "Military Pay Policy—Active Duty and Reserve Pay," updated June 2014.

APPENDIX E

Combined Cost of All Special and Incentive Pays

Table E.1
Combined Cost of All Special and Incentive Pays

Special and Incentive Pays (FY 2014 Total Enacted) (dollars in thousands)				
	Army	**Navy**	**Marine Corps**	**Air Force**
Special pays (officers)	412,839	431,901	16,866	308,928
Incentive pays (officers)	93,821	132,042	40,634	206,177
Special pays (enlisted)	706,979	747,411	151,003	318,383
Incentive pays (enlisted)	100,743	103,968	9,832	42,599
Total	1,314,382	1,415,322	218,335	876,087

SOURCE: Department of Defense, FY 2015 President's Budget, Exhibit M-1, Total Obligational Authority.

APPENDIX F

Survey Questions Relating to Tour Extension

This appendix collects the voluntary extension questions used in the analyses presented in Chapters Three and Four.

Willingness to Extend Without Additional Financial Incentive

Respondents were first asked if they would voluntary extend for no additional financial incentive. The question was worded slightly differently for those who were currently serving an overseas tour or had completed an overseas tour:

> "If given the opportunity, would you [voluntarily extend/have voluntarily extended] for an additional 12 months at your [current/most recent] overseas assignment?"
>
> Potential responses were "yes" and "no."

Willingness to Extend with Additional Financial Incentive

Respondents who answered "no" to the question that asked about voluntarily extending their most recent overseas tour were subsequently asked up to two additional questions in the following format:

> "[Would you voluntarily extend an additional 12 months at your current overseas assignment/At the time your most recent overseas assignment concluded, would you have voluntarily extended an additional 12 months] for a monthly financial incentive of $***X***?"
>
> Potential responses were "yes" and "no."

Incentive levels ***X*** were derived from the individual's base pay and were randomly drawn at discrete levels ranging from 1 percent to 45 percent of base pay. Respondents were asked a second question in this format only if they answered "no" to the question with the first drawn level. The potential levels for the second draw were restricted to be strictly greater than the first draw in order to generate additional statistical information about the respondents' preferences and were randomly drawn from the subset of discrete levels greater than the first drawn level.

Attitudinal Questions

The attitudinal questions asked of the respondents are documented in Appendix G, along with data on responses.

APPENDIX G

Attitudinal Data Tables

This appendix reports additional information about the attitudinal variables used in the analysis.

Table G.1 displays the distribution of responses to the questions

> "To what extent [do/would] the following factors [contribute/have contributed] to your decision [not] to voluntarily extend an additional 12 months . . . ?"

where 1 = not at all, 2 = small extent, 3 = moderate extent, 4 = large extent, and 5 = very large extent. The table is sorted by mean response from largest to smallest and includes both those that said they would extend and those that would not. It includes additional information about the sample size, mean, and standard deviation for each question.

Table G.2 displays the distribution of responses to the same question, including only those who stated they would voluntarily extend.

Table G.3 displays summaries of responses to the following question:

> "To what extent [do/would] the following factors [contribute/have contributed] to your decision not to voluntarily extend an additional 12 months…?"

for those who stated that they would not voluntarily extend.

Table G.4 restates the data in Figure 3.7 in table form, including the sample size, mean, and standard deviation for each question. The table reports the answers to the following question:

> "What impact, if any, would a 12-month extension to your [current/most recent] overseas assignment [have/have had] on…?"

where 1 = greatly worsened, 2 = somewhat worsened, 3 = neither improved nor worsened, 4 = somewhat improved, and 5 = greatly improved.

Table G.5 restates the data in Figure 3.8 in table form, including the sample size, mean, and standard deviation for each question. The table reports the answers to the following question:

> "Taking all things into consideration, how satisfied are you, in general, with each of the following aspects of being in the military?"

where 1 = very dissatisfied, 2 = dissatisfied, 3 = neither satisfied nor dissatisfied, 4 = satisfied, and 5 = very satisfied.

Table G.1
Distribution of Stated Reasons for Voluntary Extension Decision

To what extent [do/would] the following factors [contribute/have contributed] to your decision [not] to voluntarily extend an additional 12 months at your [current / most recent] overseas assignment?	N	Mean	Std. Dev.	Not at All or Small Extent (1–2)	Moderate Extent (3)	Large or Very Large Extent (4–5)
Geographical location	10,628	3.36	1.52	29.8%	16.0%	54.2%
The job itself	10,607	3.03	1.48	36.8%	20.3%	42.9%
Opportunity for family to visit overseas at no cost to you	10,622	2.86	1.60	43.8%	16.1%	40.1%
Stability of child(ren) or other legal dependents in school	6,346	2.85	1.65	44.9%	14.3%	40.8%
Career advancement	10,661	2.80	1.50	43.4%	20.4%	36.1%
Family inclination to stay longer	10,643	2.70	1.67	49.2%	12.4%	38.5%
Quality of living conditions	10,645	2.70	1.56	47.5%	17.7%	34.8%
Your workload	10,547	2.63	1.43	47.6%	22.9%	29.5%
Special pay and allowances	10,622	2.47	1.55	55.2%	15.4%	29.3%
Increased opportunity to use personal leave during assignment	10,641	2.45	1.48	54.3%	18.0%	27.7%
Quality of medical care and support	10,647	2.44	1.53	55.6%	15.9%	28.4%
Comfort level with local customs and language	10,641	2.34	1.44	58.0%	17.4%	24.6%
Job opportunities for spouse	9,196	2.32	1.61	60.4%	11.2%	28.4%
Personal recognition for accomplishments	10,642	2.23	1.41	61.3%	17.4%	21.3%
Quality of dependent schools	8,924	2.18	1.55	64.2%	11.0%	24.8%
Family support programs or activities	10,603	2.14	1.41	64.4%	15.3%	20.3%
Tax benefits	10,574	2.03	1.40	67.8%	13.9%	18.3%
Other	9,786	1.97	1.50	69.8%	10.5%	19.7%
Matching Thrift Savings Plan (TSP) contributions	10,633	1.93	1.39	70.9%	12.4%	16.7%

NOTE: Values of answers were 5 = very large extent, 4 = large extent, 3 = moderate extent, 2 = small extent, and 1 = not at all.

Table G.2
Distribution of Stated Reasons for Voluntarily Extending

To what extent would the following factors [contribute/have contributed] to your decision to voluntarily extend an additional 12 months at your [current / most recent] overseas assignment?	N	Mean	Std. Dev.	Not at All or Small Extent (1–2)	Moderate Extent (3)	Large or Very Large Extent (4–5)
Geographical location	4,370	3.98	1.22	12.5%	14.9%	72.7%
The job itself	4,350	3.51	1.33	21.8%	21.5%	56.7%
Special pay and allowances	4,393	3.51	1.41	24.1%	19.6%	56.3%
Quality of living conditions	4,391	3.34	1.45	27.3%	21.4%	51.3%
Stability of child(ren) or other legal dependents in school	2,649	3.23	1.58	32.8%	17.2%	50.0%
Comfort level with local customs and language	4,393	3.23	1.38	29.1%	24.5%	46.4%
Family inclination to stay longer	4,395	3.10	1.62	37.0%	14.9%	48.2%
Career advancement	4,392	3.09	1.44	33.4%	24.0%	42.6%
Your workload	4,347	3.02	1.36	33.1%	28.9%	38.0%
Increased opportunity to use personal leave during assignment	4,387	2.99	1.48	37.5%	21.6%	40.9%
Quality of medical care and support	4,383	2.98	1.52	38.0%	20.9%	41.2%
Quality of dependent schools	2,666	2.97	1.63	40.1%	16.0%	43.9%
Opportunity for family to visit overseas at no cost to you	4,377	2.93	1.60	41.4%	16.4%	42.3%
Personal recognition for accomplishments	4,388	2.77	1.46	43.6%	23.2%	33.3%
Job opportunities for spouse	2,959	2.73	1.63	48.0%	14.8%	37.2%
Tax benefits	4,368	2.69	1.57	47.4%	18.5%	34.1%
Family support programs or activities	4,374	2.64	1.49	48.1%	20.3%	31.6%
Matching Thrift Savings Plan (TSP) contributions	4,363	2.43	1.58	54.9%	16.7%	28.5%
Other	3,901	2.19	1.55	61.8%	14.8%	23.4%

NOTE: Values of answers were 5 = very large extent, 4 = large extent, 3 = moderate extent, 2 = small extent, and 1 = not at all.

Table G.3
Distribution of Stated Reasons for Not Voluntarily Extending

To what extent [do/would] the following factors [contribute/have contributed] to your decision not to voluntarily extend an additional 12 months at your [current/most recent] overseas assignment?	N	Mean	Std. Dev.	Not at All or Small Extent (1–2)	Moderate Extent (3)	Large or Very Large Extent (4–5)
Geographical location	6,258	2.92	1.55	41.9%	16.8%	41.3%
Lack of opportunity for family to visit overseas at no cost to you	6,245	2.81	1.60	45.6%	15.9%	38.6%
The job itself	6,257	2.69	1.49	47.3%	19.4%	33.3%
Career advancement	6,269	2.60	1.51	50.4%	18.0%	31.6%
Need to provide stability for child(ren) or other legal dependents in school	3,697	2.57	1.65	53.5%	12.3%	34.2%
Family's lack of desire to stay longer	6,248	2.42	1.65	57.7%	10.6%	31.7%
Your workload	6,200	2.36	1.41	57.8%	18.7%	23.5%
Delay of professional military education (PME) or professional/technical training	6,257	2.25	1.47	61.5%	14.7%	23.8%
Quality of living conditions	6,254	2.25	1.47	61.6%	15.1%	23.2%
Job opportunities for spouse	6,237	2.13	1.56	66.3%	9.5%	24.2%
Lack of opportunity to use personal leave during assignment	6,254	2.07	1.36	66.1%	15.4%	18.4%
Quality of medical care and support	6,264	2.06	1.42	67.9%	12.5%	19.6%
Personal recognition for accomplishments	6,254	1.85	1.25	73.8%	13.4%	12.9%
Quality of dependent schools	6,258	1.84	1.38	74.5%	8.9%	16.6%
Other	5,885	1.82	1.44	75.0%	7.7%	17.2%
Family support programs or activities	6,229	1.79	1.23	75.9%	11.8%	12.4%
Special pay and allowances	6,229	1.74	1.17	77.2%	12.5%	10.3%
Comfort level with local customs and language	6,248	1.72	1.12	78.4%	12.4%	9.2%
Lack of matching Thrift Savings Plan (TSP) contributions	6,270	1.58	1.12	82.0%	9.4%	8.6%
Tax benefits	6,206	1.56	1.05	82.2%	10.6%	7.2%

NOTE: Values of answers were 5 = very large extent, 4 = large extent, 3 = moderate extent, 2 = small extent, and 1 = not at all.

Table G.4
Distribution of Perceived Impact of Tour Extension on Career, Well-Being, Finances, Educational Plans, and Job Performance

What impact, if any, would a 12-month extension to your current/most recent overseas assignment have on...	N	Mean (applicable responses only)	Std. Dev. (applicable responses only)	Greatly or Somewhat Worsened (1–2)	Neither Improved nor Worsened (3)	Greatly or Somewhat Improved (4–5)	Not Applicable
Your finances?	10,912	3.53	0.97	8.5%	43.5%	45.6%	2.3%
Your job performance?	10,927	3.18	1.08	17.8%	50.1%	29.3%	2.7%
Your promotion opportunities?	10,854	3.06	1.03	20.5%	50.6%	24.9%	4.0%
Your quality of life?	10,911	3.03	1.19	26.4%	43.2%	28.5%	1.9%
Your educational plans?	10,855	2.99	1.10	22.9%	47.5%	23.5%	6.1%
Your career progression?	10,882	2.97	1.11	27.3%	44.2%	25.2%	3.3%
Your career plans?	10,873	2.88	1.16	31.3%	42.1%	23.8%	2.8%
Your morale?	10,929	2.81	1.34	40.1%	29.8%	28.3%	1.8%
Your personal/family relationships?	10,909	2.70	1.23	40.5%	36.5%	20.5%	2.5%

NOTES: Values of answers were 5 = greatly improved, 4 = somewhat improved, 3 = neither improved nor worsened, 2 = somewhat worsened, and 1 = greatly worsened. Applicable responses include all respondents who did not indicate "not applicable."

Table G.5
Distribution of Satisfaction with Military Service

Taking all things into consideration, how satisfied are you, in general, with each of the following aspects of being in the military?	N	Mean	Std. Dev.	Very Dissatisfied or Dissatisfied (1–2)	Neither Satisfied nor Dissatisfied (3)	Satisfied or Very Satisfied (4–5)
The type of work you do in your military job	17,729	3.85	1.02	12.3%	13.7%	73.9%
The quality of your supervisor	17,874	3.79	1.09	13.6%	15.7%	71.4%
Overall, how satisfied are you with the military way of life?	17,924	3.76	0.96	12.4%	15.8%	72.8%
The quality of your coworkers	17,769	3.71	0.98	13.0%	19.3%	67.9%
Your total compensation (i.e., base pay, allowances, and bonuses)	17,868	3.67	1.02	16.6%	14.7%	69.4%
Your opportunities for promotion	17,789	3.47	1.11	21.0%	20.3%	59.0%

NOTE: Values of questions were 1 = very dissatisfied, 2 = dissatisfied, 3 = neither satisfied nor dissatisfied, 4 = satisfied, and 5 = very satisfied.

APPENDIX H

Cluster Analysis Methodology and Results

Cluster Analysis Methodology

Cluster analysis is a method of organizing observations into bins such that observations in one group are similar to each other but different across groups. This is done via a mathematical algorithm that assigns each of the N observations to a unique cluster on the basis of the similarities of multidimensional data. The precise meaning of *similar* differs by algorithm but often uses the notion of Euclidian distance.[1] We use Ward's minimum variance method, an agglomerative clustering technique that attempts to minimize the increase in total within-cluster error sum of squares for each cluster, to aggregate each observation into successively smaller numbers of groups. This method was chosen due to the fact that it is based on an explicit objective function (similar to most econometric methods), though there are other options available (e.g., kmeans or kmedians).

The algorithm begins with each observation forming its own cluster (i.e., there are N clusters of observations). It then calculates the "similarity" in the patterns of answers to the data using a mathematical formula.[2] On the basis of this calculation, the algorithm then forms (N – 1) clusters of observations by grouping the two most similar observations together into one group according to a criterion based on the variability of answers within a cluster. Taking this grouping as a starting point, the algorithm continues to aggregate observations into smaller and smaller numbers of clusters recursively until exactly two clusters of observations are obtained.

Having grouped the observations into two to (N – 1) clusters of observations with similar attitudes, the analyst must determine how many clusters will be used in subsequent analysis. This is done through the use of indicator statistics and graphical analysis that represents the strength of the clustering and how distinct a grouping is relative to more disaggregate ones (for example, how distinct ten groups of observations are relative to 11 groups or more). Standard procedures are used to choose the number of groups used in this analysis. The final number of clusters is ultimately subjective but is based on standard graphical and indicator analysis. In particular, we use the Stata default Calinski-Harabasz stopping rule, which has proven to be an effective method in simulations (Milligan and Cooper, 1985; Tibshirani et al., 2001). The reader is referred to Stata, undated, for more information.

