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THESIS

A QUANTITATIVE ANALYSIS OF AVIATION MAINTENANCE SRB EFFECTIVENESS

by

Anna Fuzy

March 2019

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The purpose of this thesis is to provide the Marine Corps with an analytical review of its primary military occupational specialty (PMOS) bonuses, specific to aviation maintenance occupations, that have been available to Marines from 2008–2018, as well as, the aviation maintenance specific skills bonus implemented during the fiscal year (FY) 2018 selective retention bonus (SRB) program. The thesis includes a literature review on the importance of aviation maintenance-specific skills and the economic theory related to pay incentives in the Department of Defense; a summarization of requirements to obtain an aviation maintenance certification; a review of the SRB program; and a data analysis on take-up rates and factors affecting re-enlistment odds. An understanding of the requirements needed to produce an aviation maintenance Marine with certifications and take-up rates for those specific PMOS bonuses during this period can assist the Marine Corps in updating policies targeting the intended population for retention and hard-to-fill assignments respective to specific MOSs. Review of the SRB program explains how the program has changed over time, details what MOSs and level of experience are targeted, and longitudinal information. The analysis in this thesis identifies that changes in SRB amounts are not statistically significant correlated to affecting the odds of aviation maintenance Marines re-enlisting but increases to SRB cap amounts increase the odds of re-enlistment.

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A QUANTITATIVE ANALYSIS OF AVIATION MAINTENANCE SRB EFFECTIVENESS

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LIST OF ACRONYMS AND ABBREVIATIONS

ACOL	Annualized Cost of Living
AFQT	Armed Forces Qualification Test
AMO	Aircraft Maintenance Officer
BAH	Basic Housing Allowance
BAS	Basic Allowance for Subsistence
CDI	Collateral Duty Inspector
CDQAR	Collateral Duty Quality Assurance Representative
Cpl	Corporal (E4)
CO	Commanding Officer
DC, A	Deputy Commandant, Aviation
DMDC	Defense Manpower Data Center
DoD	Department of Defense
FW	Fixed-wing
FY	Fiscal Year
GySgt	Gunnery Sergeant (E7)
HQMC	Headquarters Marine Corps
I-level	Intermediate Level
LCpl	Lance Corporal (E3)
MAG	Marine Aircraft Group
MALS	Marine Aviation Logistics Squadron
MARADMIN	Marine Corps Administrative Messages
MCAS	Marine Corps Air Station
MCO	Marine Corps Order
MGySgt	Master Gunnery Sergeant (E9)
MSgt	Master Sergeant (E8)
NAMP	Naval Aviation Maintenance Program
NPV	Net Present Value
O-level	Organizational Level
PFC	Private First Class (E2)
PMOS	Primary Military Occupational Specialty

Pvt	Private (E1)
QA	Quality Assurance
QAO	Quality Assurance Officer
QAR	Quality Assurance Representative
RW	Rotary-wing
Sgt	Sergeant (E5)
SgtMaj	Sergeant Major (E9)
SRB	Selective Retention Bonus
SSgt	Staff Sergeant (E6)
T/M/S	Type, model, series
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
VEERP	Voluntary Enlisted Early Release Program

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I. INTRODUCTION

> CRITICAL TASK: Exploit the Competence of the Individual Marine. We have highly trained maintenance experts working in the hangars…These young men and women keep our aircraft flying. In turn, those aircraft keep the Marine Corps moving. We are maximizing the competence of these Marines, capitalizing on their expertise and their experience, and we are determined to keep our best Marines in our Corps. It is incumbent upon us to show them a path to senior leadership, a clear progression through the ranks to both capture their knowledge and reward their good work. (United States Marine Corps [USMC], 2018)

A. OVERVIEW

Retaining the most knowledgeable and experienced Marines is top priority for today's Marine Corps, for current and future success. A small pool of this larger population is aviation maintenance Marines, specifically those holding collateral duty inspector (CDI), collateral duty quality assurance representative (CDQAR), and quality assurance representative (QAR) certifications. As end-strength numbers fluctuated over the past decade, with a plus-up beginning in 2006 and a drawdown at the conclusion of the Global War on Terror, the Marine Corps felt the effects of the exodus of experienced aviation maintenance Marines. Losing this pool of experience is detrimental to the Marine Corps due to the time a Marine need to earn one of the previously mentioned qualifications. Given the high level of responsibility, Marines typically holding these certifications range from high-performing corporals to gunnery sergeants, with rare cases of outstanding junior Marines. The pool of specific skill qualified maintainers is small and if those Marines are not re-enlisting, the pool takes longer to replenish. The period of time needed to obtain one of these qualifications is typically three to four years. This happens to align with a significant decision point in a young Marine's life—to retain or separate. If the Marine re-enlists, the Marine Corps benefits from her knowledge for an additional four years, but if the Marine separates, the Marine Corps has to wait another enlistment for a new Marine to take her place.

Leadership in the aviation community strive to keep those Marines serving as long as possible, because they understand the time it takes to create one certified maintainer.

> To get the most out of not only the Marine but the skills that they acquire through the schooling, we feel it necessary to establish a longer career trajectory for them.… The aviation Marines with these qualifications are "homegrown," so it takes a while to develop those maintainers within each unit…. The intent is to keep them—to the maximum extent possible—within each unit that they're already in. It's a greater return on investment for the time that the commander puts in to training these individuals to have these qualifications. (Schogol, 2017b)

In part to maximize its training investment, the Marine Corps offers the selective retention bonus (SRB) program to incentivize these Marines to continue serving after four years. Since 2000, the Marine Corps has been using this program mainly to focus on specific occupations, at specific grades and years of service, to re-enlist through the primary military occupational specialty (PMOS) bonus. Additional kicker bonus programs have been introduced, the most recent focusing on aviation maintenance Marines holding a certification and/or re-enlisting to continue serving at a designated unit via the Aviation Maintenance kicker.

B. PROBLEM AND HYPOTHESIS

There is a growing concern with the lack of experienced aviation maintenance Marine retention. Constant turnover of these individuals undermines aircraft readiness because at least four years of maintenance experience leaves operational and intermediate maintenance departments every time a CDI, CDQAR, QAR certified Marine decides to separate. "Maintainers are just as important as spare parts and pilots…And it takes time for maintainers to gain enough experience to become certified … 'surgeons in the maintenance department'" (Schogol, 2017a). Marines holding one of the certifications is equivalent to a surgeon because they are specialists or subject matter experts in their respective work centers. A CDI Marine working in the hydraulics work center of a maintenance department has been working in that department for at least three years and holding the CDI qualification identifies her as the expert to ensure those on her team are following proper maintenance procedures. These Marines are also responsible for signing off on all maintenance action forms (MAF), ultimately certifying the repaired parts are safe for flight.

In the 2018 Aviation Plan, the Deputy Commandant, Aviation (DC, A) expresses that retaining these personnel is crucial to the Marine Corps' overall mission (USMC, 2018). As with any firm, the Marine Corps likes to measure its achievements, but how it assesses aviation success is through readiness. In the aviation community, aircraft readiness is the metric depicting a squadron's success. The overall operational readiness of Marine Corps aircraft is the metric to how successful the Aviation Combat Element (ACE) is or will be. Obtaining high levels of readiness is where aviation maintenance and CDI/ CDQAR/QAR Marines become crucial. Without their hard work and knowledge, the aircraft would not get repaired efficiently or effectively. This is the current problem facing the Marine Corps. "A key factor underlying the Marine Corps' aviation crisis stems from the recent draw down of forces when droves of highly trained maintainers left the force.… Some of … [the] most experienced maintainers were allowed to take early retirement when the service shrank from 202,000 to 184,000" (Schogol, 2017b). The exit of a large cumulative level of experience through these departures has caused aircraft readiness to decline. "More than half of the … fleet of about 1,000 fixed-wing and rotary-wing were unable to fly at the end of 2016" (Schogol, 2017b).