---

1 The Euclidian distance of observation n to the mean of cluster k defined over $s = 1 \ldots S$ Likert-scale indicators i is defined as $\sqrt{\sum_s \left(i_{sn} - \bar{i}_{sk}\right)^2}$, where $\bar{i}_{sk}$ is the mean of indicator s for cluster k.

2 In this stage, only respondents who answered every question are used.

The assignment of each observation to one cluster is thus entirely mathematically based, and the number of clusters is chosen by the analyst on the basis of indicator statistics. The interpretation of each cluster through examination of the descriptive statistics of observations belonging to each cluster is subjectively made by the analyst. Although the analogy is not perfect, this is similar to regression analysis, in which the coefficients of the regression are obtained with a mathematical formula, but the interpretation of model results must be performed by the analyst. In practice, we labeled the clusters on the basis of cluster-specific means. This is appropriate because the algorithm attempts to minimize the overall variance in the answers to the multiple questions within each cluster but maximize the variance between the clusters.

We assigned each relevant respondent (those respondents who answered the voluntary extension question) to a cluster related to three sets of attitudinal questions: (1) the extent to which a list of factors influenced the response to the question on voluntarily extending without additional financial incentives, (2) the impact of a tour extension on various aspects of the servicemembers' lives, and (3) the general attitude toward military service. In each case, only observations for which all questions were answered were used in the clustering exercise. For use in the statistical analysis, in order to avoid losing a significant number of observations, respondents not used in the formation of clusters were assigned a cluster based on the minimum Euclidian distance from the observation to the mean of the cluster. In our sample, this method results in "correct" clustering for 70.8 percent of respondents for the factor attitudinal questions, 75.4 percent for the impact questions, and 80.8 percent of the military service questions. While this prediction likely introduces additional sources of error in the analysis, our underlying analysis is not significantly altered by this treatment.[3]

While we choose to use one deterministic clustering method on our data, many other approaches exist, based on alternative similarity rules and algorithms. In addition, statistical methods of probabilistic clustering, such as latent class analysis, can also be used. Aldrich et al. (2007) provides some evidence that statistical models of willingness to pay are robust to clustering methods.

Reason Clusters

The ten reason clusters are

1. *Financial – / Family +*
   - Financial concerns are less important reasons than the sample average, while family considerations are more important reasons.
2. *Financial – / Quality +*
   - Financial concerns are less important, while stability of dependents and quality of dependent schools, quality of living conditions, and quality of medical care are more important.
3. *Financial + / All +*
   - Financial concerns are more important, and all factors tend to be more important than average.

[3] Specifically, statistical models estimated with only the observations used in the clustering analysis result in significant coefficient estimates that are of the same sign and similar magnitudes.

4. *Family – / Locality +*
   – Family considerations are less important, while comfort with the location, the job itself, workload, and geography are more important.
5. *All ++*
   – All reasons are either more important or considerably more important.
6. *Inclination + / All –*
   – All reasons except family (dis)inclination to stay longer are less important, while family (dis)inclination is more important. Note that this cluster captures family inclinations in both directions—the determining feature of inclination is the importance assigned to it, not whether it is positive or negative.
7. *Career + / All –*
   – All reasons except career advancement and workload are less important; career advancement and workload are more important.
8. *Visit + / All –*
   – All reasons except opportunity for family to visit at no cost are less important, while the opportunity for family to visit at no cost is more important.
9. *Other ++ / All –*
   – All reasons except "other" are less important, while "other" is considerably more important.
10. *All – –*
   – All reasons are either less important or considerably less important than the sample average.

Table H.1 provides the means for the 19 reason answers by reason cluster.

The row labeled "number of observations" provides an indication of the size of the cluster relative to the total number of observations used in the cluster analysis. For example, cluster 1 (*Financial – / Family +*) contains 475 observations out of 4,876, or approximately 9.7 percent of the sample. Cluster 7 (*Career + / All –*) is the largest of the reason clusters.

Overall, respondents in clusters 6 through 10 (*Inclination + / All –*, *Career + / All –*, *Visit + / All –*, *Other ++ / All –*, and *All – –*) tend to downplay the importance of the listed reasons relative to the average, while those in cluster 3 (*Financial + / All +*) and cluster 5 (*All ++*) tend to deem the entire set more important than average. Cluster 1 (*Financial – / Family +*), cluster 2 (*Financial – / Quality +*), and cluster 4 (*Family – / Locality +*) tend to be more discriminatory on certain collections of factors. Members of cluster 7 (*Career + / All –*) tended to emphasize career considerations in their reasoning.

Reason Clusters and the Propensity to Extend or Not Extend

Because membership in a reason cluster was used as an explanatory variable in the multivariate statistical analysis, this subsection reports the proportion of members assigned to each cluster who answered "yes" or "no" to the question regarding voluntary extension. This provides some insight into how the reasons affect the decision to voluntarily extend. As documented below, it appears that family considerations, "other" reasons for extension, and generally not having a strong reason to extend increase the propensity to decline the invitation to serve an extra year overseas.

As can be seen in Table H.2, lower average mean responses across most questions tend to result in a "no" answer, as can be seen by the answers given by respondents in clusters 6–10.

Table H.1
Mean Values of Extension Reasons by Reason Cluster

Reason	1 Financial – Family +	2 Financial – / Quality +	3 Financial + / All +	4 Family – / Locality +	5 All ++	6 Inclination + / All –	7 Career + / All –	8 Visit + / All –	9 Other ++ / All –	10 All – –	Mean (sample)	Standard Deviation (sample)
Career advancement	2.77	2.58	3.29	3.05	4.11	2.17	2.72	1.51	1.53	2.24	2.73	1.51
The job itself	2.91	3.49	3.29	3.77	4.20	2.06	3.49	1.47	1.64	1.24	2.90	1.49
Your workload	2.39	2.88	2.91	3.21	3.96	1.63	2.77	1.34	1.42	1.08	2.48	1.40
Geographical location	3.56	3.95	3.42	4.15	4.52	2.82	2.96	3.13	2.25	1.17	3.26	1.54
Special pay and allowances	1.85	2.48	3.22	3.01	4.34	1.48	2.03	1.33	1.18	1.11	2.32	1.49
Tax benefits	1.38	1.62	2.89	2.34	3.87	1.17	1.55	1.14	1.05	1.06	1.90	1.33
Matching Thrift Savings Plan (TSP) contributions	1.29	1.63	3.15	1.95	3.37	1.24	1.36	1.14	1.06	1.04	1.83	1.34
Personal recognition for accomplishments	1.68	2.29	2.64	2.65	3.79	1.32	1.83	1.24	1.22	1.11	2.06	1.35
Comfort level with local customs and language	1.69	3.00	2.54	3.15	4.05	1.48	1.58	1.30	1.20	1.03	2.18	1.40
Increased opportunity to use personal leave during assignment	1.89	3.30	2.70	2.99	4.11	1.42	1.77	1.74	1.32	1.07	2.30	1.43
Family support programs or activities	1.92	3.16	2.69	2.36	4.18	1.52	1.37	1.37	1.44	1.03	2.19	1.41

Table H.1—continued

Reason	1 Financial – Family +	2 Financial – / Quality +	3 Financial + / All +	4 Family – / Locality +	5 All ++	6 Inclination + / All –	7 Career + / All –	8 Visit + / All –	9 Other ++ / All –	10 All – –	Mean (sample)	Standard Deviation (sample)
Opportunity for family to visit overseas at no cost to you	3.07	3.67	3.27	3.06	4.28	2.23	1.98	3.28	2.36	1.24	2.86	1.60
Stability of child(ren) or other legal dependents in school	3.22	4.22	3.05	1.82	4.53	2.43	1.49	2.73	2.09	1.07	2.76	1.64
Quality of dependent schools	3.18	3.55	2.88	1.27	4.35	2.20	1.34	1.10	1.22	1.04	2.42	1.59
Family inclination to stay longer	4.35	3.98	3.46	2.56	4.57	3.48	1.53	1.25	2.06	1.18	3.04	1.65
Job opportunities for spouse	3.55	2.58	3.27	1.65	4.20	2.28	1.23	1.09	1.18	1.16	2.41	1.61
Quality of living conditions	3.30	3.81	3.31	3.27	4.52	1.94	1.59	1.28	1.34	1.04	2.67	1.55
Quality of medical care and support	2.91	3.47	3.26	2.67	4.50	1.61	1.32	1.08	1.27	1.07	2.44	1.53
Other	2.61	1.85	2.21	1.56	3.30	1.16	1.34	1.07	4.61	1.02	1.93	1.48
Number of observations	475	541	638	304	587	778	670	296	179	408	4,876	4,876

NOTES: Values shown in tables are mean five-point scale question scores by cluster for all respondents who answered each question. Mean (sample) and std. dev. (sample) refer to all data used to cluster. Values of answers were 5 = very large extent, 4 = large extent, 3 = moderate extent, 2 = small extent, and 1 = not at all. Only individuals who answered all 19 questions were used to form initial clusters. Other observations were assigned to a cluster on the basis of their similarity to each cluster mean.

Table H.2
Willingness to Voluntarily Extend by Reason Cluster

Extend?	1 Financial – Family +	2 Financial – / Quality +	3 Financial + / All +	4 Family – / Locality +	5 All ++	6 Inclination + / All –	7 Career + / All –	8 Visit + / All –	9 Other ++ / All –	10 All – –
No	75%	44%	53%	41%	24%	78%	70%	85%	92%	88%
Yes	25%	56%	47%	59%	76%	22%	30%	15%	8%	12%
Number of observations	475	541	638	304	587	587	670	296	179	408

Similarly, 75 percent of cluster 1 (*Financial – / Family +*) and 78 percent of cluster 6 (*Inclination + / All –*), both of which tended to emphasize family considerations, were unwilling to extend. Thus, tending not to have an important reason for one's decision, or emphasizing family considerations as important, results in a greater proportion of individuals not volunteering.

Cluster 7 (*Career + / All –*), in which career and workload were signaled as relatively more important factors than average, is the second-largest cluster overall, at 13.7 percent of the sample, and also comes closest to representing the overall "yes" rate in the data used for clustering at 30 percent "yes." However, the majority of respondents in this cluster would still not extend voluntarily.

Cluster 5 (*All ++*), whose respondents tended to rank every reason as important, had the highest proportion of voluntary extension. It also appears that those who tended to view comfort with the locality, the job itself, workload, and geography as more important and family considerations as less important (cluster 4, *Family – / Locality +*) tended to vote "yes," as well as those who deemphasized financial considerations but deemed stability of dependents and quality of dependent schools, quality of living conditions, and quality of medical care as more important (cluster 2, *Financial – / Quality +*). Interestingly, the proportion of negative votes is largest for the smallest cluster (cluster 9, *Other ++ / All –*), which is characterized by "other" considerations being deemed strongly important.

Impact Clusters

The eleven impact clusters are as follows:

1. *Career – – / Well-Being – –*
   - Perceived impacts on career (including promotion opportunities, career progression, and career plans) and well-being (including morale, quality of life, and personal relationships) are considerably less than average. Other aspects (finances, educational plans, and job performance) are considerably less than average.
2. *Career – / Well-Being –*
   - Perceived impacts on career and well-being are less than average. Other aspects are also less than average.
3. *Career – – / Well-Being –*
   - Perceived impacts on career are considerably less than average, while impacts on well-being are less than average. Impacts on educational plans and job performance are less than average.

4. *Career / Well-Being –*
   – Perceived impacts on career are about average, while impacts on well-being are less than average. Impacts on educational plans are less than average.
5. *Career – / Well-Being*
   – Perceived impacts for career aspects are less than average, while impacts on well-being are about average. Impacts on educational plans are less than average.
6. *Career / Well-Being*
   – Perceived impacts on both aspects are about average. Impacts on finances are less than average.
7. *Career + / Well-Being*
   – Perceived impacts on career are above average, while impacts on well-being are about average. Impacts on educational plans and job performance are above average.
8. *Career / Well-Being +*
   – Perceived impacts on career are about average, while impacts on well-being are above average. Other aspects (finances, educational plans, and job performance) are about average.
9. *Career + / Well-Being +*
   – Perceived impacts on all aspects are above average.
10. *Career – / Well-Being ++*
    – Perceived impacts on career are less than average, while impacts on well-being are considerably above average. Impacts on finances and job performance are above average.
11. *Career ++ / Well-Being ++*
    – Perceived impacts on all aspects are considerably greater than average.

Table H.3 provides the means for the nine impact answers by impact cluster.

Cluster 1 (*Career – – / Well-Being – –*) is the smallest cluster (approximately 2 percent of the sample) and is associated with perceived impacts that are considerably worse than average for the sample. Cluster 2 (*Career – / Well-Being –*) is the largest cluster, at about 16 percent of the sample, and is associated with a perception that overseas tour extensions tend to worsen career, well-being, and other aspects of life, though not as strongly as cluster 1. The next-largest cluster (cluster 6, *Career / Well-Being*) comprises almost 15 percent of the sample and is characterized by perceptions that tour exertions neither improve nor worsen the aspects listed in the table.

Impact Clusters and the Propensity to Extend or Not Extend

As with the reason clusters, the impact clusters will be used as explanatory variables in the statistical analysis that follows. As such, we explore the distribution of responses on extending versus not extending in this subsection. In general, it appears that the perceived impact of tour extensions on career, well-being, and other aspects of life is very likely to influence the propensity to extend an overseas tour, with negative perceptions leading to a smaller share of volunteers (or, analogously, the probability of extending).

Table H.4 reports the answer to the voluntary question by impact cluster.

Overall, membership in an impact cluster appears to be strongly related to the propensity to voluntarily extend. Except for cluster 10 (*Career – / Well-Being ++*), majorities of respondents in clusters who perceive impacts on career and/or well-being more negatively than average

Table H.3
Mean Values of Perceived Impact of Tour Extension by Impact Cluster

Aspect	1 Career – – / Well-Being – –	2 Career – / Well-Being –	3 Career – – / Well-Being –	4 Career / Well-Being –	5 Career – / Well-Being	6 Career / Well-Being	7 Career + / Well-Being	8 Career / Well-Being +	9 Career + / Well-Being +	10 Career – / Well-Being ++	11 Career ++ / Well-Being ++	Mean (sample)	Std. Dev. (sample)
Job performance	1.51	2.30	2.13	3.03	3.16	3.16	3.84	3.27	4.01	3.88	4.79	3.20	1.06
Promotion opportunities	1.50	2.93	1.44	3.15	3.01	3.01	4.19	3.00	3.69	2.44	4.67	3.09	1.01
Career progression	1.41	2.69	1.22	3.13	2.99	2.99	4.24	2.96	3.75	2.39	4.75	3.00	1.09
Career plans	1.12	2.17	1.20	2.93	3.01	3.01	4.00	3.04	3.82	2.93	4.79	2.92	1.14
Educational plans	1.24	2.37	2.04	3.00	3.10	3.10	3.69	3.15	3.65	3.23	4.47	3.00	1.09
Morale	1.03	1.36	1.52	1.95	2.96	2.96	3.04	3.66	4.29	4.61	4.91	2.84	1.33
Quality of life	1.03	1.75	2.01	2.67	2.99	2.99	3.10	3.61	4.13	4.68	4.91	3.05	1.18
Finances	1.28	3.10	3.32	3.49	3.00	3.00	3.67	3.90	4.00	4.41	4.81	3.53	0.97
Personal/family relationships	1.03	1.53	1.78	2.10	2.83	2.83	2.67	3.30	3.46	4.55	4.57	2.72	1.23
Number of observations	230	1,595	699	915	1,180	1,407	779	813	677	403	977	9,675	9,675

NOTES: Values shown in tables are mean five-point scale question scores by cluster for all respondents who answered each question. Mean (sample) and std. dev. (sample) refer to all data used to cluster. Values of answers were 5 = greatly improved, 4 = somewhat improved, 3 = neither improved nor worsened, 2 = somewhat worsened, and 1 = greatly worsened. Only individuals who answered all nine questions were used to form initial clusters. Other observations were assigned to a cluster on the basis of their similarity to each cluster mean.

Table H.4
Willingness to Voluntarily Extend by Impact Cluster

Extend?	1 Career – – / Well-Being – –	2 Career – / Well-Being –	3 Career – – / Well-Being –	4 Career / Well-Being –	5 Career – / Well-Being	6 Career / Well-Being	7 Career + / Well-Being	8 Career / Well-Being +	9 Career + / Well-Being +	10 Career – / Well-Being ++	11 Career ++ / Well-Being ++
No	98%	96%	95%	87%	68%	52%	50%	25%	18%	10%	10%
Yes	2%	4%	5%	13%	32%	48%	50%	75%	82%	90%	90%
Number of observations	230	1,595	699	915	1,180	1,407	779	813	677	403	977

would not extend. For cluster 10 (*Career – / Well-being ++*), it appears that the expected positive impact on well-being overwhelms the somewhat negative perceptions of impacts on career.

The largest individual cluster is cluster 2 (*Career – / Well-Being –*), with 16.5 percent of observations. It is comprised of those who tend to view the impacts on career and well-being more negatively than average, though the intensity is relatively weak. However, a greater proportion of the sample believes a tour extension would have strongly positive impacts on both dimensions (cluster 11, 10 percent of the sample) than those who believe it would have strongly negative impacts (cluster 1, 2 percent of the sample). Finally, nearly 30 percent of the sample are in clusters more likely to extend than not, while 62 percent are in clusters less likely to extend than not.[4]

Military Satisfaction Clusters

The four military satisfaction clusters are as follows:

1. *MilSat – –*
   – Satisfaction is considerably lower than average for all aspects.
2. *MilSat –*
   – Satisfaction is lower than average for all aspects.
3. *MilSat*
   – Satisfaction is about average for all aspects.
4. *MilSat +*
   – Satisfaction is above average for all aspects.

Table H.5 provides the means for the six military satisfaction questions by impact cluster.

Only a small proportion of the sample (about 5 percent) reported considerable dissatisfaction with aspects of their military service, while a larger proportion (about 25 percent) tended to report high levels of overall satisfaction. The largest cluster (about 40 percent) had approximately average levels of satisfaction.

Military Satisfaction Clusters and the Propensity to Extend or Not Extend

Table H.6 reports the willingness to voluntarily extend by the military satisfaction clusters.

[4] The exclusion of cluster 6 in this calculation, which has a 48-percent acceptance rate, results in 48 percent of the sample that are less likely to extend.

Table H.5
Mean Values of Attitudes Related to Military Service by Military Satisfaction Cluster

Military Aspect	1 MilSat – –	2 MilSat –	3 MilSat	4 MilSat +	Mean (sample)	Std. Dev. (sample)
Your total compensation (i.e., base pay, allowances, and bonuses)	2.92	3.09	3.74	4.49	3.70	1.02
The type of work you do in your military job	2.53	3.27	4.06	4.61	3.88	1.01
Your opportunities for promotion	1.80	2.78	3.61	4.42	3.48	1.12
The quality of your coworkers	2.01	3.17	3.89	4.47	3.72	0.98
The quality of your supervisor	1.55	3.31	3.99	4.46	3.82	1.07
Overall, how satisfied are you with the military way of life?	2.43	3.25	3.97	4.50	3.81	0.95
Number of observations	567	3,107	4,198	2,687	10,559	10,559

NOTES: Values shown in tables are mean five-point scale question scores by cluster for all respondents who answered each question. Mean (sample) and std. dev. (sample) refer to all data used to cluster. Values of answers were 1 = very dissatisfied, 2 = dissatisfied, 3 = neither satisfied nor dissatisfied, 4 = satisfied, and 5 = very satisfied. Only individuals who answered all six questions were used to form initial clusters. Other observations were assigned to a cluster on the basis of their similarity to each cluster mean.

Table H.6
Willingness to Voluntarily Extend by Military Satisfaction Cluster

Extend?	1 MilSat – –	2 MilSat –	3 MilSat	4 MilSat +
No	67%	62%	58%	56%
Yes	33%	38%	42%	44%
Number of observations	567	3,107	4,198	2,687

As might be expected, the proportion of respondents unwilling to extend increases with dissatisfaction with aspects of military service. However, the variation is not nearly as distinct as the pattern in the reason and impact clusters. Not surprisingly, we discovered in our next stage of analysis that these clusters provided little to no explanatory power in explaining stated extension behavior.

APPENDIX I

Modeling Extension Behavior with Financial Incentives Using Probit and Interval Regression Models

This appendix provides details about the multivariate statistical modeling of stated extension behavior when financial incentives are offered. We begin by describing the use of a probit model to model tour extension using the first financial incentive only. We next describe the interval regression model, which is shown to match the probit when using only the answer to the first financial incentive question. We then show how the interval regression model can be used to incorporate the additional information known about the bounds of the minimum incentive necessary to induce an extension. The final two subsections explain how the interval regression model can be used to obtain the marginal change in the probability of an extension, akin to the results of a standard probit model.

Probit Model of Extension with Financial Incentive

The probability of a "yes" answer given a positive financial incentive (and perhaps other covariates) can be modeled using a probit model. Formally, for each individual, we model

$$\Pr\left(yes \mid inc, \boldsymbol{\beta}\right) = f\left(inc, \boldsymbol{\beta}\right),$$

where *inc* is the incentive amount and β is a vector of coefficients that parameterizes the model. Appending a mean-zero normally distributed error term to the right-hand side of the model and using the observed "yes" and "no" responses as dependent variables results in the probit model.

Table I.1 provides the probit estimates for a model using only an intercept and the first financial incentive as an independent variable.

Table I.1 provides statistical evidence that respondents respond to the first financial incentive via the statistical significance of the variable *Incentive.* Furthermore, the coefficient is positive, indicating that the probability of answering "yes" is increasing with the financial incentive. Finally, the marginal effect of the financial incentive is 0.015, suggesting that a 1-percentage point increase in the financial incentive relative to baseline salary will increase the probability of extending by 1.5 percentage points at a financial incentive of around 13 percent of base pay.

Figure I.1 uses the simple probit model to display the predicted probabilities of acceptance at each first financial incentive level.

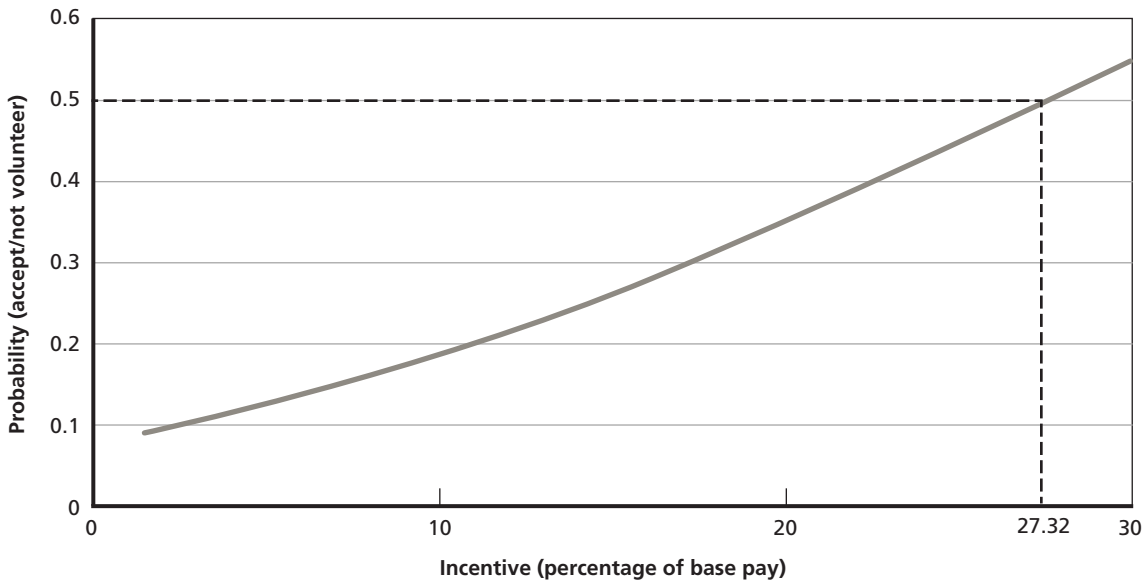
Relative to the raw data, the probit model tends to underestimate the probability of acceptance at intermediate financial incentive levels and overestimate at lower and higher incentive levels. This is due to the functional form assumed by the probit model and the implicit assump-

Table I.1
Simple Probit Model Predictions of First Financial Incentive Acceptance

	Coefficients	Marginal Effect
Incentive	0.0501*** (0.00196)	0.0154*** (0.0006)
Constant	–1.369*** (0.0345)	n/a
Number of observations	6,328	6,328

NOTES: Standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Marginal effect of incentive calculated at mean of first financial incentive level (13.03).

Figure I.1
Simple Probit Model Predictions of First Financial Incentive Acceptance



NOTES: Conditional on nonacceptance of voluntary extension without additional financial incentive. Dashed line shows median willingness to accept for a tour extension.

RAND *RR1034-I.1*

tion that individuals have identical probabilities of acceptance (i.e., we include no observable covariates in the model).

The probit coefficient estimates can be used to estimate the median financial incentive necessary to induce acceptance across the sample.[1] This level is calculated by solving for the incentive level that corresponds to a probability level of 50 percent. As indicated in Figure I.1, the median willingness to accept a tour extension using this simple model is 27.32 percent of base pay.[2]

[1] The median corresponds to the 50th percentile. The willingness to accept at any percentile level can be calculated similarly.

[2] Formally, this is equivalent to the negative of the constant coefficient divided by the coefficient of *Incentive* obtained by the probit results.

We next show how an interval regression model can be used to represent the same relationships in the data.

The Interval Regression Model

Interval regression methods estimate outcomes based on interval censoring, in which it is known that an observation lies in a particular interval, but the exact location is unknown. In this case, instead of modeling the probability of a "yes" answer, the interval regression model estimates median willingness to accept, with coefficients representing the change in willingness to accept with respect to a one-unit change in the variable associated with that coefficient. Consider the probability statement $\Pr(lb < \text{WTA}_i < ub)$, where *lb* and *ub* are the lower and upper bounds, respectively, of willingness to accept (WTA) a tour extension for individual *i*. WTA is the minimum incentive level necessary to induce individual *i* to accept. The true willingness to accept is unknown to the researcher, so an error term must be appended to WTA for the purposes of modeling. Parameterizing $\text{WTA}_i = \beta_0 + \beta_1 X_{i1} + \ldots + \beta_k X_{ik} + \varepsilon_i$ and assuming a distribution for the error term ε_i provides sufficient information to estimate the parameters $\boldsymbol{\beta}$ via an interval regression model. Assuming normally distributed errors, we estimate

$$\Pr\left(lb < \beta_0 + \beta_1 X_{i1} + \ldots + \beta_k X_{ik} + \varepsilon_i < ub\right) = \Phi(\mathbf{x}'\boldsymbol{\beta})$$

This model provides identical median WTA estimates to the simple probit model when $\beta_1 = \ldots = \beta_k = 0$ and

$$lb = -\infty \;\&\; ub = incent_i \text{ if } vote1_i = \text{"no"}$$
$$lb = incent_i \;\&\; ub = \infty \text{ if } vote1_i = \text{"yes"},$$

where *vote*1 is the answer to the first financial incentive question. In this case, the coefficient β_0 of the interval regression model gives the median willingness to accept for a tour extension.

Table I.2 (Model 1, Base Model) is the interval regression model corresponding to the probit model of Table I.1. The median willingness to accept is the constant term (*Constant* = 27.32), which perfectly replicates the median willingness to accept calculation reported for the probit model.

We next show how the interval regression model can be used to incorporate additional information available in the data.

Incorporating Additional Bounding Information in the Interval Regression Model

Neither a probit specification nor the simple interval regression model presented in the previous subsection makes full use of the information available in the series of questions related to voluntary extensions. For those respondents who answered "no" to the first financial incentive question, we have additional information via the second financial incentive question asked. In addition, because respondents were not obligated to answer each question in the survey, some may have skipped certain questions regarding their willingness to extend. Furthermore, the treatment of these skipped questions (i.e., interpreting them as zeros versus having no information) can affect the model coefficients. Finally, the probit model does not take into account the information that those who received the first financial incentive responded "no" to a question that implicitly used a zero financial incentive. That is, the data suggests that the lower bound of

Table I.2
Interval Regression Results Across Different Data Treatments

Variables	1 Base Model	2 Zero Lower Bound Model	3 Partially Bounded Model	4 Partially Bounded with Zero Lower Bound Model	5 Partially Bounded with Zero Lower Bound & Missing=0 Model
Constant	27.32*** (0.597)	23.69*** (0.280)	25.11*** (0.340)	24.63*** (0.250)	25.02*** (0.252)
ln(sigma)	2.993*** (0.0392)	2.508*** (0.0186)	3.020*** (0.0214)	2.718*** (0.0146)	2.731*** (0.0146)
Number of observations	6,328	6,328	6,342	6,342	6,464

NOTES: Standard errors are in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.1. Model (1) is equivalent to simple probit model. Model (2) assumes zero lower bounds for those voting "no" to the voluntary extension with zero financial incentive. Model (3) incorporates both the first and second financial incentives without assuming zero lower bounds as in Model (2), but accounting for bounds implied by missing responses. Model (4) is Model (3) assuming zero lower bounds for those voting "no" to voluntary extension with zero financial incentives. Model (5) is Model (4) plus coding all missing votes as "no" for those respondents that answered at least one voluntary extension question. *ln(sigma)* is the natural log of the square root of the estimated error variance (assumed normally distributed with mean zero).

willingness to accept for these individuals is at least zero. By specifying the correct bounds for each observation in the sample based on the answers to the two financial incentive questions, the maximum amount of information can be incorporated into the interval regression model.[3]

Table I.2 gives several estimates of an intercept-only interval regression model using alternative assumptions about the information contained in the data. The zero lower bound model incorporates a lower bound of zero for all respondents who voted "no" to the voluntary extension without financial incentive question. Note that this decreases the median WTA, or equivalently shifts the predicted acceptance curve up or to the left. The intuition is that the lower bound WTA for those who voted "no" to the zero incentive question has increased from $-\infty$ to zero, functionally increasing the probability of acceptance at each bid level and lowering median WTA.

The partially bounded model takes the base model and incorporates the second financial incentive question for those that voted "no" to the first financial incentive. This has a similar effect as including the zero lower bound in Model (2), as more information is incorporated as to the specific interval in which the true WTA is located for many observations. Note that the sample size increases slightly as well, as some observations with skipped answers are incorporated into the model.

The partially bounded with zero lower bound model uses the zero lower bound assumption of Model (2) with the partially bounded Model (3).