How the Marine Corps incentivizes these individuals to re-enlist is important when competing with equivalent civilian job market opportunities that may be more enticing to enlisted aviation maintenance Marines than continued service. Currently, a Marine's re-enlistment depends on the recommendation of her commanding officer (CO). The CO determines whether or not a Marine is eligible for re-enlistment based off pre-requisites, including: "conduct, performance, and future potential as it relates to rank, age, experience, and maturity level" (United States Marine Corps, 2010). Nowhere in this order does a re-enlistment recommendation consider the technical skills a Marine develops during her first enlistments of active duty service. Complementing this order, to fill any technical expertise gaps that may be overlooked in the previous order, is Marine Corps Order (MCO) 7220.24P. This order details SRB and broken service selective retention bonus (BSSRB) programs, particularly identifying that "SRB/BSSRBs are monetary incentives paid to enlisted members at the time of reenlistment to assist in attaining and sustaining the

requisite number of career enlisted personnel in designated … (PMOSs)" USMC, 2016. The primary requisites for SRB eligibility, that tie to this study, are

> 2. Be eligible and recommended for reenlistment. 3. Be serving in the grade of Lance Corporal or above. 4. Be assigned a PMOS designated in the annually published reference (f) and serve within that PMOS for the duration of the reenlistment unless authorized by HQMC … 6. Meet skill qualification prior to payment of the SRB for a member transferring into a PMOS. (USMC, 2016)

Through these orders, one observes the Marine Corps strives to retain those highly trained, experienced, and knowledgeable individuals. Even in the Marine administrative messages (MARADMINs) pertaining to fiscal year SRB/BSSRB programs, the first paragraph of each message explains it the responsibility of a Marine's leadership to retain the highest qualified for continued success of the Marine Corps. The program message from fiscal year (FY) 2018 states "Retaining our experienced and qualified Marines remains one of the Commandant's highest priorities. Achieving retention goals is vital for shaping and sustaining the Marine Corps' enlisted force" (Steele, 2017). The outlook of the aviation community leadership and the bonus programs demonstrate attitudes and measures the Marine Corps is willing to make to retain its human capital.

This study aims to provide insight into the aviation maintenance community, highlighting the skills and time needed to earn a CDI, CDQAR, or QAR certification; analysis of the bonus programs that have been and are currently available to aviation maintenance Marines; analysis of the bonuses on retention of this population; and an analysis of the quality of Marines taking advantage of SRB program opportunities.

In this research, I hypothesize aviation maintenance Marines are less likely to take-up incentives as bonus pay amounts decrease, each year; those Marines re-enlisting later in the year are more likely to be "lower quality" than those who re-enlist early; aviation maintenance Marines and those aviation maintenance Marines holding CDI, CDQAR, or QAR certifications are less likely to retain due to civilian opportunities.

The study's main research question is to empirically test how bonus elasticities affect re-enlistment rates. The study breaks down this notion further by also investigating if current incentive programs and military compensation are competitive with civilian

opportunities to induce aviation maintenance Marines to re-enlist, and if the quality of those re-enlisting is comparable to the technical experts aviation community leadership strive to retain. The study's analyses focus on active duty enlisted aviation maintenance Marines, holding ranks from E1-E9, who have or are currently filling aviation maintenance billets.

C. PURPOSE

This study uses multivariate analysis using personal and financial data to identify the following: relations between bonus pay elasticities and re-enlistment rates, determine if aviation maintenance certified Marines are more likely to re-enlist, quality of those Marines taking advantage of SRB opportunities. Maintaining aviation maintenance Marines holding CDI, QAR, and CDQAR certifications is critical to the success of Marine Corps aviation. My thesis finds aviation maintenance specific skill certified Marines are more likely to re-enlist when eligible, compared to aviation maintenance Marines without a CDI, CDQAR, or QAR certification. I also find military pay and SRB caps elasticities further increase the odds one of these Marines re-enlist. My last portion of results find that increasing quality of Marine decreases the odds she will re-enlist because her human capital is more transferrable to civilian job market opportunities than lower quality Marines'. The correlation between re-enlistment and pay and bonus cap elasticities correlate to increased re-enlistment probabilities, but they are not causal.

Research Questions

1. Primary Research Question

- How have bonus elasticities affected retention rates since 2008?

2. Secondary Research Questions

- Are Marines that have taken advantage of bonus pays the "high quality" the Marine Corps strives to retain through its bonus pay programs?
- Is the Marine Corps able to meet its goals during times of high competition—low unemployment rates and low military-civilian pay ratios?

- Do other factors—such as marital status, number of dependents, race, test scores, compensation, age, years of service, holding a maintenance certification—affect the probability of an aviation maintenance Marine re-enlisting?

D. METHODS

To analyze the sample, re-enlistment eligibility and take-up rates, descriptive statistics are formulated using panel datasets resulting from merges of personnel database and financial database observations. First applying graphical analysis to each portion of the study identifies trends for further investigation and establishing trends. Then applying multivariate regression models to the datasets determine which human and compensation factors correlate to re-enlistment rates.

A second pooled cross-sectional dataset is created for the quantitative analysis of the quality of Marines that have re-enlisted using evaluation information received from the personnel database. Applying multivariate regression models to this data demonstrates how aviation maintenance Marines' quality changes over time.

E. SCOPE AND LIMITATIONS

Examining re-enlistment rates and quality respective to active duty aviation maintenance Marines limits the study. The results do not account for Marine Corps manpower requirements outside this community, like special duty assignments, which may impact a Marine's decision to retain or separate. The scope of the study is designed to be narrow, to provide Marine Corps policy maker with insight into re-enlistment rates and factors affecting aviation maintenance Marines' decisions.

Presenting information relative to only primary military occupational specialty (PMOS) and specific skills kickers relative to the Marine Corps' SRB program also limit the study. This program is the most relevant to the study's target population and the primary means the Marine Corps has to target specific occupations for re-enlistment initiatives.

F. ORGANIZATION OF STUDY

Organization of this thesis separates the information into 5 chapters. Chapter II provides background information on aviation maintenance occupations and certifications,

aviation maintenance Marines' impact on aircraft readiness, and incentive pay programs. Chapter III presents examples and synthesizes previous research applicable to the present research through a literature review. Chapter IV describes the data, statistical models, and analyzes the correlation bonus elasticities and human and compensation characteristics have to re-enlistment probabilities. The chapter also discusses aviation maintenance Marine quality, of those who re-enlist. Chapter V summarizes the study, generates conclusions, and presents recommendations for future studies and manpower policies.

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II. BACKGROUND

A. U.S. MARINE CORPS AVIATION MAINTENANCE

The Naval Aviation Maintenance Program (NAMP) is a publication, directed by the Chief of Naval Operations (CNO), addressing maintenance policies, procedures, and responsibilities for all levels of maintenance: organizational, intermediate, and depot level. The purpose of this program is to establish standardized protocols for aviation material readiness, maintenance policies, procedures, responsibilities, and safety for maintenance departments across the operational forces within the Navy and Marine Corps. The NAMP is instrumental to a properly functioning maintenance department (United States Navy [USN], 2017). This publication is important to this study as it establishes how technically proficient and well-trained aviation maintenance Marines are, highlighting the importance of this human capital, as well as providing evidence to how important it is to retain these highly trained individuals. The aviation maintenance Marines holding CDI, CDQAR, or QAR certifications must be experts in their assigned work center or maintenance department, and part of that expertise is understanding and holding other maintenance Marines accountable to the policies set in the NAMP.