Finally, the partially bounded with zero lower bound & missing=0 model assumes, for the 122 observations for which there was a "no" response to the zero financial incentive question and missing responses for the positive financial incentive questions, that true WTA was greater than the second financial incentive offered. As expected, median WTA increases in

[3] It is a straightforward exercise to convert the coefficient estimates of the interval regression model with normally distributed errors to the corresponding probit-type coefficient estimates using a simple change of scale based on the estimated error variance.

this case. For the final interval regression model in the text, we treat the data as in Model 5, as it incorporates the most information available. The interval mode is preferred, however, as it incorporates more information about the sample.

Probability Curves Implied by the Interval Regression Model

The interval regression model can also be used to recover the probability curve, as in Figure I.1. To do so, we use the cumulative standard normal distribution $\Phi(\cdot)$ to model

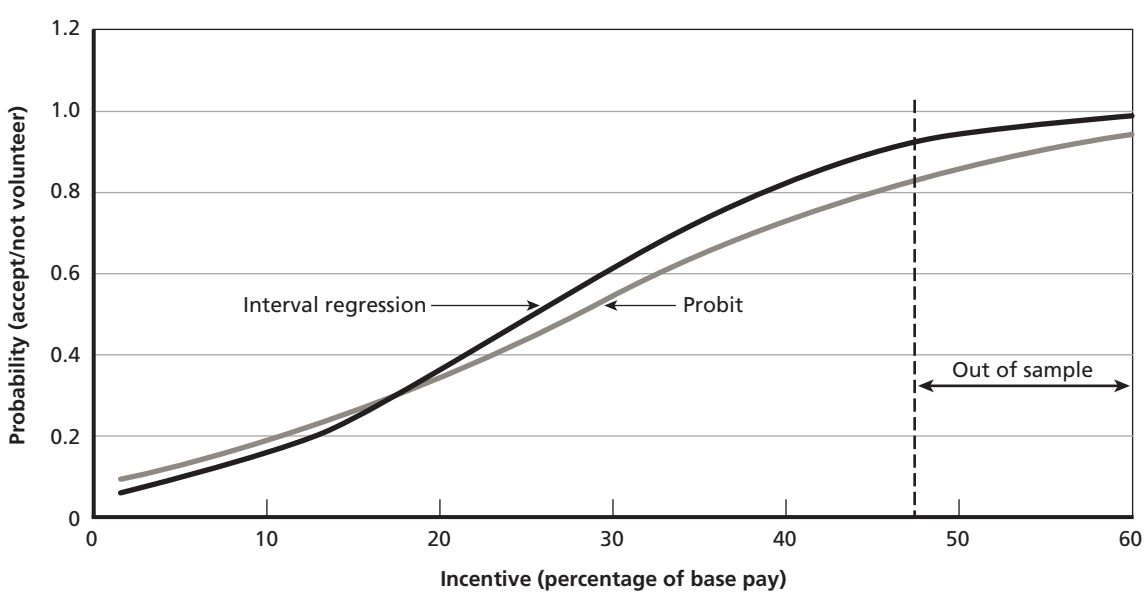
$$\Pr\left(WTA_i < incent\right) = \Phi\left(\frac{incent - \hat{\beta}_0}{\hat{\sigma}}\right),$$

where $\hat{\beta}_0$ is the estimated constant term (WTA) for Model (5) in Table I.2, $\hat{\sigma}$ is the square root of the estimated error variance, and *incent* is the incentive level. As can be seen in Figure I.2, the interval regression model results in lower probabilities for low incentive levels, but higher probabilities for higher incentive levels. This moves the model closer to observed proportions for lower values of the incentive but exacerbates the over prediction at higher levels. The median falls within this latter category—i.e., the lower median WTA is associated with a greater probability of answering "yes" at this incentive level.

Marginal Probability Effects in the Interval Regression Model

The probability curve associated with the baseline respondent for the final interval regression model discussed in the text is provided in Figure I.3.

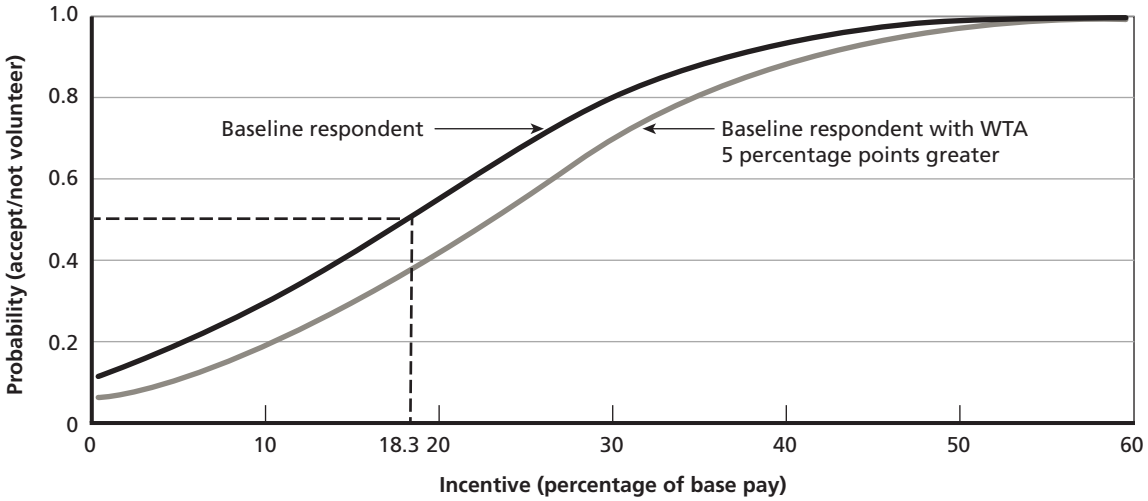
Figure I.2
Estimated Probabilities of Interval Regression with Zero Bounds and Zero-Coded Missing Responses (Model 5) Versus Simple Probit Model



NOTES: The greatest incentive offered in the survey was 45 percent of base pay. Simple probit model is equivalent to Model (1) in Table I.1.

RAND *RR1034-I.2*

Figure I.3
Probability of Extension for Baseline Respondent by Incentive Level and Shift



NOTES: The black line shows probability of extension at each incentive level for baseline respondent. The gray line shows baseline respondent with a willingness to accept (WTA) 5 percentage points greater than baseline. Baseline respondent serves the Army at a pay grade of E-4, has served for 6 to less than 10 years, is married with dependents, has no college experience, and is non-Hispanic white. The overseas tour was in Germany, and the respondent was accompanied by family. For respondents on a current tour, the baseline is a tour length of 36 months with arrival in 2013. For respondents not on a current tour, the baseline tour length is 24 to less than 26 months. The baseline respondent is assigned to reason cluster 7 (*Career +/All –*), impact cluster 6 (*Career/Well-Being*), and military cluster 2 (*Military*).

RAND *RR1034-I.3*

The median minimum willingness to accept for the baseline respondent is 18.39 percent of baseline salary (the constant term in the interval regression), which is approximately $442 per month for an E-4 with approximately eight years of service. Probabilities associated with additional incentive levels can be read off the curve.

Coefficients in the interval regression model are the marginal change in minimum willingness to accept given a change in an explanatory variable. For example, a coefficient of +5.0 in the interval regression model results in an increase of median willingness to accept of 5 additional percentage points of base pay (from 18.39 to 23.39 percent of base pay). This is equivalent to shifting the probability curve down vertically, resulting in a lower probability of accepting the extension offer at any incentive level. These lower probabilities, reported at the minimum willingness to accept of the baseline respondent, are reported in the text as marginal effects.

In Figure I.3, the probability of acceptance decreases from 50 percent to 36.5 percent at the median willingness to accept of 18.39. This is a marginal effect of –0.135, or a decrease of 13.5 percentage points. Note that due to the nonlinear nature of the model, the shift in probabilities is not the same for each incentive level. In addition, the probabilities implied by the model can be interpreted as shares of the population with a certain set of characteristics that would accept the offer.

APPENDIX J

Alternative Auction Mechanisms

There are multiple ways to design auctions in order to provide flexibility for DoD. Three variations that may be particularly relevant to the tour extension problem are (1) the uniform-price quality-adjusted discount (QUAD) auction, which allows the government to account for servicemember qualifications (and quality) in its assignment of tour extensions and incentive pays; (2) the combinatorial retention auction mechanism (CRAM), which allows the government to incorporate nonmonetary incentives in lieu of cash compensation as a means of reducing costs; and (3) the sequential self-selection auction mechanism (S3AM), which allows servicemembers to bid for varying tour lengths. These variations have been proposed in the academic literature but not implemented.

Uniform-Price Quality-Adjusted Discount (QUAD) Auction

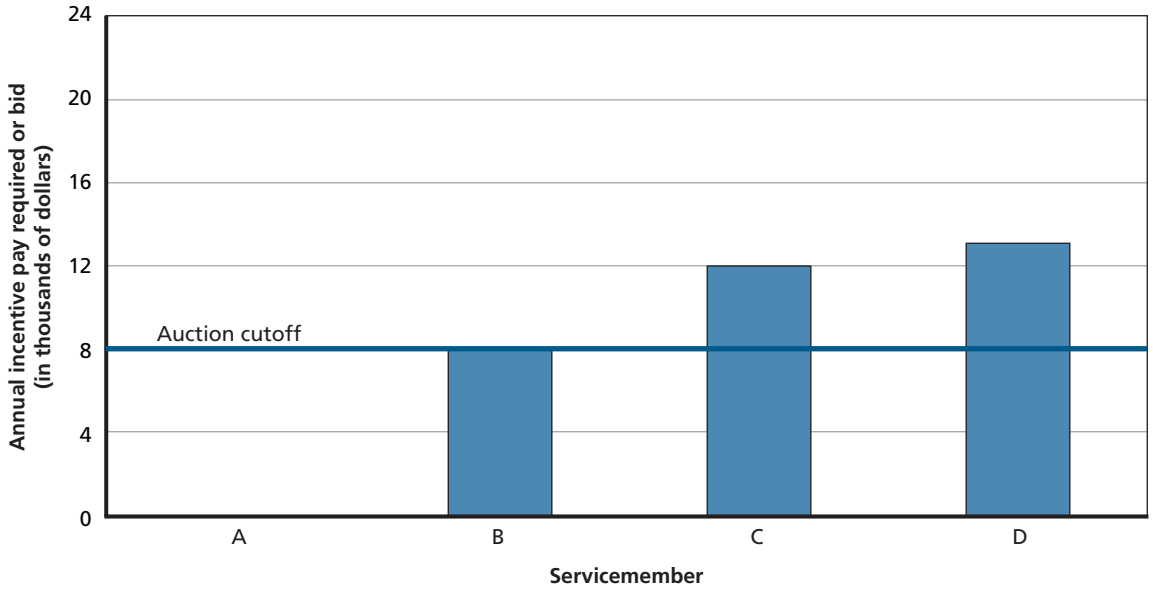
As we noted in Chapter Five, the government may want to account for considerations other than incentive pay, such as PCS costs or servicemember qualifications, in determining whose tours to extend. The QUAD auction is specifically designed to account for servicemember qualifications (or quality) while leveraging the competitive pressure inherent in auctions to minimize the size of incentive pays.

In a standard uniform-price auction, servicemembers bid on incentive pay; bids are ranked from lowest to highest; the servicemembers submitting the lowest bids are selected to have their tours extended; and each of the selected servicemembers receives an incentive pay equal to *the lowest losing bid*.

To illustrate, consider the example depicted in Figure J.1. Servicemembers A, B, C, and D are willing to extend their tours by 12 months in exchange for incentive pays represented by the blue columns. In a standard uniform-price auction, servicemembers bid truthfully—that is, each servicemember bids the minimum incentive pay he requires to voluntarily extend his or her tour.[1] As such, the blue bars in Figure J.1 represent both the minimum required pays and the bid amounts. If the budget for incentive pays were to equal $24,000, then servicemembers

[1] Truthful bidding in a uniform-price auction occurs because the rules of the auction break the connection between what a servicemember bids and what he receives in incentive pay. As a consequence, servicemembers no longer have an incentive to raise their bids in an effort to capture a larger incentive pay. The role of the servicemember's bid is reduced to determining whether or not his or her tour is extended. As such, servicemembers bid as low as possible (i.e., their minimum required pays) in order to maximize their chances of winning the auction and having their tours extended. See Krishna, 2002, for more on uniform-price auctions.

Figure J.1
A Standard Uniform-Price Auction



RAND *RR1034-J.1*

A and B would have their tours extended, and each would receive an incentive pay equal to $12,000—the bid submitted by servicemember C, which is the lowest losing bid.

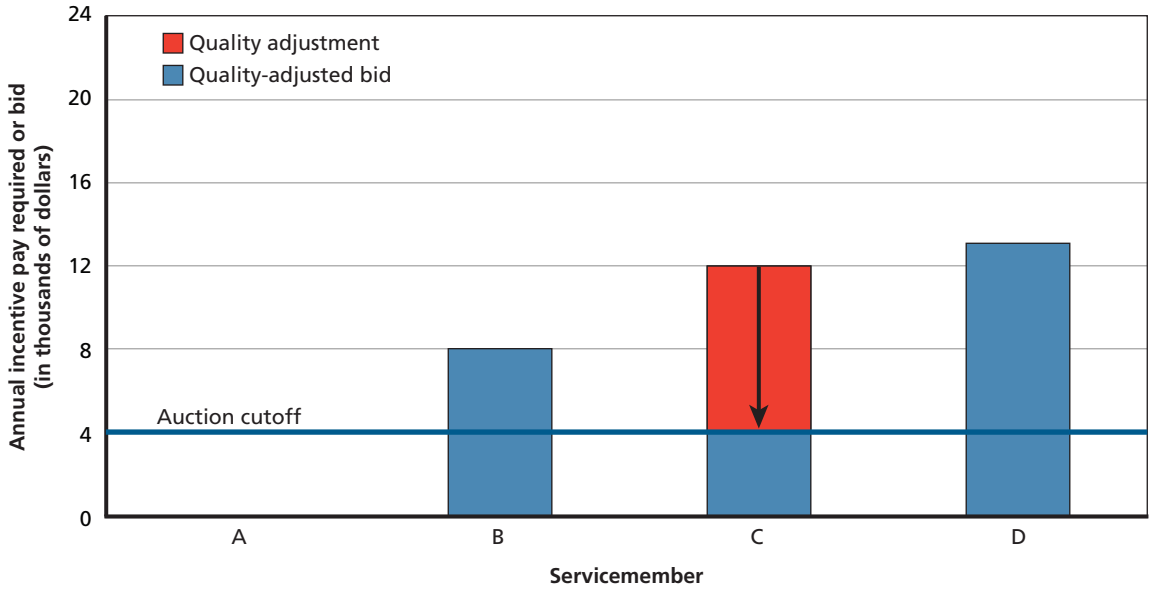
QUAD auctions differ from the standard uniform-price auction in that they provide a fixed advantage to bids submitted by high-quality servicemembers. Each servicemember's quality is rated *ex ante*, and a quality threshold is set. Bids submitted by servicemembers whose quality exceeds the threshold are discounted by a fixed amount. All bids are then ranked from lowest to highest, with high-quality bids enjoying the advantage inherent in the discount. The servicemembers submitting the lowest bids are selected for tour extensions.

To illustrate, consider the example depicted in Figure J.2. As before, servicemembers A, B, C, and D are willing to extend their tours by 12 months in exchange for incentive pays of $0, $8,000, $12,000, and $13,000, respectively. However, in this case, the minimum required pays are represented by the sum of the blue and red bars. As before, servicemembers bid their minimum required pays.