1. Maintenance Department Composition

To generate a better understanding of the number of aviation maintenance Marines supporting the aviation community this section provides details of maintenance departments and the level of responsibility associated with each.

a. Organizational Level (O-level)

Aviation maintainers at this level are the Marines directly attached to an operational squadron. They are the first line of defense when maintaining a squadron's aircraft readiness. The primary function of the maintenance department at this level includes "inspecting, servicing, lubricating, adjusting, and replacing parts, minor assemblies, and subassemblies of aircraft, Unmanned Aircraft (UA) or Unmanned Aircraft Systems (UAS),

and aeronautical equipment" (USN, 2017) Figures 1 and 2 depict the general organization of fixed-/rotary-wing and UA O-level maintenance departments, respectively.

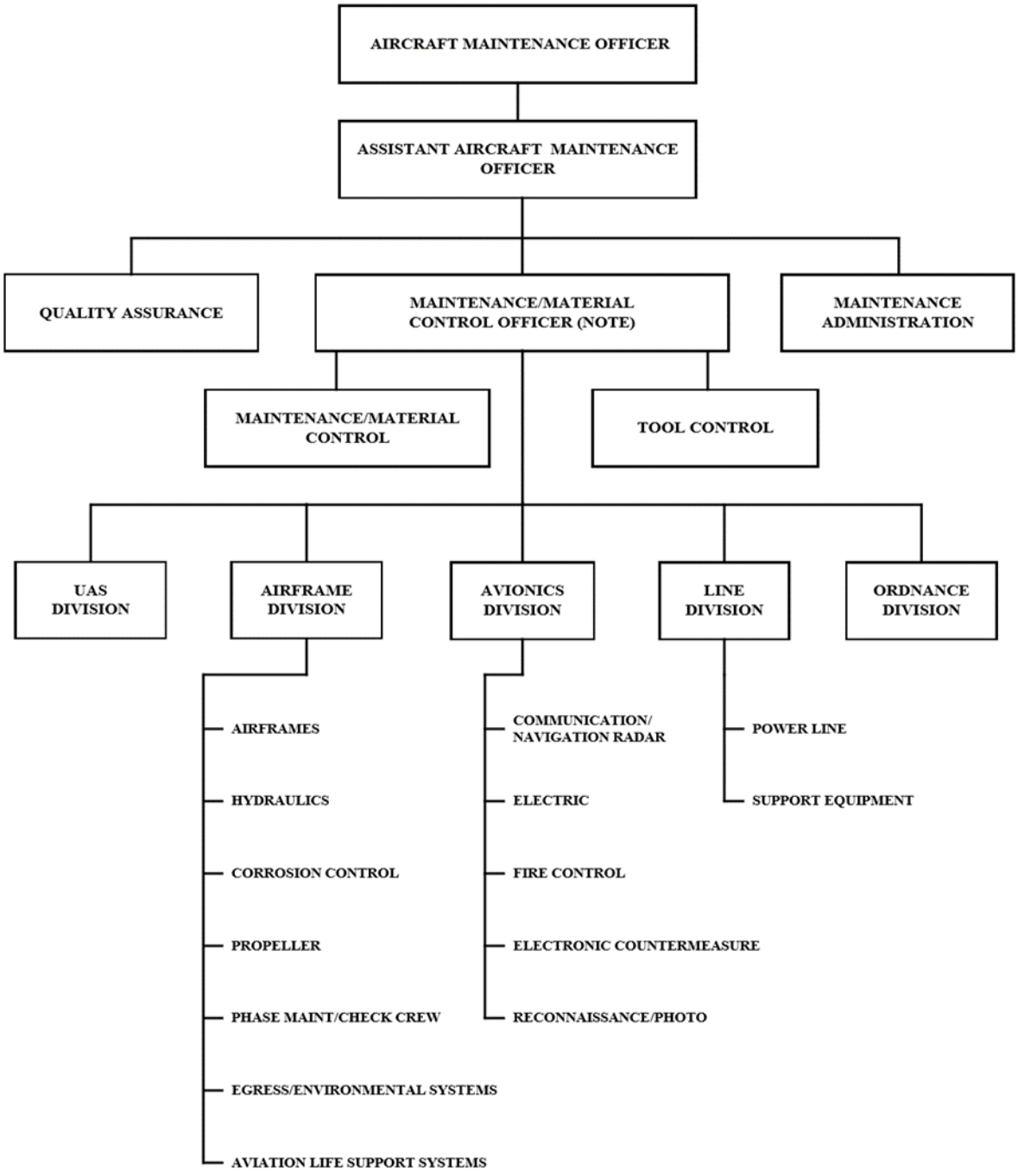

Figure 1. O-level maintenance department (Marine Corps).
Source: USN (2017).

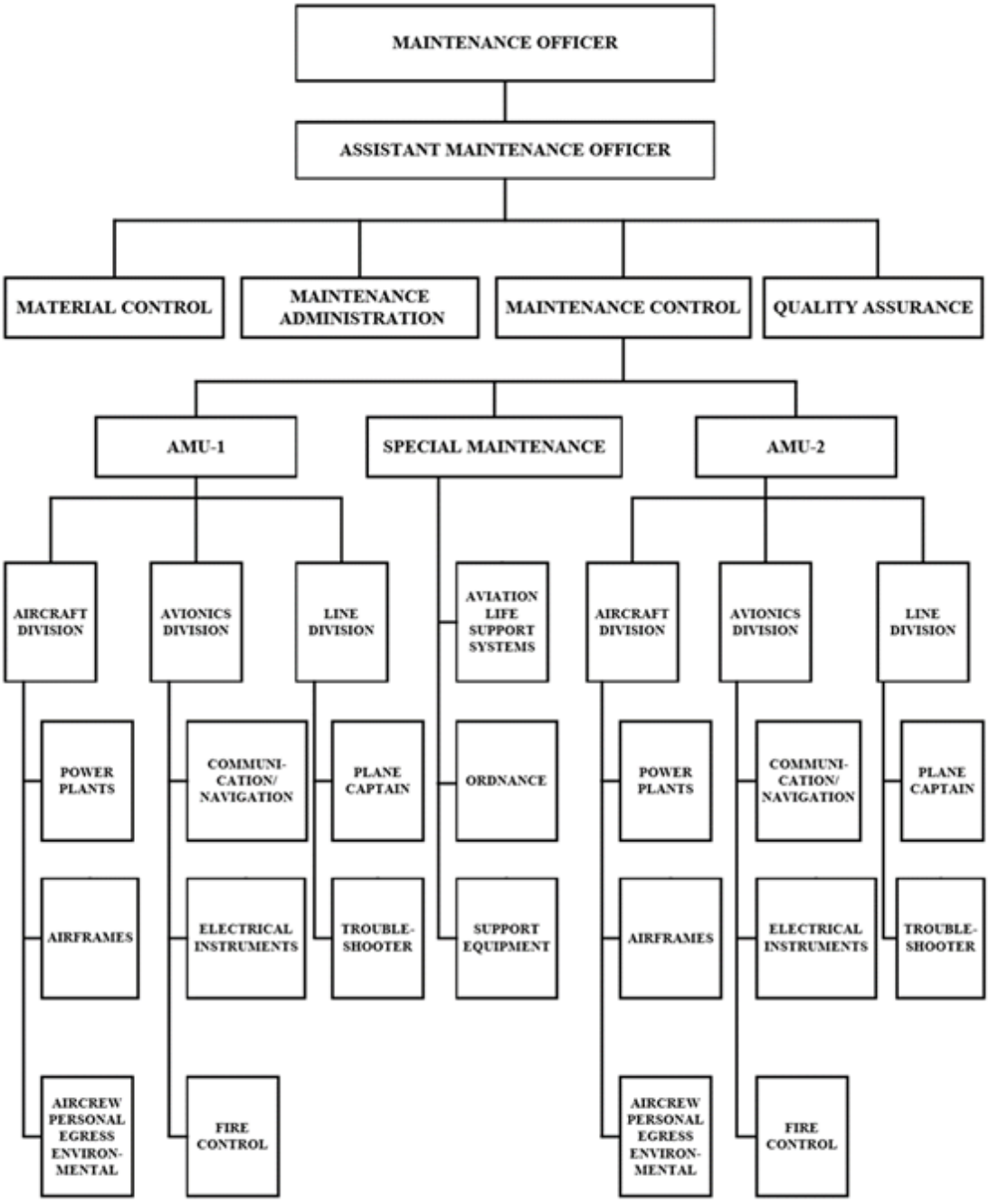

Figure 2. O-level autonomous maintenance unit concept.
Source: USN (2017)

The MOSs comprising each type of O-level department and type, model, series (T/M/S) of aircraft supported may be different, the overall organization of these maintenance departments are the same.

b. Intermediate Level (I-level)

Aviation maintenance departments at this level are the next echelon of aircraft repair capability. Typically, these maintenance departments are located with the operational aviation units they support. For example, Marine Aviation Logistics Squadron (MALS) 26 is the I-level maintenance department supporting all the flying squadrons within Marine Aircraft Group (MAG) 26. Since all the squadrons it supports are aboard Marine Corps Air Station (MCAS) New River, MALS-26 is located directly next to the flight line for maximum support. The maintenance conducted here focuses on those tasks that cannot be completed at the O-level due to lack of equipment or qualification, testing and repairing aeronautical components and support equipment, calibration of tools, technical assistance to O-level units, and manufacturing certain aeronautical components. Aviation maintenance Marines in I-level departments may also support non-local activities (USN, 2017). If a machine is down at MALS-29, MALS-26 I-level may be able to support MALS-29's maintenance efforts until the machine is fully operational. Figure 3 shows how an I-level maintenance department differs from the O-level.

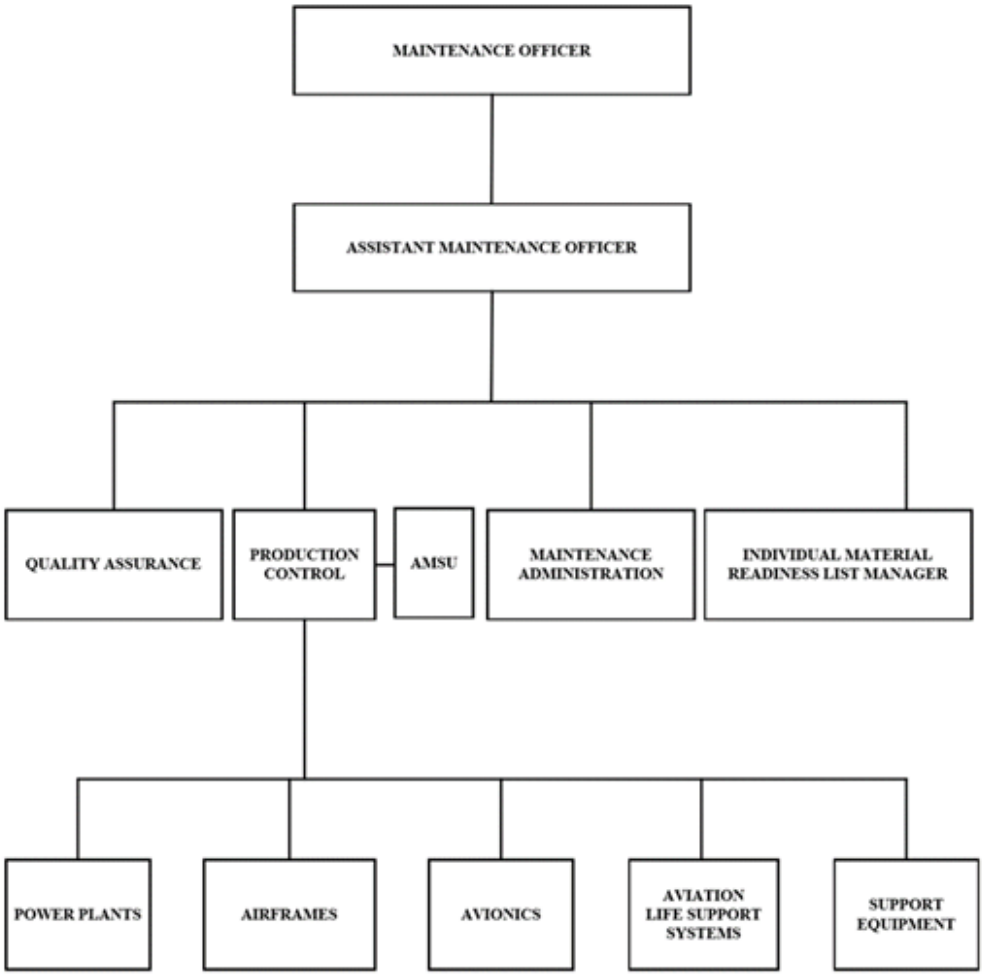

Figure 3. I-level maintenance department organization (Marine Corps). Source: USN (2017).

This level of aviation maintenance changes from the O-level by having a production control work center, a material readiness manager, support equipment and life support systems work centers. Since the I-level is responsible for large-scale (multi-squadron) support, it needs divisions to support such a wide range of maintenance.

c. Depot Level (D-level)

While the maintenance at this level is completed by contractors, I-level aviation maintenance Marines work closely with D-level employees. When working with the

contractors, the I-level Marines learn new techniques and technical directives, that expand individual levels of expertise and knowledge, but are lessons these same Marines can impart on others within the I-level department. Particularly, if a new technical directive is published and taught by D-level contractors, I-level CDIs, CDQARs, and QARs are the ones to ensure these amendments are incorporated into daily operations and aviation maintenance Marines are adhering to the new standard (USN, 2017).

2. Aviation Maintenance MOSs

Each maintenance echelon is comprised of aviation maintenance Marines filling billets that correlate to a four-digit code assigned to individual Marines once they complete basic occupational training. The MOS codes also depend on the T/M/S their respective maintenance departments' support. The descriptions of codes in this section correlate directly to the population studied in this thesis.

a. Aircraft Maintenance

The occupations in this field are responsible for "direct and indirect support of the total airframes and power plant package of all aviation aircraft weapons systems" (USMC, 2013). Marines in this occupational field have opportunities for progression to management/supervisory roles, and some MOSs have the advantage of participating in a formal apprenticeship program resulting in receipt of a Department of Labor Certification, if successfully completed. Table 1 lists the MOSs comprising this occupational field, detailing MOS code, title, ranks that can fill the respective billets, and billet descriptions.

Table 1. General aviation maintenance MOSs.
Adapted from USMC (2013).