Now suppose that servicemember C is considered "high quality" and that the rules of this QUAD auction are such that an $8,000 discount is applied to the bids of high-quality servicemembers. Then, despite the fact that servicemembers A, B, C, and D bid $0, $8,000, $12,000, and $13,000, respectively, their bids are evaluated as if they were $0, $8,000, $4,000, and $13,000, respectively. With a budget of $24,000, servicemembers A and C would have their tours extended. Servicemember A would receive an incentive pay equal to $8,000—the bid submitted by servicemember B, which is the lowest losing bid. Servicemember C would receive an incentive pay equal to $16,000—the lowest losing bid plus the $8,000 quality adjustment.

While QUAD auctions have yet to be implemented, there are a handful of studies that project the cost savings associated with replacing various incentive pay programs with QUAD auctions. Nowell (2012) examines using QUAD auctions to set Surface Warfare Officer retention bonuses. Pearson (2011) examines using QUAD auctions to assign voluntary separation

Figure J.2
A QUAD Auction



RAND *RR1034-J.2*

pay to Marine officers. White (2010) examines replacing the Marine Corps' Aviation Continuation Pay (ACP) system with QUAD auctions.

Combinatorial Retention Auction Mechanism (CRAM)

Existing tour assignment programs often utilize nonmonetary incentives. For example, OTEIP offers 15 days of nonchargeable leave plus round trip transportation between the overseas location and the port of debarkation in CONUS for the servicemember and his or her family. The Active Duty Enlisted Voluntary Stabilized Base Assignment Program (VSBAP) encourages volunteers for certain unpopular, high-turnover CONUS bases by offering the nonmonetary benefit of a stabilized four- or five-year tour.

Using auctions does not preclude the government from offering nonmonetary incentives. In fact, the Naval Postgraduate School (NPS) has explored providing nonmonetary incentives—such as billet of choice, geographic stability, and sabbatical leave for education—in addition to cash to create flexible benefit packages through the combinatorial retention auction mechanism (CRAM). Unlike existing incentive programs like OTEIP, which offer a fixed package of nonmonetary and cash incentives to all eligible servicemembers, CRAM allows each servicemember to customize his or her benefits package by choosing only the nonmonetary incentives he or she intends to use. If the servicemember's value for a particular nonmonetary incentive is greater than the cost to the government of providing it, then the nonmonetary incentive is granted in lieu of cash, which, of course, saves the government money.

CRAM operates in the following fashion. Servicemembers bid for incentive pay, as usual. In addition, servicemembers report the cash amount they are willing to forego for each non-

monetary incentive the government offers. For each servicemember, the government creates a custom incentive package as follows:

1. The package begins as a cash payment equal to the servicemember's bid.
2. For each nonmonetary incentive, the government compares the cash value reported by the servicemember to its cost of providing the incentive.
3. If the cost of providing the incentive is less than the cash value reported by the servicemember, then the nonmonetary incentive is added to the incentive package, and the cash component of the package is reduced by the reported cash value of the nonmonetary incentive.

Once a custom incentive package is created for each servicemember, the government calculates the cost of providing each package. The cost to the government includes the value of the cash component as well as the cost of providing the nonmonetary incentives. The government then ranks the packages by cost. The servicemembers whose packages carry the lowest costs have their tours extended and receive their custom incentive packages.

There are two issues associated with implementing CRAM. First, the assumption that the cost to the government of providing these nonmonetary incentives is known or calculable is questionable. Second, survey data indicate a nontrivial proportion of servicemembers provide responses that are not internally consistent or rational (Denmond et al., 2007; Zimmerman, 2008). This result suggests that offering a menu of multiple nonmonetary incentives introduces complexity, which necessitates additional training to ensure servicemembers understand CRAM. For more on CRAM, see Coughlan, Gates, and Myung (2013).

Sequential Self-Selection Auction Mechanism (S3AM)

Another way to provide flexibility to both the government and servicemembers is to offer extension contracts of varying lengths. The sequential self-selection auction mechanism (S3AM) assigns such contracts by administering two sequential auctions: the first for a shorter tour extension and the second for a longer tour extension. Only those servicemembers who secure shorter tour extensions by winning the first auction are eligible to participate in the second auction. For further details, see Anderson (2007) and Bock (2007).

The concept of S3AM is promising, but the mechanism is still in an early phase of development. Further experimental or survey research is needed to identify the mechanism's viability and obtain better estimates of potential cost savings. Further theoretical research is needed to explore any unintended consequences of sequencing the two auctions. For example, individuals may bid more aggressively (lower bids) in the first auction in order to secure access to the long-term contracts offered in the second auction.

APPENDIX K

Private Sector Uses of Bidding for Workforce Management

Mechanisms that rely on bidding are widely used outside the military for managing personnel assignments. For example, many hospitals use online auctions to assign nurses to hard-to-fill shifts, and airlines typically use some form of bidding system to match crew with flight schedules. Many police stations, prisons, and call centers also use similar mechanisms. Another use of bidding that is not directly analogous but is nonetheless informative is the use of bidding systems to allocate seats at oversubscribed law school and business school courses to students.

What these systems have in common with each other—and with the Navy's AIP program—is that they are flexible mechanisms that allow organizations to infer preferences, determine who has a bigger claim on available assignments, and fill vacancies at lowest cost amid uncertainty surrounding how great the need for staff will be at any particular time. They can typically accommodate multiple considerations—not just bid amounts. In the case of shift-bidding mechanisms, they also allow employees to volunteer for extra duty and extended assignments.

Our analysis of these systems draws on scholarly studies published in journals of economics, management science, and operations research, as well as on newspaper articles, interviews, and public discussions in online chat forums for nurses and similar forums for airline crew. Our key findings are that bidding systems have been employed successfully in many settings; that personnel typically find them easy to use; that they tend to improve morale by giving employees more flexibility and greater say over their assignments; and that they can generate substantial savings.

Shift Bidding in Hospitals

Scheduling nurses is a complex problem that involves determining each nurse's on and off days, as well as shift start and finish times. The goal of shift-bidding systems is to ensure that hospitals secure sufficient staffing levels to meet their nursing requirements (which cannot be predicted beforehand with certainty) while respecting seniority, complying with various labor regulations, and honoring nurses' employment contracts, as well as their stated preferences. Ideally, nurse rosters should satisfy a number of staffing and scheduling constraints. For example, there should be sufficient numbers of nurses of each type on duty at any time, but no nurse should work two shifts in a row or have inadequate time for rest and recovery between shifts (De Grano et al., 2009).

In hospitals that do not use shift bidding, large percentages of shifts are often vacant. Nurse managers spend hours each week managing paper lists and telephoning nurses to

encourage them to fill shifts or managing automated rostering systems. In much the same way that the military services have often had to extend military tour lengths unexpectedly, hospitals often resort to requiring unscheduled overtime. Some use "holdover" overtime, extending the hours of workers from a prior shift, while others use such arrangements as on-call overtime (Campbell, 2012). As is the case with extended combat tours in the military, the excessive use of overtime by hospitals can be detrimental to nurses' well-being, can depress recruitment and retention, and can lead to lower quality service.

Many states have passed laws banning mandatory overtime for nurses. At the same time, states have passed laws requiring minimum nurse-to-patient ratios. As a result, hospitals have increasingly relied on nurses from external staffing agencies to fill unpopular shifts. This has been an unsatisfactory solution because outside contractors are typically much more expensive but are less familiar with the hospital and its patients. The use of outside workers can also damage staff morale, because regular employees sometimes resent working alongside higher-paid contract labor.

How Shift Bidding Works

Since around 2000, many hospitals have implemented online shift-bidding systems as a solution to those challenges. Cases that have received considerable attention and scrutiny in the media and in the academic literature include St. Peter's Hospital in Albany, New York, which introduced a shift-bidding program for nurses in 2000; Spartanburg Regional Medical Center in South Carolina, which started using shift bidding in 2002; and Southern Regional Medical Center in Georgia and Tucson Medical Center in Arizona, which introduced shift bidding in 2004. By 2009, 170 hospitals were using the online shift auctioning system designed by Concerro, just one of the many bidding software companies serving hospitals (Campbell, 2012).

The following description captures the main features of one commonly used mechanism:

1. Nurse managers post open shifts on a website.
2. Nurses interested in volunteering for additional shifts go online and submit one sealed bid with the hourly wage they would require to work for each shift in which they are interested.
3. Once the bidding period closes, nurse managers review the list of employees who requested to work a shift and assign it to the lowest bidder, all other things being equal.
4. Shift-bidding systems can incorporate algorithms that take into account a variety of other criteria, such as skill mix, experience, and seniority, or nurse managers can be given some discretion over the final decision.
5. Nurses are notified by email when they have been awarded a shift.

Although this format is quite popular, hospitals use a wide range of bidding options. Some systems use open reverse auctions, in which staff view a starting price and submit decreasing bids until the bidding period closes. Others use multiphase auctions, in which bidding is first opened to a particular group of employees (e.g., the most senior) but then opened to other groups once the first bidding period expires. Some use fixed bids, in which staff may request to work for a defined price set by the manager. Others use applications that allow each user to set a minimum bid but then automatically place proxy bids on each user's behalf, starting at the posted starting price and reducing them by a specified amount on each round until the

user's minimum is reached. In other systems, nurses are allocated an allotment of points and bid points on the shifts they would most like to work (De Grano et al., 2009).

Advantages and Disadvantages of Shift Bidding

Shift bidding has many advantages. It is flexible enough to accommodate many different kinds of incentives. It is typically popular with employees because it gives them more scheduling choice and the option to increase their earnings. According to many hospitals that use the system, it can improve nurse retention and recruitment, thereby allowing them to cut spending on advertising and recruitment. It can also improve the fairness and transparency of the personnel scheduling system—rather than relying on nurse managers to phone nurses one by one at their discretion, shift bidding can make open shifts visible throughout the organization and available equally among staff. It can also generate substantial cost savings: St. Peter's Hospital saved more than $1.7 million in the first three years of online bidding by filling open shifts with internal staff instead of agency staff (Sabet, 2006).

There are also some notable disadvantages. Implementing shift-bidding systems typically requires purchasing software or paying fees to a company that hosts the shift-bidding application. Substantial competition in the market for shift-bidding technology has driven prices down, but any new application of online auction technology could be expensive to implement initially. Online shift-bidding products might cost between $3,000 and $9,000 per month for a 300-bed hospital, but more advanced, integrated staffing and scheduling products can cost more than $100,000 (Sabet, 2006).

Although we have not found any studies that cited adverse selection as a concern, theoretically, the quality of workers who remain in the bidding for an assignment could deteriorate as the wage is bid down. We have found no evidence in the literature of gaming being a problem, but collusion among staff to increase wage levels is also theoretically possible and more likely to be a problem in small organizations, where the same staff members repeatedly interact with one other. One reason gaming is not widely observed in practice is that hospitals tend to be large organizations and to advertise open shifts to nurses across departments, as well as to nurses from outside agencies.

The chief disadvantage is that the system is unpopular with some nurse unions, which argue that the system is open to abuse, that it bids nurse pay below what it should be, and that it creates a hostile work environment in which colleagues are encouraged to undercut each other. Unions also object to the possibility that nurses might be paid different amounts for the same work. Some unions argue that while shift bidding may be a temporary solution to staffing problems, it undermines the long-term solutions, which include better base pay, less overtime, better training, and better working conditions. However, these strategies typically increase costs (May et al., 2006), whereas shift bidding tends to reduce costs.

Lessons Learned from Shift Bidding

The case of shift bidding in hospitals contains several lessons learned that may be relevant to the military's use of auctions. Key lessons are listed below:

- Online auctions for personnel scheduling are widely used in large organizations.
- They can be implemented effectively and efficiently.
- They can generate substantial savings.
- They can improve staff morale by giving staff greater choice and flexibility.

- They are invulnerable to gaming when applied in organizations with large numbers of staff members, especially when staff are geographically dispersed.
- They can be controversial and may conflict with an organization's culture or with its other priorities.

Course Bidding in Universities

Student demand often exceeds the number of slots available in business and law school courses. As a result, allocating course seats to students equitably and efficiently can be a challenging task, especially since course allocations are only feasible if they satisfy certain conditions. For example, students cannot enroll in classes that meet at the same time, there is a limit on the number of students who can be registered in each class, and there are typically limits on the number of classes or credits a student can take each semester.

Universities have developed a number of different approaches to solving the problem—some based on preference rankings, and others based on bidding. For example, Harvard Business School and Stanford Business School use preference-ranking mechanisms, whereas Columbia Business School and Yale School of Management use bidding systems. Mechanisms that incorporate both bids and preference rankings have been shown, both theoretically and experimentally, to produce superior outcomes (Sönmez and Ünver, 2005; Krishna and Ünver, 2008; Sönmez and Ünver, 2010).

How Preference-Ranking Mechanisms Work

The most commonly used mechanism for allocating course seats (or dormitory rooms) to students involves the following steps:

1. Students list the courses they are interested in taking, in order of preference.
2. Students are randomly ordered into a single line. One at a time, they are assigned their highest-ranked choice among those still available.

How Course-Bidding Mechanisms Work

Bidding mechanisms are widely used as an alternative to the preference-ranking approach. In the belief that they would be more efficient and improve student welfare, many schools have shifted from preference-ranking to course-bidding mechanisms (e.g., Ross School of Business at the University of Michigan [UMBS]). There are many versions of course-bidding systems, but the version described below is most typical:

1. Students are each given a positive bidding endowment (e.g., 100 bidding points) to allocate across the courses they are interested in taking.
2. All bids for all courses and all students are ordered into a single list. Bids are considered one at a time, starting with the highest. A bid is honored if the student has not yet filled his or her schedule and if the course has not yet filled its seats.
3. If numerous students submit the same bid, a random number generator can be used to increment each bid by some fraction between 0 and 1 and serve as a tiebreaker.

How Combined Rank-and-Bid Mechanisms Work

Krishna and Ünver (2008) were the first to show that a mechanism combining bidding and ranking could vastly improve the efficiency of course allocation systems. Their proposed system proceeds as follows:

1. Each student proposes his or her ideal course schedule (i.e., lists his or her most preferred classes totaling the maximum number of credits he or she is allowed to take).
2. In addition, each student submits his or her bids for courses, as he or she would under a traditional bidding system.
3. Each course rejects all but the highest-bidding *N* students who have proposed, where *N* represents the capacity of the course. Students who are not rejected are kept on hold.
4. Each student proposes his or her ideal schedule, drawing only from those courses that have not rejected him or her previously. In addition, each student submits bids for the courses that make up this schedule.
5. Each course rejects all but the highest-bidding students among those who have proposed. Students who are not rejected are kept on hold.
6. Steps 4 and 5 are repeated until no proposal is rejected. Students are assigned to the courses that keep them on hold, and course assignments are finalized. The market-clearing bid is the lowest successful bid if all seats are filled, and zero otherwise.

Advantages and Disadvantages of Alternative Course Allocation Mechanisms

Preference-ranking mechanisms have been used for centuries and are simple to implement. They are unsatisfactory, however, because they collect only ordinal rankings of student preferences; they do not collect information about the intensity of those preferences. For instance, Ann and John may each rank a set of four courses in the same way, but Ann may be essentially indifferent between the four, whereas John may have an extremely high preference for his top-ranked course over his fourth-ranked course. Under a preference-ranking mechanism, it is conceivable that Ann would get her first choice, but not John. Preference-ranking mechanisms fail to account for the strength of a student's preferences and, as such, do not ensure an efficient allocation of courses. That is, there may be other allocations that would give some students more preferred schedules without giving any of the other students less preferred schedules.

Bidding mechanisms are widely believed to be more efficient because they give students a way of signaling the strength of their preferences. They produce cardinal, rather than ordinal, preference rankings that can be compared across people. Nonetheless, they have been shown by Sönmez, Ünver, and Krishna to be susceptible to gaming and to produce inefficient allocations. A student may choose to bid only one point on his or her most preferred class if he or she expects it to be unpopular and undersubscribed. As a result, bids may not truthfully reflect student preferences.

The combined system, while based on a relatively straightforward algorithm, has the disadvantage of being more complicated to implement and requiring students to submit both preference rankings and bids. However, the benefits may outweigh the costs. A field study conducted at UMBS found that the approach vastly improved the efficiency of course allocations over a traditional bidding system, making approximately 20 percent of students better off (Krishna and Ünver, 2008). Several business schools have expressed interest in the mechanism, but none has adopted it yet. This may be due to perceived barriers to implementation or simply due to organizational inertia.

Lessons Learned from Course Bidding

Several key lessons emerge from a case study of course bidding in universities:

- Bidding systems must be designed with care to avoid gaming and associated efficiency losses.
- Appropriate mechanism designs can produce vast efficiency improvements.
- Efficiency improvements may require more complicated mechanism designs and the elicitation of additional information.
- Organizations may resist adopting new assignment mechanisms, especially if they are perceived as complicated.

Airline Bidding Systems

Over several decades of commercial flight, the airline industry has developed a range of solutions to the complex problem of assigning pilots and other crew members to flights (Achour et al., 2007). The challenge is to schedule staff in such a way that there are adequate numbers of crew with the appropriate skills on each flight, while satisfying Federal Aviation Administration regulations, labor laws, and relevant collective bargaining agreements; rewarding seniority; minimizing costs; and accommodating crew preferences about days off each week, leave periods, destinations, and other considerations. The schedules must also be flexible enough to accommodate unexpected changes, such as delayed flights or sick crew members. Since the 1990s, airlines have used advanced mathematical models and optimization software programs to manage the problem.

How Preferential Bidding and Other Airline Bidding Systems Work

Typically, crew management software tools construct feasible sequences of flights that begin and end at the same airport, referred to as "pairings," and then combine groups of pairings into feasible monthly flight schedules called "lines." Crew members are then assigned to lines in one of the following ways. The older line-bidding system, which is still used by airlines such as American Airlines, operates as follows:

1. Crew members go online and are shown a subset (perhaps 60) of the feasible lines generated using optimization software.
2. Crew members rank these lines in order of preference, 1 through 60.
3. An optimization program assigns crew to lines using a common mechanism known as *simple serial dictatorship,* based on seniority. In other words, the program assigns the most senior pilot his first choice of line, the next pilot his highest choice among the remaining options, and so on.
4. Any crew members who are not assigned are placed in a reserve status and must be available to arrive at their home airport within some time period to fly when needed—for example, when another crew member calls in sick.

The newer preferential bidding system (PBS), which is used by JetBlue Airways, among others, works somewhat differently (Gamache et al., 1998):

1. Crew members are shown a list of generic flight characteristics, such as duration, destination, aircraft type, and day of the week.
2. Crew members do not rank flight lines, but rather score these generic flight characteristics according to their preferences. For example, a pilot might give a score of 250 to all flights that arrive in Hawaii but a score of –1,000 to all flights that take place on a weekend. Scores can be any integer value, positive or negative.
3. The PBS software program then computes a score for each feasible flight line, based on the combined scores of the characteristics of each flight involved.
4. In order of seniority, each crew member is assigned his or her maximum-score line, *provided* there are still feasible (although not necessarily preferred) schedules available for all remaining employees. This modification of the serial dictatorship mechanism is known as the residual problem.
5. If assigning the most senior pilot to his or her maximum-score line precludes another pilot from having any feasible options, he or she is assigned to his or her next-highest-scoring line instead, and so on.

Advantages and Disadvantages of Airline Bidding Systems

Although both systems are described as involving bids, neither is really an auction-based mechanism, and staff do not actually place bids of cash or points. Rather, they are preference-matching systems that strictly prioritize seniority. If the only feasible lines that remain for junior staff are those to which they assigned low scores, then they are simply assigned to those lines. The mechanisms do not prioritize the maximization of staff welfare. That said, they are still relevant to our study as examples of scheduling tools that are implemented online and that treat staff preferences as important inputs in the planning process, while also balancing a large number of other considerations. Rather than first determining possible schedules and then assigning staff to those schedules, PBS mechanisms first collect information about staff preferences and then generate schedules on the basis of those preferences. Anecdotally, this system has substantially improved employee satisfaction.[1]

Lessons Learned from Airline Bidding Systems

Several lessons from the experience of airline bidding are relevant for military assignment mechanisms and tour length extensions:

1. Online staff assignment systems can be designed to accommodate a range of organizational priorities, such as seniority, experience, or merit.
2. Treating preferences as important inputs into tour-length determination decisions upfront could improve personnel satisfaction levels.

By collecting data on how willingness to extend tours is associated with tour characteristics, the military services might gain information on how best to plan tours and incentivize tour length extensions.

---

[1] In online chat rooms for airline crew, there is a great degree of discussion about how crew prefer PBS over line bidding. Press releases from airlines announcing their adoption of PBS systems typically justify the added expense by citing improvements in employee satisfaction.

APPENDIX L

The Navy's Assignment Incentive Pay Program

The Navy's Assignment Incentive Pay (AIP) program is the only auction-based program for managing military personnel currently employed within DoD.[1] Prior to the introduction of AIP, the Navy dealt with recurring manning shortages in certain billets by either assigning sailors involuntarily or using a patchwork of incentives, including promising a preferred future assignment and giving sea duty rotational credit for a shore duty assignment (Golding and Cox, 2003). In June 2003, the AIP pilot program was launched with three objectives in mind:

- reducing the cost of providing sea duty credit in Type 3 locations by converting these billets to Type 6 (shore duty) billets and offering AIP[2]
- alleviating manning shortages in less desirable locations
- increasing volunteerism in hard-to-fill jobs in order to increase retention (Golfin et al., 2009).

The pilot program was limited in scope, offering AIP for shore billets in Sigonella, Naples, and Misawa only and operating with a budget of $1 million (Golfin, 2006).

The AIP program permits sailors to bid on the monthly incentive pay they would be willing to accept to volunteer for a job in a given location. Bids are submitted via the Career Management System Interactive Detailing (CMS/ID), the Navy's online interactive job application and selection system.[3] Sailors begin searching for jobs on CMS approximately nine months prior to their projected rotation date (PRD). They may apply for up to five jobs in each requisition cycle until they are selected for a job by the detailer. Selection typically occurs at least six months before a sailor's PRD (Golfin et al., 2009).

Detailers need not select the lowest bidder. They may consider over 30 factors, including a sailor's qualifications, PCS costs, training costs, and billet priority (Golding and Cox, 2003). For each AIP-eligible billet, detailers first determine which sailors are qualified based on these factors and then select the lowest bidder from among the qualified sailors. The sailor selected

[1] Auctions have also been used for workforce management in the private sector. We review these applications in Appendix K.

[2] "Type 3" refers to overseas shore duty for which sailors receive sea duty credit for rotational purposes due to the relative undesirability of the geographic area. "Type 6" refers to standard overseas shore duty; sailors are credited for shore duty, not sea duty, for rotational purposes.

[3] CMS was previously known as the Job Advertising and Selection System (JASS).

to fill the billet receives an incentive pay equal to the amount of his or her bid (Golfin et al., 2004).[4]

Incentive pays are limited by reservation caps. Sailors may not bid in excess of the reservation cap set for the billet in question. Reservation caps vary by location, pay grade, and rating, with harder-to-fill billets featuring higher caps (Golfin et al., 2004). Caps are reviewed by the Navy periodically and, hence, also vary over time. The caps set by the Navy may not exceed the maximums dictated by Congress (Golfin et al., 2009). See Figure L.1.

On occasion, an AIP-eligible billet remains vacant either because no bids were submitted or because the detailer disqualified every sailor who did bid. In these cases, a sailor may be assigned to the billet involuntarily. If the sailor was selected for another job but is redirected to the AIP-eligible billet due to an emerging requirement or some other reason, the sailor receives some incentive pay, typically equal to the historical average bid for that location. If, instead, the detailer fills the billet by assigning a sailor who reached the end of his or her detailing window without being selected for another job, the sailor receives no incentive pay.[5] Navy personnel have reported that some detailers contact sailors to warn them that they will be involuntarily assigned to a particular AIP billet at the end of the cycle. Many of these sailors then bid for the billet and are selected rather than involuntarily assigned (Golfin et al., 2009).

The AIP pilot program was regarded as a success, and AIP was extended incrementally in the years that followed. By 2008, AIP-eligible billets were available in 41 countries (Golfin et al., 2009),[6] and the program's budget increased from $1 million in fiscal year 2003 to $26.5 million in fiscal year 2006 (Golfin, 2006). Between 2003 and 2008, 9,800 sailors successfully bid for roughly 10,000 AIP-eligible billets. Almost 4 percent of these sailors bid $0, and the average winning bid was $397 per month (Golfin et al., 2009).

Benefits of the AIP Program

A number of benefits have accrued to the Navy since the introduction of the AIP program. In particular, the program appears to have met the three objectives the Navy set out to achieve when it piloted the program 11 years ago.

Offering AIP has proven to be more cost-effective than offering sea duty credit as a means of increasing the rate of volunteerism for hard-to-fill overseas shore duty billets. CNA estimates that offering sea duty credit cost the Navy an average of $2,200 per month per sailor (Golfin et al., 2004). In contrast, over the first five years of the AIP program, the average winning bid for shore duty billets that previously carried sea duty credit was $424 per month (Golfin et al., 2009). In some instances, winning bids come in at $0, meaning the billet is filled without incentive pay. Between June 2003 and December 2007, 5.4 percent of winning bids for billets in Misawa and nearly 6 percent of winning bids for billets in Sigonella came in at $0 (Golfin et al., 2009).

The AIP program has also been effective at improving manning. In the first requisition cycle of the pilot program, the average number of applications per AIP-eligible billet posted

---

[4] The selection mechanism described is effectively a first-price, sealed-bid auction with a qualification stage inserted between the bidding stage and the selection stage.

[5] The Navy introduced this practice in July 2004 (Golfin, 2006).

[6] For a complete list of countries where AIP-eligible billets are offered, see Appendix A of Golfin et al., 2009.

Figure L.1
Navy AIP Eligibility Chart

APPROVED: 06 June 2014

COUNTRY	LOCATION	COMMAND TITLE	UIC	RATING / QUALIFICATION	PAYGRADE	MAX BID RATE
Australia	Alice Springs	NIOD Alice Springs	32224	CTR	E5-6	$550
					E7-9	$600
				CTT	E5-6	$550
				YN	E-6	$550
Bahrain	Manama	NIOC Bahrain	48035	CTI	E5-E6	$350
	MD	OFFICE OF NAVAL INTELLIGENCE SUPPORT CENTER OPERATION SEA DUTY COMP	32998	NEC 0416 (STG/STS)	E7-9	$1,000
	CA	NMAWC SAN DIEGO	38301			
	CT	COMMANDER SUBMARINE 15 SUBMARINE SURVEILLANCE EQUIPMENT PROGRAM (COMSUBRON 15 SSEP)	40058			
	CT	CSUBGR 2	42914			
	HI	SSEP PAC SURV	42916			
	HI	SSEP PAC	42917			
	GUAM	COMMANDER, SUBMARINE SQUADRON 15 (COMSUBRON 15)	43709			
	JP	NAVY COMMAND AND CONTROL SYSTEM SUBMARINE GROUP 7	43741			
	VA	SUBTRAFAC NORFLT	4613a			
	MD	ONI SUB COMP	48909			
	DC	TECHANALCEN DC	53262			
	GA	COMSUBGRU 10	55241			
	CA	SUBMARINE SQUADRON 11 SUBASE	55244			
	CT	COMSUBGRU 2	55429			
	WA	COMMANDER, SUBMARINE DEVELOPMENT SQUADRON 5 (COMSUBDEVRON 5)	55522			
Guam	Agana	USS FRANK CABLE (AS 40)	45255	MM (RCN 3701)	E5-6	$400
				HT	E5-9	$600
				ET	E5-6	$200
		Naval Special Warfare Unit One	46987[a]	NEC 5326 (SO)	E6-9	$800
Italy	Naples	NCTS Naples	70294	IT	E5-9	$500
United States	NY/SC	Nuclear Power Training Unit	Various [1]	Various [2]	E5-9	$166.67 [3] [b]
Notes						
1.) UICs include 47723, 49230, 49410, and 43135.						
2.) NECs include 3353, 3354, 3355, 3356, 3363, 3364, 3365, 3366, 3383, 3384, 3385, 3386, 3393, 3394, 3395, 3396.						
3.) Will be paid in lump sum based on tour length.						
FY 14 additions to AIP eligibility chart:						
a. 23 Feb 2014 (sub note: [a])						
b. 06 June 2014 (sub note: [b])						

SOURCE: "AIP Eligibility Chart," 2015.

RAND *RR1034-L.1*

was 0.45; by March 2006, the ratio had risen to 0.69 (Golfin, 2006). Manning rose from 76 percent to 83 percent in Misawa between 2003 and 2008, from 85 percent to 97 percent for *USS Kitty Hawk* between 2004 and 2007, and from 91 percent to 99 percent in Lemoore between 2004 and 2007 (Golfin et al., 2009). Moreover, sea manning improved due to the

replacement of sea duty rotational credit with AIP. The conversion of Type 3 billets to Type 6 billets resulted in a sizable decrease in the number of sea duty billets available. Since the supply of sailors available to fill those billets remained relatively constant, sea manning improved (Golfin, 2006).

Finally, using AIP to assign sailors to billets has increased the rate of retention relative to making involuntary assignments. A 2009 CNA study found that the continuation behavior of sailors who bid for and are selected for AIP billets is statistically indistinguishable from the continuation behavior of their non-AIP peers. However, involuntarily assigned sailors who receive no incentive pay and redirected sailors leave the Navy at significantly higher rates than do their non-AIP peers. Sailors who are involuntarily assigned to AIP-eligible billets are 370 percent more likely to leave the Navy, and sailors who are redirected to AIP-eligible billets are 70 percent more likely to leave (Golfin et al., 2009).

In addition to achieving the three objectives, the AIP program has provided greater flexibility in setting and adjusting incentive pays. Bid amounts have varied widely both within and across locations. Between June 2003 and December 2007, winning bids in Misawa ranged from $0 to $850, with the average winning bid being $275. In contrast, the average winning bid in *USS Kitty Hawk* was $384 (Golfin et al., 2009).[7] The variation in preferences reflected in the bids suggests the AIP program is a more efficient way of setting incentive pay than offering a uniform incentive, such as sea duty credit. Using an auction to set incentive pay also provides greater flexibility over time. Assignments to *USS Kitty Hawk* became less popular in the years preceding its decommissioning in early 2009. The AIP program allowed incentive pays to increase as needed to maintain requisite manning levels (Golfin et al., 2009).