MOS	Title	Applicable Ranks	Billet Description
6012	Aviation Maintenance Controller/Production Controller	Sgt - GySgt	"Plan, direct, and control the performance and execution of aviation maintenance department functions at both the O-Level and I-Level ."
6018	Aviation QAR/CDQAR/CDI	Cpl - MGySgt	"Responsible for the prevention of the occurrence of defects. The concept embraces all events from the start of the maintenance operation to its completion. They must possess a detailed, working knowledge of all Navy-sponsored aviation maintenance programs and processes."
6019	Aircraft Maintenance Chief	MSgt - MGySgt	"Expected to supervise all maintenance areas, personnel qualifications and MOS development within respective squadrons."
6023	Aircraft Power Plants Test Cell Operator	Cpl - GySgt	"Responsible for inspecting, testing, and performing corrective maintenance to aircraft gas turbine engines and engine systems."
6033	Aircraft Nondestructive Inspection Technician	Cpl - GySgt	"Conduct nondestructive testing of metals in aircraft structures and other aircraft or engine components."
6042	Individual Material Readiness List (IMRL) Asset Manager	Pvt - MGySgt	"Manage IMRL asset inventories in accordance with NAMP and Aircraft Maintenance Material Readiness List (AMMRL) program procedures."
6043	Aircraft Welder	LCpl - GySgt	"Fabricate and repair aircraft metals through basic welding using gas/tungsten/titanium welding/arc welding (GTAW) procedures on alloys: aluminum, steel, stainless steel, and precipitating hardening nickel based."
6046	Aircraft Maintenance Administration Specialist	Pvt - MGySgt	"Maintain aircraft log books, naval aircraft maintenance publications, as well as prepare reports, logs records, directives, and correspondence."
6048	Flight Equipment Technician	Pvt - GySgt	"Inspect, maintain, and repair parachutes; flight survival equipment; flight equipment; carbon dioxide, and other gaseous and liquid oxygen equipment."
6049	NALCOMIS Application Administrator/Analyst	Sgt - MGySgt	"Conduct data analysis and trend interpretation for developing statistical process control methods in support of aviation information and readiness reporting requirements."
6062	Aircraft I-Level Hydraulic/Pneumatic Mechanic	Pvt - GySgt	"Inspect, maintain, and repair aircraft intermediate level hydraulic/pneumatic system components."
6072	Aircraft Maintenance Supply Equipment Hydraulic/Pneumatic/Structures Mechanic	Pvt - GySgt	"Inspect, maintain, repair, and test aircraft maintenance SE, hydraulic/pneumatic/structures systems and system components."
6073	Aircraft Maintenance SE Electrician/Refrigeration Mechanic	Pvt - GySgt	"Install, inspect, test, maintain, and repair aircraft SE, electrical/instrument and refrigeration and air conditioning equipment, systems, and components."
6074	Cryogenics Equipment Operator	Pvt - GySgt	"Assemble, operate, and maintain liquid oxygen/nitrogen (LOX) generating plants, storage and aircraft servicing equipment, vaporizing equipment, vacuum pumps, and LOX tank purging units."
6092	Aircraft I-Level Structures Mechanic	Pvt - Gysgt	"Inspect, maintain, and repair aircraft intermediate level structural components."

b. Aircraft Maintenance (Rotary-Wing)

MOSs in this occupational field are focused on maintaining the Marine Corps' rotary-wing assets. After completing basic MOS training, aviation maintenance Marines in this field are awarded a 6111 MOS indicating she has successfully completed helicopter/ tiltrotor mechanic training. Follow-on schools are where these Marines are filtered into the

various MOS supporting operational rotary-wing and tiltrotor squadrons. Table 2 details these MOS, titles, applicable ranks, and billet descriptions.

Table 2. Rotary-wing and tiltrotor maintenance MOSs. Adapted from USMC (2013).

MOS	Title	Applicable Ranks	Billet Description
6112	Helicopter Mechanic, CH-46	Pvt - GySgt	"Inspect and maintain helicopter airframes and airframe components and perform duties relating to flight line operation."
6113	Helicopter Mechanic, CH-53	Pvt - GySgt	"Inspect and maintain helicopter airframes and airframe components and perform duties relating to flight line operation."
6114	Helicopter Mechanic, UH/AH-1	Pvt - GySgt	"Inspect and maintain helicopter airframes and airframe components and perform duties relating to flight line operation."
6116	Tiltrotor Mechanic, MV-22	Pvt - GySgt	"Inspect and maintain tiltrotor airframes and airframe components and perform duties relating to flight line operation."
6122	Helicopter Power Plants Mechanic, T-58	Pvt - GySgt	"Inspect, maintain, test, repair, and perform complete repair of helicopter poer plants and power plants systems."
6123	Helicopter Power Plants Mechanic, T-64	Pvt - GySgt	"Inspect, maintain, test, repair, and perform complete repair of helicopter poer plants and power plants systems."
6124	Helicopter Power Plants Mechanic, T-400/T-700	Pvt - GySgt	"Inspect, maintain, test, repair, and perform complete repair of helicopter poer plants and power plants systems."
6132	Helicopter/Tiltrotor Dynamic Components Mechanic	Pvt - GySgt	"Inspect, maintain, test, and repair helicopter/tiltrotor dynamic components."
6152	Helicopter Airframe Mechanic, CH-46	Pvt - GySgt	"Inspect, maintain, and repair helicopter airframe systems."
6153	Helicopter Airframe Mechanic, CH-53	Pvt - GySgt	"Inspect, maintain, and repair helicopter airframe systems."
6154	Helicopter Airframe Mechanic, UH/AH-1	Pvt - GySgt	"Inspect, maintain, and repair helicopter airframe systems."
6156	Tiltrotor Airframe Mechanic, MV-22	Pvt - GySgt	"Inspect, maintain, and repair tiltrotor airframe systems."

c. Aircraft Maintenance (Fixed-Wing)

MOSs in this occupational field are focused on maintaining the Marine Corps' fixed-wing assets. After completing basic MOS training, aviation maintenance Marines in this field are awarded a 6251 MOS indicating she has successfully completed fixed-wing mechanic training. Another basic MOS training complete MOS is 6281, identifying these Marines are ready for follow-on safety equipment mechanic training. Follow-on schools are where these Marines are filtered into the various MOS supporting operational fixed-wing squadrons. Table 3 details these MOS, titles, applicable ranks, and billet descriptions.

Table 3. Fixed-wing maintenance MOSs. Adapted from USMC (2013).