Drawbacks of the AIP Program

While the AIP program is generally regarded as successful, it does come with a number of drawbacks, including wide variation in winning bids, some loss of control over the assignments made, and some difficulties in implementing and administering the program.

As noted earlier, bid amounts have varied widely both within and across locations. Some Navy policymakers have expressed concern that the variation in winning bids for similar jobs may be perceived as inequitable. However, experience has shown that sailors find such variation acceptable: Prior to the introduction of AIP, sailors within a rating were receiving different Selective Reenlistment Bonus (SRB) levels (Golding and Cox, 2003). If the Navy were to feel compelled to mitigate the variation, it could do so by implementing reservation caps or floors.

Another concern is that some billets garner few bids or no bids at all. For instance, in the last requisition cycle of 2007, there were over 2,700 AIP-eligible billets advertised but only 712 applications (Golfin et al., 2009). There are a number of reasons why this may occur. Sailors may be poorly informed about some AIP-eligible billets. Sailors may prefer to deal with a detailer than to apply for an AIP-eligible billet via CMS/ID. Alternatively, the reservation caps for some AIP-eligible billets may be too low.

When a billet garners no bids, it either remains unfilled or is filled via involuntary assignment. Between 2006 and 2008, 900 sailors were involuntarily assigned to AIP-eligible billets, with 40 percent of them receiving no incentive. The rate of involuntary assignments varies

[7] The average for *USS Kitty Hawk* was taken over the period beginning in August 2004 and ending in December 2007.

widely across locations. In the first four years that Lemoore offered AIP, there were 3.2 voluntary assignments for every involuntary assignment. In contrast, Sigonella featured 12.0 voluntary assignments for every involuntary assignment over a similar period (Golfin et al., 2009).[8] As noted earlier, involuntary assignments without incentive pay are problematic because they have an adverse effect on retention.

Another drawback of the AIP program is that it reduces the control detailers' exercise over assignments. By using bids to assign billets, the detailer may lose some control over the quality of the sailors assigned or the demographic distribution of sailors assigned to a particular location. For instance, AIP is thought to be responsible for an increase in the proportion of male sailors and a decrease in the proportion of single-parent sailors in both Naples and Sigonella (Golfin, 2006).

Nevertheless, detailers still exercise a significant amount of discretion over assignments to AIP-eligible billets. As noted earlier, detailers use over 30 factors to discard the bids of sailors deemed unqualified. In fact, a criticism of the AIP program is that the process by which detailers assign sailors to AIP-eligible billets remains opaque (Golfin et al., 2009). Moreover, economic theory suggests that accounting for factors other than the bids submitted reduces the pressure to compete over incentive pay, resulting in higher bids on average (Che, 1993; Lamping, 2010; Rezende, 2009). The design of the AIP program requires that detailers strike a delicate balance between exercising greater control over the assignments made and allowing the auction mechanism to determine the assignments, thereby inducing sailors to compete more vigorously over incentive pay.

Striking this balance is one of several challenges inherent in managing an auction-based system like AIP. Setting reservation caps and adjusting them appropriately over time presents another challenge. For each AIP-eligible billet, the reservation cap should be set a bit below the maximum the government is willing to pay to fill the billet (Myerson, 1981; Riley and Samuelson, 1981). Doing so ensures the winning bid does not exceed what the government can afford, and the additional reduction in the cap limits the extent to which sailors can inflate their bids beyond the minimum they require to voluntarily fill the billet. However, one must take care not to set the cap too low, lest there be no bidder willing to fill the billet for an incentive pay that falls below the cap. The challenge is in identifying this "sweet spot" and adjusting it appropriately in response to changes in demand over time.

Even if the reservation cap is optimally set and adjusted, sailors may systematically bid more than the minimum they require to voluntarily fill the billet. This phenomenon is often referred to as "gaming" the auction (Golding and Cox, 2003). There is some evidence that sailors participating in the AIP program have inflated their bids. Between 2003 and 2008, average winning bids increased by 10 percent. Over the same period, the share of sailors bidding the cap increased, while the share of sailors bidding $0 decreased (Golfin et al., 2009).[9] One explanation for these trends is that as sailors became more familiar with the AIP program, they developed a better sense of the extent to which they could raise their bids and still win the auction. Alternatively, the increase in winning bids could be due to changes in the mix of pay grades, ratings, and locations offering AIP.

---

[8] The figure for Lemoore was taken over the period beginning in January 2004 and ending in December 2007. The figure for Sigonella was taken over the period beginning in June 2003 and ending in December 2007.

[9] In 2003, just over 50 percent of winning bids hit the reservation cap, but in 2008, 75 percent hit the cap. Also in 2008, only 2 percent of winning bids were $0.

There are a few measures the government can take to limit gaming. It can set reservation caps appropriately, as discussed above. It can stimulate competition by encouraging sailors to bid for AIP-eligible billets or by reducing the importance of factors other than incentive pay in selecting the winning sailor. It can raise the likelihood of an unfavorable assignment for those who bid for an AIP-eligible billet but do not win. However, these measures can be difficult to implement and, in some cases, may generate unintended adverse consequences. The bottom line is that gaming can be mitigated but not eliminated. The government cannot hold the sailor to the minimum incentive pay he or she requires because only the sailor knows what that is. But this is precisely the reason why the AIP program works: Auctions leverage competition among bidders to set an appropriate price in situations where the minimum pay each bidder requires cannot be observed.

Another drawback of the AIP program is that the cost of setting up and administering a bidding system may be larger than the cost of implementing a more standard, take-it-or-leave-it style incentive program. If the additional setup and administration costs are sufficiently large, a standard take-it-or-leave-it program may be a better choice.

Finally, the AIP program exists within a larger market for billets, which presents challenges for implementing AIP properly from a systemwide perspective. AIP has been less effective at filling billets for ratings that are severely undermanned, such as the IT rating (Golfin et al., 2009). If there are more available billets than qualified sailors, then offering AIP for some billets will necessarily result in vacancies in other billets. Overall manning for the rating may not improve, but the cost to the government in the form of incentive pays will increase. Moreover, AIP competes with other incentive programs for filling Navy billets. For instance, the incentive pay required to attract a sailor to an AIP-eligible billet must be high enough to draw the sailor away from billets that offer Sea Duty Incentive Pay (SDIP). Because of these interactions, selecting billets for AIP requires careful consideration of the assignment system in its entirety.

APPENDIX M

A Pilot Program

RAND recommends that DoD consider replacing the current slate of incentive programs for inducing voluntary tour extensions with an auction-based program, which permits servicemembers to bid for tour length extensions. Economic theory, the Navy's experience with sailors bidding for Assignment Incentive Pay (AIP), and the private sector's experience using auctions for workforce management across a number of sectors suggest that an auction-based program can deliver a greater number of voluntary tour extensions and lower incentive pays when compared with the take-it-or-leave-it programs currently in use.

As an alternative to launching a full-scale bidding program at the outset, DoD might consider having one or more of the services implement a smaller-scale pilot program first. A pilot program would yield a number of benefits. It would permit DoD to assess the true performance of an auction-based program, as well as variations in program design, in a controlled but live environment. A pilot would facilitate the identification of program design flaws, implementation challenges, and unintended consequences, all of which could be corrected prior to rolling out a larger-scale program. The data collected from the pilot could be used to improve cost and savings estimates, including estimates of the cost of administering an auction program and estimates of any savings associated with replacing existing programs with an auction program. Implementing a pilot program would also increase opportunities for feedback and buy-in from stakeholders. Ultimately, a pilot program would serve as a means of managing risk: The auction-based program could be tested, assessed, and modified while limiting the expenditure of resources.

In order to compare the performance of auction-based programs to the performance of the current slate of take-it-or-leave-it incentive programs, RAND recommends designing the pilot program to include four groups:

1. control group: A population of servicemembers who may voluntarily extend their current overseas tours without additional compensation or incentive pay
2. treatment group 1: A population of servicemembers who may voluntarily extend their current overseas tours using the current slate of incentive programs
3. treatment group 2: A population of servicemembers who may voluntarily extend their current overseas tours by bidding for incentive pay in a discriminatory-price auction
4. treatment group 3: A population of servicemembers who may voluntarily extend their current overseas tours by bidding for incentive pay in a uniform-price auction.

The current slate of incentive programs would be suspended for the control group and for treatment groups 2 and 3. Servicemembers in the control group could volunteer for a tour

extension but would not be permitted to access the current slate of incentive programs. For servicemembers in treatment groups 2 and 3, the auction program would be the only means by which tours could be extended.

Including treatment groups 2 and 3 would provide valuable information about the performance of a uniform-price auction relative to a discriminatory-price auction. However, including both treatment groups requires an increase in the scale—and cost—of the pilot program. A simpler and less expensive pilot would include treatment group 2 but not treatment group 3.

Designing a pilot program is not trivial. The discussion of which treatment groups to include is just one example of the numerous details that require careful consideration. We catalog a number of them below.

Scale

One of the key considerations in designing a pilot program is the question of scale. The pilot program's scale must be set across a number of dimensions, including the following:

- Which services will participate in the pilot program?
- For how long will the pilot program run?
- Which overseas locations will participate in the pilot? How will these locations be selected?
- Which servicemembers will be eligible to participate in the pilot? Will the participants be limited to enlisted personnel or will officers participate in the pilot as well?
- What will the budget for incentive pays be?

Administration

Another set of considerations involves program administration. One must decide how the various components of the program will be administered and who will be responsible for managing them. These considerations include the following:

- What will the eligibility criteria be, and who will determine which servicemembers are eligible?
- How will bids be submitted? Will they be submitted via an electronic system? If so, who will design and maintain the electronic system?
- What criteria will be used to assess the bids submitted? Will PCS costs, servicemember qualifications, and other factors play a role in determining which servicemembers have their tours extended?
- Who will be responsible for assessing bids and assigning tour extensions?

Communication

The design of the pilot should also include a communication plan that stipulates the information to be transmitted to program participants as well as the means of transmission. These considerations include the following:

- How will eligible servicemembers be made aware of the pilot program?
- How will eligible servicemembers be educated about the auction rules?
- How will participating servicemembers be informed about the status of their bids and tour extensions?

Training

Since the pilot is intended as a testbed for a full-scale rollout of the auction program, it is best to move program participants—both eligible servicemembers and program administrators—up the learning curve as quickly as possible. Doing so increases the likelihood that the behaviors observed in the pilot are representative of the behaviors one would observe following a full-scale rollout. To this end, one should train program participants to perform their respective functions in advance. For instance:

- Eligible servicemembers should be educated about the auction rules and trained to formulate appropriate bids.
- Detailers and other program administrators should be trained to evaluate bids and select servicemembers for extension.

Careful consideration is needed to determine who will be trained, what the content of the training will be, and how the training will be administered.

Feedback Mechanisms

In order to better assess the behaviors and outcomes observed in the pilot program, it is best to provide a structured mechanism for collecting feedback from participants, administrators, and other stakeholders. These feedback mechanisms might include the following:

- surveys of servicemembers following program participation
- surveys of eligible servicemembers who elected not to participate
- surveys of eligible servicemembers to be administered one year after completion of the pilot program
- surveys of detailers or other relevant administrators.

For each of these, one must determine who will be surveyed, when the surveys will be administered, and what questions will be asked.

Data Collection

A key set of considerations involves data collection. In order to effectively identify and apply the lessons learned from the pilot program, one must construct a data collection plan in advance, keeping in mind the hypotheses to be evaluated. The data to be collected may include the following:

- participation and selection
  - number of servicemembers in the control group requesting a tour extension
  - number of servicemembers in the control group whose tours are extended
  - number of servicemembers in treatment group 1 who apply for each of the existing programs
  - number of servicemembers in treatment group 1 whose tours are extended and the benefits (incentive pay and otherwise) that accrue to each
  - number of servicemembers in each of the auction treatment groups who are eligible to participate in the auction
  - number of servicemembers in each of the auction treatment groups who elect to participate in the auction
  - bid amount submitted by each participating servicemember
  - number of servicemembers in each of the auction treatment groups whose tours are extended and the incentive pay that accrues to each of these servicemembers
- participant characteristics
  - most recent PCS cost for each eligible servicemember
  - demographic characteristics for each eligible servicemember
  - quality measures for each eligible servicemember (e.g., Armed Forces Qualification Test [AFQT] scores, rank, speed to promotion)
- tour characteristics, including length and location
- data from surveys of eligible servicemembers
  - minimum incentive pay required to extend (stated)
  - awareness of existing program/auction program
  - clarity of auction instructions
  - ease of use of the bidding system
  - fairness and equity
  - satisfaction with outcome
- data from one-year post-pilot surveys
  - satisfaction with outcome
  - interest in future participation
- data from surveys of detailers or other relevant administrators
  - ease of administration and/or management of auction programs
  - differences across programs (existing versus auction) in ease of administration and/or management
  - differences across programs in servicemembers selected for extension
  - difference across programs in incentive pays.

Costs

Costs should be assessed both before and after the pilot program. Prior to the pilot, careful consideration should be given to the program's budget. Funds must be set aside to cover not only the incentive pays and other benefits that will accrue to servicemembers whose tours are extended but also the cost of administering the various programs offered (i.e., existing programs and auction programs). Following the pilot, the realized costs should be assessed in rela-

tion to the planned costs in order to inform the design and budget for a larger-scale rollout. Consideration of costs might include the following:

- At what level will the budget for incentive pays and other benefits be set?
- How do we expect the budget to affect competition among bidding servicemembers?
- Will the budget vary across auction sessions as a means of testing the relationship between budgets and bidding behavior?
- How much will be set aside to cover the cost of informing eligible servicemembers about the pilot program?
- How much will be set aside to cover the cost of training servicemembers, detailers, and other relevant administrators?
- How much will be set aside to cover the cost of designing, implementing, and administering an electronic bid submission system?
- How much will be set aside to cover the labor costs associated with evaluating bids and selecting servicemembers for extension?

Measures of Success

Ultimately, the pilot will inform the decision of whether to extend the auction-based program or shutter it altogether. To this end, the pilot design should include a set of clearly defined conditions that, if met, would prompt DoD to roll out the program on a larger scale. These conditions might include the following:

- The number of tour extensions achieved using an auction-based program is greater than the number achieved when no incentives are offered.
- The number of tour extensions achieved using an auction-based program is greater than the number achieved using existing programs.
- The incentive pays set by an auction-based program are less than those set by existing programs after controlling for the number of extensions achieved.
- The incentive pays set by an auction-based program plus the cost of administering the program are less than the incentive pays set by existing programs plus the cost of administering those programs.
- The expected savings in PCS costs associated with the additional extensions achieved via an auction-based program are sufficient to cover the incentive pays set by the program and the cost of administering the program.

If these conditions are not met, DoD would shutter the pilot program and abandon any plan to adopt an auction-based program for extending current overseas tours.

APPENDIX N

2013 Status of Forces Survey of Active Duty Members

The following information about SOFS-A was replicated from DMDC, *2013 Status of Forces Survey of Active Duty Members: Statistical Methodology Report*, Report No. 2013-052, Alexandria, Va., 2013.

Readers interested in additional information about the survey are referred to that document and DMDC, *2013 Status of Forces Survey of Active Duty Members: Administration, Datasets, and Codebook*, Report No. 2013-051, Alexandria, Va., 2014.