MOS	Title	Applicable Ranks	Billet Description
6212	Fixed-Wing Aircraft Mechanic, AV-8/TAV-8	Pvt - GySgt	"Inspect and maintain aircraft airframes and airframe components and perform duties relating to flight line operations."
6213	Fixed-Wing Aircraft Mechanic, EA-6	Pvt - GySgt	"Inspect and maintain aircraft airframes and airframe components and perform duties relating to flight line operations."
6214	Unmanned Aerial Vehicle (UAV) Mechanic	Pvt - GySgt	"Inspect and maintain UAV airframes and airframe components and perform duties relating to flight line operations."
6216	Fixed-Wing Aircraft Mechanic, KC-130	Pvt - GySgt	"Inspect and maintain aircraft airframes and airframe components and perform duties relating to flight line operations."
6217	Fixed-Wing Aircraft Mechanic, F/A-18	Pvt - GySgt	"Inspect and maintain aircraft airframes and airframe components and perform duties relating to flight line operations."
6218	Fixed-Wing Aircraft Mechanic, F-35B	Pvt - GySgt	"Inspect and maintain aircraft airframes and airframe components and perform duties relating to flight line operations."
6222	Fixed-Wing Aircraft Power Plants Mechanic, F-402	Pvt - GySgt	"Inspect, maintain, test, repair, and perform complete repair of aircraft power plants and power plant systems."
6223	Fixed-Wing Aircraft Power Plants Mechanic, J-52	Pvt - GySgt	"Inspect, maintain, test, repair, and perform complete repair of aircraft power plants and power plant systems."
6226	Fixed-Wing Aircraft Power Plants Mechanic, T-56	Pvt - GySgt	"Inspect, maintain, test, repair, and perform complete repair of aircraft power plants and power plant systems."
6227	Fixed-Wing Aircraft Power Plant Mechanic, F-404	Pvt - GySgt	"Inspect, maintain, test, repair, and perform complete repair of aircraft power plants and power plant systems."
6251	Fixed-Wing Aircraft Airframe Mechanic-Trainee	Pvt - SSgt	Students who are training for one the fixed-wing aircraft airframe systems
6252	Fixed-Wing Aircraft Airframe Mechanic-AV-8/TAV-8	Pvt - GySgt	"Inspect, maintain, and repair the aircraft hydraulic/pneumatic and structure systems."
6253	Fixed-Wing Aircraft Airframe Mechanic, EA-6	Pvt - GySgt	"Inspect, maintain, and repair the aircraft hydraulic/pneumatic and structure systems."
6256	Fixed-Wing Aircraft Airframe Mechanic, KC-130	Pvt - GySgt	"Inspect, maintain, and repair the aircraft hydraulic/pneumatic and structure systems."
6257	Fixed-Wing Aircraft Airframe Mechanic, F/A-18	Pvt - GySgt	"Inspect, maintain, and repair the aircraft hydraulic/pneumatic and structure systems."
6258	Fixed-Wing Aircraft Airframe Mechanic, F-35B	Pvt - GySgt	"Inspect, maintain, and repair the aircraft hydraulic/pneumatic and structure systems."
6282	Fixed-Wing Aircraft Safety Equipment Mechanic, AV-8/TAV-8	Pvt - GySgt	"Inspect, maintain, and repair the aircraft centered safety equipment and systems."
6283	Fixed-Wing Aircraft Safety Equipment Mechanic, EA-6	Pvt - GySgt	"Inspect, maintain, and repair the aircraft centered safety equipment and systems."
6286	Fixed-Wing Aircraft Safety Equipment Mechanic, KC-130/V-22	Pvt - GySgt	"Inspect, maintain, and repair the aircraft centered safety equipment and systems."
6287	Fixed-Wing Aircraft Safety Equipment Mechanic, F/A-18	Pvt - GySgt	"Inspect, maintain, and repair the aircraft centered safety equipment and systems."
6288	Fixed-Wing Aircraft Safety Equipment Mechanic, F-35B	Pvt - GySgt	"Inspect, maintain, and repair the aircraft centered safety equipment and systems."

d. Organizational Avionics Maintenance

Marines in this occupational field are expected to directly and indirectly support all the Marine Corps' aviation weapon systems. As with the structural and components mechanics occupational fields, avionics also has career progression opportunities where a junior Marine could become a work center supervisor/manager should she have the required years of service and requirements completed. As stated in the O-level description of this paper, Marines at this level are the "first line of defense" when repairing and maintaining aircraft. They are at the operational or flying squadron level. Table 4 details the MOSs comprising this occupational field and the respective billet descriptions.

Table 4. O-level avionics MOSs. Adapted from USMC (2013).

MOS	Title	Applicable Ranks	Billet Description
6313	Aircraft Communications/Navigation/Radar Systems Technician, EA-6	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment of installed aircraft communications/navigation/electrical/radar systems to include deceptive electronic countermeasures (DECM systems."
6314	Avionics/Maintenance Technician, UAS	Pvt - GySgt	"Install, remove, inspect, test, maintain, and reapir systems, components, and ancillary equipment. These Marines also perform launch, recovery, and other lfight line operations at the organizational maintenance level."
6316	Aircraft Communications/Navigation Systems Technician, KC-130	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment of installed aircraft communications/navigation/electrical/radar systems to include deceptive electronic countermeasures (DECM systems."
6317	Aircraft Communications/Navigation/Radar Systems Technician, F/A-18	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment of installed aircraft communications/navigation/electrical/radar systems to include deceptive electronic countermeasures (DECM systems."
6322	Aircraft Avionics Technician, CH-46	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment of installed aircraft communications/navigation/electrical/radar systems to include deceptive electronic countermeasures (DECM systems."
6323	Aircraft Avionics Technician, CH-53	Pvt - GySgt	"Install, remove, inspect, test, maintain, and reapir systems, components, and ancillary equipment. These Marines also perform launch, recovery, and other lfight line operations at the organizational maintenance level."
6324	Aircraft Avionics Technician, UH/AH-1	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment of installed aircraft communications/navigation/electrical/radar systems to include deceptive electronic countermeasures (DECM systems."
6326	Aircraft Avionics Technician, MV-22	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment. These Marines also perform launch, recovery, and other lfight line operations at the organizational maintenance level."
6332	Aircraft Avionics Technician, AV-8B	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment of installed aircraft electrical systems."
6333	Aircraft Electrical Systems Technician, EA-6	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment of installed aircraft electrical systems."
6336	Aircraft Electrical Systems Technician, KC-130	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment of installed aircraft electrical systems."
6337	Aircraft Electrical Systems Technician, F/A-18	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment of installed aircraft electrical systems."
6338	Aircraft Avionics Technician, F-35B	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment of installed aircraft communications/navigation/electrical/radar systems to include deceptive electronic countermeasures (DECM systems."
6386	Aircraft Electronic Countermeasures Systems Technician, EA-6B	Pvt - GySgt	"Install, remove, inspect, test, maintain, and repair systems, components, and ancillary equipment of installed aircraft electronic countermeasures systems."
6391	Avionics Chief	MSgt - MGySgt	"Supervise the maintenance and repair of aircraft avionics systems, equipment and components."

e. Intermediate Avionics Maintenance

I-level avionics Marines, like those working in organizational avionics work centers, are focused on the direct and indirect support of all aviation weapons systems. The skills these Marines learn and develop, through various schools, are similar, but support a diverse range of avionics systems. Avionics Marines completing basic MOS training receive the 6400 MOS and through follow-on schools develop more advanced skills to fill I-level specific avionics billets. Should a Marine serve complete multiple re-enlistments, or contracts, she has ample opportunities to progress into supervisory/managerial roles.

Table 5 lists the MOSs making-up this occupational field, with respective ranks applicable to the billets, and job descriptions.

Table 5. I-level avionics MOSs. Adapted from USMC (2013).

MOS	Title	Applicable Ranks	Billet Description
6414	Advanced Aircraft Communications/Navigation Systems Technician	Pvt - GySgt	"Inspect, test, maintain, and repair weaon replaceable assemblies, shop replaceable assemblies, and ancillary equipment whose aggregate constitutes a complete aircraft communications, navigation, or cryptographic system beyond normal fault isolation procedures."
6423	Aviation Electronic Micro/Miniature Component and Cable Repair Technician	Pvt - GySgt	"Inspect, test, maintain, and repair modules, cards, printed-circuit boards, cables, and miniature and micro-miniature components. They also perform appropriate level corrosion control."
6432	Aircraft Electrical/Instrument/Flight Control Systems Technician, Fixed-wing	Pvt - GySgt	"Inspect, test, maintain, and repair components, assemblies, subassemblies, modules, cards, printed circuit boards, and ancillary equipment whose aggregate constitutes a complete aircraft electrical/flight control system or subsystem."
6433	Aircraft Electrical/Instrument/Flight Control Systems Technician, Rotary wing	Pvt - GySgt	"Inspect, test, maintain, and repair components, assemblies, subassemblies, modules, cards, printed circuit boards, and ancillary equipment whose aggregate constitutes a complete aircraft electrical/flight control system or subsystem."
6434	Advanced Aircraft Electrical/Instrument/Flight Control Systems Tech	Pvt - GySgt	"Inspect, test, maintain, and repair weapon replaceable assemblies, shop replaceable assemblies, and ancillary equipment whose aggregate constitutes a complete aircraft electrical/flight control system beyond normal fault isolation procedures."
6469	Reconfiguration Transportable Consolidated Automated Supported System (RTCASS) Technician	Pvt - GySgt	"Inspect, test, maintain, repair, and analyze airborne weapon replaceable assemblies, shop replaceable assemblies, automatic test equipment, and ancillary equipment failures, beyond normals fault isolation procedures."
6483	Communication/Navigation/Cryptographic/ Countermeasures Systems Technician	Pvt - GySgt	"Inspect, test, maintain, and repair airborne weapon replaceable assemblies, shop replaceable assemblies and ancillary equipment whose aggregate constitutes a complete aircraft communications, navigation, cryptographic, countermeasures system or subsystem beyond normal fault isolation procedures."
6492	Aviation Precision Measurement Equipment (PME) Calibration/Repair Technician	Pvt - GySgt	"Test, maintain, calibrate, and repair aviation precision measurement and automatic test equipment."
6499	Mobile Facility Technician	Pvt - GySgt	"Inspect, service, maintain, and repair mobile facilities and associated environmental control units, generators, and all other electrical and ancillary equipment."