Target Population

The target population of the 2013 SOFS-A was designed to represent active-duty members of the Army, Navy, Marine Corps, and Air Force, up to and including pay grade O-6, who were at least 18 years of age at the beginning of the survey fielding period. National Guard and Reserve members in active-duty programs were excluded. Fielding of the survey began October 17, 2013, and ended December 16, 2013.

Sampling Frame

The population frame, for 2013 SOFS-A, consisted of 1,341,066 records drawn from the February 2013 Active Duty Master Edit File (ADMF). Auxiliary information used to develop the frame was obtained from the February 2013 Active Duty Family Database, the February 2013 Base Allowance for Housing (BAH) Population File, and the March 2013 Contingency Tracking System (CTS) File. Additional administrative files that were compiled prior to the scheduled starting date of the survey fielding period contributed to the creation of the sample. These files were the July 2013 Defense Enrollment Eligibility Reporting System (DEERS) Medical Point in Time Extract (PITE), the June 2013 UIC file, and the June 2013 DEERS Medical PITE. Individuals were included on the frame based on membership in both the February 2013 ADMF and the April 2013 PITE; sample members no longer in the June 2013 DEERS Medical PITE were dropped. Sample members who became ineligible during the period of October 17, 2013, through December 16, 2013, were identified as self- or proxy-report ineligible.

Sample Design

The sample for the 2013 SOFS-A survey used a single-stage stratified design. The first 11 strata contained the members on unaccompanied tours by country (ten individual countries and then all others). Five population characteristics defined the stratification dimensions for the rest of the 2013 SOFS-A sample: service, pay grade, race/ethnicity, duty location, and family status. These five variables along with the two that defined the first 11 strata are the first seven variables shown in Table 1. The frame was partitioned into 175 strata, produced by cross-classification of the stratification variables. Levels were collapsed within dimension; occasionally, dimensions were collapsed, in reverse order as listed. Service and pay grade boundaries were preserved.

Within each stratum, individuals were selected with equal probability and without replacement. However, because allocation was not proportional to the size of the strata, selection probabilities varied among strata, and individuals were not selected with equal probability overall. Nonproportional allocation was used to achieve adequate sample sizes for domains that included subpopulations defined by the stratification characteristics, as well as others, such as enlisted year of service. The reporting domain variables are shown in Table N.1 for the 2013 SOFS-A.

Sample Allocation

The total sample size was based on precision requirements for key reporting domains. Given estimated variable survey costs and anticipated eligibility and response rates, an optimization algorithm determined the minimum-cost allocation that simultaneously satisfied the domain precision requirements. Estimated eligibility and response rates for the Army, Navy, Marine Corps, and Air Force were based on the combination of the December 9 SOFS-A, a subset of the January 11 SOFS-A, and the June 12 SOFS-A. The January 11 SOFS-A contained an experiment to determine the effect of postal notifications on response rate. To be consistent with the 2013 SOFS-A, only the subset of the sample receiving the traditional SOFS-style mailing strategy were included.

Response Rates

Table N.2 reports the location, completion, and response rates for the SOFS-A.

Table N.1
Variables for Stratification and Key Reporting Domains

Variable	Categories
Off-base assistance 3*	Unaccompanied tour All other
Country 2*†	Japan Republic of Korea United States Germany Italy United Kingdom Guam Kuwait Bahrain Spain All others
Service branch*	Army Navy Marine Corps Air Force
Pay group 5*	E-1–E-4 E-5–E-9 W-1–W-5 O-1–O-3 O-4–O-6
Race/ethnic category*	Nonminority Minority
Duty location*	United States and U.S. territories, other, unknown Europe Asia/Pacific Islands
Family status 4*	Single with child(ren) Dual-service spouse Other family
Pay group 2	Enlisted Officer
Off base/base allowance for housing (BAH) status	Off base/receiving BAH On base/no BAH
Family status 4	Single with child(ren) Single without child(ren) Married with child(ren) Married without children
Deployment status	Deployed Not deployed
Enlisted years of service	3 to 5 years of service 6 to 9 years of service
Education	No college Some college 4-year degree Graduate/professional degree

NOTES: * denotes stratification variable. † denotes variable only used in first 11 unaccompanied tour strata.

Table N.2
Location, Completion, and Response Weights of SOFS-A

Type of Rate	Computation	Weighted	Unweighted
Location	Adjusted located sample/ adjusted eligible sample	94%	93%
Completion	Usable responses/adjusted located sample	26%	26%
Response	Usable responses/adjusted eligible sample	25%	25%

NOTE: For rate definitions, see DMDC, *2013 Status of Forces Survey of Active Duty Members: Statistical Methodology Report*, Report No. 2013-052, Alexandria, Va., 2013.

References

Abdulkadiroğlu, Atila, and Tayfun Sönmez, "School Choice: A Mechanism Design Approach," *American Economic Review*, Vol. 93, No. 3, June 2003, pp. 729–747.

Achour, H., M. Gamache, F. Soumis, and G. Desaulniers, "An Exact Solution Approach for the Preferential Bidding System Problem in the Airline Industry," *Transportation Science*, Vol. 41, No. 3, 2007, pp. 354–365.

"AIP Eligibility Chart," September 28, 2015. As of October 18, 2015:
http://www.public.navy.mil/bupers-npc/career/payandbenefits/Documents/AIP%20Eligibility%20Chart.pdf

Air Force Audit Agency, *Active Duty Permanent Change of Station Management*, 2010.

Aldrich, G. A., K. M. Grimsrud, J. A. Thatcher, and M. J. Kotchen, "Relating Environmental Attitudes and Contingent Values: How Robust Are Methods for Identifying Preference Heterogeneity?" *Environmental and Resource Economics*, Vol. 37, 2007, pp. 757–775.

Anderson, R. L., "The Potential Impact of an Auction Based Retention Bonus and Other Factors on the Continuation Rates of General Dentists Completing Their Initial Obligation," thesis, Naval Postgraduate School, 2007.

Bock, P. B., "The Sequential Self-Selection Auction Mechanism for Selective Reenlistment Bonuses: Potential Cost Savings to the U.S. Marine Corps," thesis, Naval Postgraduate School, 2007.

Bulow, J., and J. Levin, "Matching and Price Competition," *American Economic Review*, Vol. 96, No. 3, 2006, pp. 652–668.

Campbell, G. M., "On-Call Overtime for Service Workforce Scheduling When Demand Is Uncertain," *Decision Sciences Journal*, Vol. 43, No. 5, 2012, pp. 817–850.

Champ, P. A., K. J. Boyle, and T. C. Brown, eds., *A Primer on Nonmarket Valuation*, Norwell, Mass.: Kluwer Academic Publishers, 2003.

Che, Yeon-Koo, "Design Competition Through Multidimensional Auctions," *RAND Journal of Economics*, Vol. 24, No. 4, Winter 1993, pp. 668–680.

Christensen, E., H. Golding, and L. Houck, "Hard-to-Fill Billets, Individual Assignment Preferences, and Continuation," CNA Research Memorandum D0006179.A2, 2002.

Consolidated Appropriations Act, Public Law 113-76, 2014.

Coughlan, P., W. Gates, and N. Myung, *The Combinatorial Retention Auction Mechanism (CRAM)*, Monterey, Calif.: Naval Postgraduate School, NPS-GSBPP-13-004, November 2013. As of December 3, 2015:
http://calhoun.nps.edu/handle/10945/37889

De Grano, M. L., D. J. Medeiros, and D. Eitel, "Accommodating Individual Preferences in Nurse Scheduling via Auctions and Optimization," *Health Care Management Science*, Vol. 12, No. 3, 2009, pp. 228–242.

Denmond, C. M., D. N. Johnson, C. G. Lewis, and C. R. Zegley, "Combinatorial Auction Theory Applied to the Selection of Surface Warfare Officer Retention Incentives," MBA Professional Report, Naval Postgraduate School, 2007.

Department of Defense Comptroller, "Military Personnel Programs (M-1) Department of Defense Budget, Fiscal Year 2015," March 2014. As of October 15, 2015:
http://comptroller.defense.gov/Portals/45/documents/defbudget/fy2015/fy2015_m1.pdf

Department of Defense Inspector General, "Opportunities for Cost Savings and Efficiencies in the DoD Permanent Change of Station Program," DODIG-2014-076, 2014.

Defense Manpower Data Center, *2013 Status of Forces Survey of Active Duty Members: Statistical Methodology Report*, Report No. 2013-052, Alexandria, Va., 2013.

Defense Manpower Data Center, *2013 Status of Forces Survey of Active Duty Members: Administration, Datasets, and Codebook*, Report No. 2013-051, Alexandria, Va., 2014.

DMDC—*see* Defense Manpower Data Center.

Gale, D., and L. S. Shapley, *College Admissions and the Stability of Marriage*, Santa Monica, Calif.: RAND Corporation, P-2240, 1961. As of January 26, 2016:
http://www.rand.org/pubs/papers/P2240.html

Gale, D., and L. S. Shapley, "College Admissions and the Stability of Marriage," *American Mathematical Monthly*, Vol. 69, No. 1, 1962, pp. 9–15.

Gamache, M., F. Soumis, D. Villeneuve, J. Desrosiers, and É. Gélinas, "The Preferential Bidding System at Air Canada," *Transportation Science*, Vol. 32, No. 3, 1998, p. 246.

Golding, H., and G. Cox, "Design and Implementation of AIP," CNA Annotated Briefing D0007827.A2, 2003.

Golfin, P., "Manning Under AIP," CNA Annotated Briefing D0014440.A1, 2006.

Golfin, P., D. Lien, and D. Gregory, "Evaluation of the Assignment Incentive Pay (AIP) System," CNA Annotated Briefing D0010240.A2, 2004.

Golfin, P., M. McIntosh, and D. Gregory, "Assignment Incentive Pay Revisited: Manning and Continuation Effects," CNA Research Memorandum D0020390.A2, 2009.

Hess, S., and N. Beharry-Borg, "Accounting for Latent Attitudes in Willingness-to-Pay Studies: The Case of Coastal Water Quality Improvements in Tobago," *Environmental and Resource Economics*, Vol. 52, 2012, pp. 109–131.

Koopman, M. E., and D. Gregory, "Incomplete Tours: Causes, Trends, and Differences," CNA Annotated Briefing D0016916.A2, 2007.

Krishna, A., and M. U. Ünver, "Research Note—Improving the Efficiency of Course Bidding at Business Schools: Field and Laboratory Studies," *Marketing Science*, Vol. 27, No. 2, 2008, pp. 262–282.

Krishna, V., *Auction Theory*, San Diego, Calif.: Academic Press, 2002.

Lamping, J., "The Value of Information in Auctions with Matching," Boulder, Colo.: University of Colorado at Boulder, 2010.

May, J. H., G. J. Bazzoli, and A. M. Gerland, "Hospitals' Responses to Nurse Staffing Shortages," *Health Affairs*, Vol. 25, No. 4, 2006, pp. W316–W323.

Military Personnel, *Air Force Justification Book*, March 2014a.

Military Personnel, *Army Justification Book*, March 2014b.

Military Personnel, *Marine Corps Justification Book*, March 2014c.

Military Personnel, *Navy Justification Book*, March 2014d.

Milligan, G. W., and M. C. Cooper, "An Examination of Procedures for Determining the Number of Clusters in a Data Set," *Psychometrika*, Vol. 50, No. 2, June 1985, pp. 159–179.

Myerson, R. B., "Optimal Auction Design," *Mathematics of Operations Research*, Vol. 6, No. 1, 1981, pp. 58–73.

Nimon, R. W., and R. Hall, "Empirical Analysis of the Efficiency of Job Assignment Auctions," *Applied Economics*, Vol. 39, No. 13, 2007, pp. 1679–1690.

Nowell, J. T., "Application of a Uniform Price Quality Adjusted Discount Auction for Assigning Surface Warfare Officer Retention Bonuses," thesis, Naval Postgraduate School, 2012.

Pearson, Q. R., "Application of a Uniform Price Quality Adjusted Discount Auction for Assigning Voluntary Separation Pay," thesis, Naval Postgraduate School, 2011.

Rezende, L., "Biased Procurement Auctions," *Economic Theory*, Vol. 38, No. 1, 2009, pp. 169–185.

Riley, J. G., and W. F. Samuelson, "Optimal Auctions," *American Economic Review*, Vol. 71, No. 3, 1981, pp. 381–392.

Roth, A. E., "The Economist as Engineer: Game Theory, Experimental Economics and Computation as Tools of Design Economics," *Econometrica*, Vol. 70, No. 4, 2002, pp. 1341–1378.

Roth, A. E., and E. Peranson, "The Redesign of the Matching Market for American Physicians: Some Engineering Aspects of Economic Design," *American Economic Review*, Vol. 89, No. 4, 1999, pp. 748–779.

Roth, Alvin E., Tayfun Sönmez, and M. Utku Ünver, "Kidney Exchange," *Quarterly Journal of Economics*, Vol. 119, No. 2, May 2004, pp. 457–488.

Sabet, L., "Adopting Online Nurse Scheduling and Staffing Systems," *Health Reports*, First Consulting Group, 2006.

Sönmez, T., and M. U. Ünver, "Course Bidding at Business Schools," Boston College Working papers in Economics 618, 2005.

Sönmez, T., and M. U. Ünver, "Course Bidding at Business Schools," *International Economic Review*, Vol. 51, No. 1, 2010, pp. 99–123.

Stata, "Cluster—Introduction to Cluster-Analysis Commands," undated. As of August 17, 2015: http://www.stata.com/manuals13/mvcluster.pdf

Tibshirani, R., G. Walther, and T. Hastie, "Estimating the Number of Clusters in a Data Set via the Gap Statistic," *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, Vol. 63, 2001, pp. 411–423.

U.S. Department of Defense, Per Diem, Travel and Transportation Allowance Committee, "Joint Federal Travel Regulations," Appendix Q, revised August 2013.

U.S. General Accounting Office, *Military Tour-Length and Tour-Curtailment Policies and Practices*, GAO/NSIAD-85-114, 1985.

White, C. S., "The Uniform Price Quality Adjusted Discount Auction for Aviation Continuation Pay: Potential Benefits to the U.S. Marine Corps," thesis, Naval Postgraduate School, 2010.

Zimmerman, B., "Integrating Monetary and Non-Monetary Reenlistment Incentives Utilizing the Combinatorial Retention Auction Mechanism (CRAM)," thesis, Naval Postgraduate School, 2008.

The U.S. Department of Defense (DoD) moves about one-third of its military servicemembers each year. This study was designed in part to support DoD in preparing a report for Congress on its permanent change of station (PCS) programs. It examined the workings of those programs with the goal of determining the potential for savings that could accrue from reducing the total number of PCS moves by increasing the average amount of time between them. The research covered current policies and programs, looking particularly at incentive programs designed to encourage servicemembers to stay longer at their current stations. The authors collaborated with the Defense Manpower Data Center to develop survey questions designed to collect responses on individual propensities to extend tours and the factors that influence such decisions, with emphasis on overseas tours, which are the most expensive. The analysis suggests that a substantial fraction of those serving overseas would be willing to extend their tour of service if a sufficiently attractive incentive package were offered. The authors recommend implementation of an auction mechanism that would allow servicemembers to bid for extensions to their current overseas tours. The estimated average annual savings could range from $19 million to $84 million.

RAND NATIONAL DEFENSE RESEARCH INSTITUTE

www.rand.org

$42.50

ISBN-10 0-8330-9122-0
ISBN-13 978-0-8330-9122-2

54250

9 780833 091222

RR-1034-OSD