f. 6018: CDI, CDQAR, QAR Aviation Maintenance Qualifications

This section further details a small pool of the overall focus population of this study. While the research does observe re-enlistment rates of all aviation maintenance Marines, a smaller target population is those Marines filling CDI, CDQAR, QAR billets. SRB programs, from 2008 to 2018, have been used to induce aviation maintenance Marines to re-enlist after 17 months or six years of service (first-term Marines) or six to ten years of service (career Marines). The DC, A mentioned, along with other senior officers, aviation maintenance Marines must be retained due to the time it takes to train them and the amount of experience and knowledge they have developed after their initial contract terms. While these Marines are important, a focus group of the FY18 enlistment campaign and aviation plan is retaining those Marines holding the 6018 MOS. These Marines have expertise that surpasses that of the average first-term Marine. As such, the FY18 SRB program included an aviation maintenance kicker targeting those Marines with the 6018 MOS, “responding to the Marine Corps’ need to retain qualified maintainers” (Schogol, 2017a). This initiative also demonstrates what officers at Manpower and Reserve Affairs (M&RA) have said

about getting the most return on investment from the Marines that receive this extensive training.

Any aviation maintenance Marine may earn a CDI, CDQAR, or QAR qualification as long as she is at least a Corporal, meets the pre-requisites, and requirements listed in the NAMP. Marines skill qualified in a primary MOS from any of the aviation maintenance occupational fields are eligible for these certifications: 60/61/62, aircraft maintenance and 63/64, avionics (USMC, 2013). As these Marines are responsible for the preventing the occurrence of defects, acting as lower echelon quality assurance inspectors, they are accountable to the Quality Assurance Officer (QAO) and Aircraft Maintenance Officer (AMO) (USMC, 2013). The QAO and AMO are responsible to a squadron's Commanding Officer for ensuring aviation maintenance Marines are following NAMP procedures, thus safely and efficiently maintaining aircraft readiness. Since 6018 Marines are the responsibility of the QAO, they are expected to achieve the overall concept and objectives of the quality assurance (QA) division. The concept of the division is "fundamentally the prevention of the occurrence of defects and is an integral part of every maintenance process from start to completion." Meeting the objectives of this work center ensures the maintenance department is meeting NAMP standards and safely maintaining aircraft: "improve the safety of flight and ground operations; improve the quality, uniformity, and reliability of aircraft and equipment; improve the quality of maintenance materials, technical data, and processes; improve the skills and consistency in performance of maintenance personnel; and eliminate unnecessary man-hours and material expenditures" (USN, 2017).

As CDI, CDQAR, and QAR Marines are directly assigned to QA, they are direct representatives of the CO "for ensuring the quality of aircraft, engines, components, and equipment, and must possess the highest standards of professional integrity. In addition to inspection duties, QARs, CDQARs, and CDIs serve as trainers and mentors in their areas of expertise" (USN, 2017). This passage exemplifies the importance of these Marines. Not only do they have to be skill qualified in one of the pre-requisite primary MOSs and of the appropriate rank, they must also be high performers. The level of responsibility associated with these certifications is greater than what the average aviation maintenance Marine must

contend with during typical daily operations. Since these Marines are representatives of the CO, act as quality assurance inspectors ensuring all aircraft, components, and equipment are properly functional and maintained accordingly, and train/mentor Marines in their respective primary MOSs, they cannot be "low quality." The CO, AMO, and QAO rely on these Marines to ease the workload on QA and certify aeronautical components and aircraft are safe for flight. Ultimately, these Marines are responsible for the safety of the aircrew resulting in CDIs, CDQARs, and QARs needing to be "high quality" (USN, 2017).

(1) Quality Assurance Representative

These Marines must be at least Staff Sergeants (E6) and "fully qualified in the Aviation Maintenance Training and Readiness Program (AMTRP) syllabus in their technical field for the T/M/S aircraft supported" (United States Marine Corps [USMC], 2009). The AMTRP is a publication distributing training standards and regulations pertaining to the training of aviation maintenance Marines to the operational fleet. Within this document, it specifies the certification process for Marines to earn the QAR billet. This process includes all training and readiness (T&R) tasks, both on-the-job training (OJT) and NAMP prescribed,

> encompassed within the attainment of Subsystem or System Skill Proficiency, Qualification or Designations, and required tests or boards. Once the certification process is complete, individuals are "certified eligible" to possess the particular Qualification, Designation, or License they are working to attain. The term "Certified" does not equate to Qualified or Designated. Only when the appropriate authority signs-off the Qualification … is an individual authorized to perform the duties to which those QDLs pertain. (USMC, 2009)

They must also complete the personnel qualification standards (PQS) and QAR training syllabus applicable to their assigned billet, and pass a written exam administered by QA. Marines who desire to achieve this qualification must be skilled in reading, researching, and interpreting drawings, maintenance technical manuals, directives, and data. They must also be able to write clearly and with technical accuracy, as well as be "conscientious and committed to quality in all aspects of naval aviation" (USN, 2017).

Marines holding a QAR qualification are subject to lose their certifications should they fail to maintain proficiency in all tasks laid out in the qualification syllabus. The qualification can also be revoked or suspended. If this happens, Marines have to regain the qualification by completing "'R-coded' Tasks as delineated in the Qualification syllabus" and "observed and signed-off by an individual who meets or exceeds the Task Sign-Off Authority for each Task" (United States Marine Corps, 2009). Obtaining this qualification starts when a Marine begins completing OJT and NAMP T&R tasks, however much time it takes. She must also be recommended by the AMO to the CO, substantiating the Marine has completed all required tasks, meets all pre-requisites, and is of the caliber needed to be a QAR. The process to obtain and maintain a QAR qualification emphasizes the importance of only "high quality" Marines being certified to hold this billet al.so, the timeline to secure the qualification, even to re-certify the qualification, the Marine Corps must strive to retain these individuals.

(2) Collateral Duty Quality Assurance Representative

While accountable to QA, these Marines are "assigned to production work centers when needed to supplement the QA Division's capacity to perform QAR-level inspections" (USN, 2017). These Marines must be at least a Sergeant (E5) and complete the same training and testing syllabi as QARs assigned to the respective QA Division billet.

(3) Collateral Duty Inspector

Still working under QA oversight, CDIs are expected to "inspect all work and comply with the required QA inspections during all maintenance actions performed by their production work center" (USN, 2017). Aviation maintenance Marines wishing to obtain a CDI certification must be at least a Corporal (E4) and skill qualified in NAMP programs and processes applicable to a CDI's respective production work center. Like QARs and CDQARs, CDIs must complete a training syllabus commiserate with their assignment, and pass a written exam administered by the QA division.

(4) Training

The qualifications an aviation maintenance Marine can obtain act as proficiency, or career, milestones. Those high-performing E4s should hold a CDI qualification, and as they

progress through an aviation maintenance career should obtain a CDQAR certification once promoted to E5 and QAR once becoming a Staff Non-commissioned Officer (SNCO), or E6.

While the NAMP prescribes the training syllabus each aviation maintenance qualification must complete, the responsibility of developing procedures for earning such certifications are delegated to local leadership.

> Type Wings and Marine Aircraft Wing (MAWs) must publish local command procedures (LCP) that include QAR, CDQAR, and CDI training syllabus … and a written test for each.… MOS and work center assignment, for each T/M/S aircraft supported. I-level activities must establish a QAR, CDQAR, and CDI training syllabus … and written test requirements specific to engines, components, and equipment they support. The training syllabus … and the test, must cover the QA requirements for test, inspection, and administrative processes specific to QAR, CDQAR, or CDI assignment. (USN, 2017)

The NAMP dictates what a training syllabus must include, so each certification is standardized: AMTRP requirements; formal school requirements applicable to QA billet; testing and inspection procedures, like corrosion control; required reading, such as NAMP standard operating procedures (SOP) applicable to the QA billet; T/M/S functional check flight (FCF) requirements; QA sign-off and certification procedures; data collection and monitoring procedures; auditing and monitoring techniques; a written exam; a practical application exam; and topics for the oral interview conducted by the QA officer (USN, 2017).

Completing the requirements to become a CDI, CDQAR, and QAR do not end at passing exams and adequately completing interviews. These Marines then "must be designated by the activity's CO in writing via Quality Assurance Representative/Inspector Recommendation/Designation" (USN, 2017). Figure 4 shows the endorsement sheet that accompanies each prospective CDI, CDQAR, and QAR package. The sheet shows the level of scrutiny involved with choosing the best aviation maintenance Marines for to hold these certifications. Once it has been signed by the unit's Commanding Officer, the completed form is the maintenance department's means of identifying qualified Marines (USN, 2017).

OPNAVINST 4790.2
COMNAVAIRFORINST 4790.2

QUALITY ASSURANCE REPRESENTATIVE/INSPECTOR DESIGNATION

CANDIDATE NAME *(Last Name, First Name, Middle Initial)*:	RATE/GRADE:

I. DIVISION OFFICER RECOMMENDATION

In accordance with the current COMNAVAIRFORINST 4790.2 the above named person is recommended for:

☐ QAR ☐ CDQAR ☐ CDI

FOR *(Aircraft/System/Work Center/Etc.,)*:

DIVISION OFFICER TYPED NAME AND RANK:	SIGNATURE DATE:	DIVISION OFFICER SIGNATURE:

II. QUALITY ASSURANCE ANALYSIS OFFICER ENDORSEMENT

The candidate has been examined in accordance with the current COMNAVAIRFORINST 4790.2 and has passed all requirements satisfactorily. Recommend approval.

QA/A OFFICER TYPED NAME AND RANK:	SIGNATURE DATE:	QA/A OFFICER SIGNATURE:

III. MAINTENANCE OFFICER ENDORSMENT

Candidate is fully qualified in accordance with the requirements of COMNAVAIRFORINST 4790.2. Recommended for designation for the specified Quality Assurance Representative/Inspector position.

MAINTENANCE OFFICER TYPED NAME AND RANK:	SIGNATURE DATE:	MAINTENANCE OFFICER SIGNATURE:

IV. COMMANDING OFFICER ACTION

☐ DESIGNATED ☐ NOT DESIGNATED

COMMANDING OFFICER TYPED NAME AND RANK:	SIGNATURE DATE:	COMMANDING OFFICER SIGNATURE:

V. DESIGNEE ACKNOWLEDGEMENT

I UNDERSTAND MY RESPONSIBILITY AS SET FORTH HEREIN

"When performing inspection, I am considered to be the direct representative of the Commanding Officer for ensuring safety of flight of the item concerned. I will not permit factors, such as operational desires, maintenance consideration, personal relations or the approach of liberty to modify my judgment. By signing an inspection report. I am certifying upon my own individual responsibility that the work involved has been personally inspected by me; that it has been properly completed and is in accordance with current instructions and directives; that it is satisfactory; that any related parts or components whish may have been removed by the work are properly replaced and all parts are secure, and that the work has been performed in such a manner that the item is completely safe for flight or use"

CANDIDATE TYPED NAME AND RANK:	SIGNATURE DATE:	CANDIDATE SIGNATURE:	STAMP NO.:

OPNAV 4790/12 (REV 10/2016)

Original to: Individual
Copy to: Quality Assurance/Analysis Officer
Division Officer

Figure 4. Quality assurance representative/inspector recommendation/ designation (OPNAV 4790/12). Source: USN (2017).

The QA officer must ensure a Marine has satisfied all qualification requirements before sending his/her recommendation to the AMO. This Marine, typically a Major (O4), must also endorse the recommendation prior to forwarding an enlisted aviation maintenance Marine's CDI, CDQAR, or QAR packet to the CO (USN, 2017). Since these Marines are certified subject matter experts, the high level of training involved, and the time required to obtain such certifications, they must be retained. Otherwise, aviation maintenance leadership and the Marine Corps are spending at least four years training aviation maintenance Marines to this level of expertise just to have them separate, then spend another four years training a replacement, resulting in a total of eight years' experience lost.

3. Career Timeline

Aviation maintenance qualifications are highly prized by the Marine Corps, such that current bonus programs have included Marines holding these skills as eligible for $20,000 during FY18. However, to fully understand why retaining these Marines is necessary to aviation success, the section details the training these Marines undergo and the time it takes to develop a specific skill certified aviation maintainer.

Individuals' first introduction to Marine Corps training is the 13 weeks they spend at recruiting depots: Parris Island in Beaufort, SC, and San Diego, CA. After just over 3 months of basic training, learning how to be Marines, individuals are sent to either School of Infantry-East (SOI-East) or School of Infantry-West (SOI-West). Since these Marines are not filling combat arms occupations, they will be sent to Marine Corps Training (MCT) Battalion aboard SOI-East or SOI-West. Here enlisted Marines spend 29 days learning battle skills which allow them to operate in combat environments regardless of MOS. After almost 4 months of basic skills training, enlisted Marines are then sent to their respective MOS schools. In the case of aviation maintenance, these Marines are sent to MOS training all over the country. Tables 6–12 shows the schools required for each MOS. The occupations with no information do not have required training since the only pre-requisite is to be qualified in a primary MOS. These types of occupations are additional billets enlisted Marines can obtain once they meet specific years of service.

Table 6. 60XX: aircraft maintenance MOS required training. Adapted from USMC (2013).

MOS	Title	Requirements	Required MOS Schools	Location
6012	Aviation Maintenance Controller/Production Controller	Necessary MOS (NMOS) generated from any PMOS: 60XX, 61XX, 62XX, 63XX, or 64XX	N/A	N/A
6018	Aviation QAR/CDQAR/CDI	NMOS filled from PMOSs: 60XX, 61XX, 62XX, 63XX, 64XX	N/A	N/A
6019	Aircraft Maintenance Chief	Must be a qualified 60XX, 61XX, 62XX	N/A	N/A
6023	Aircraft Power Plants Test Cell Operator	NMOS filled from 6122, 6123, 6124, 6216, 6222, 6223, 6227	N/A	N/A
6033	Aircraft Nondestructive Inspection Technician	NMOS filled from 6062, 6092, 615X, 625X	Naval Aircraft Nondestructive Inspection Technician Class C1	Pensacola, FL
6042	Individual Material Readiness List (IMRL) Asset Manager		IMRL Asset Managers System (IAMS)	Meridian, MS
6043	Aircraft Welder	Be qualified as an aircraft structures mechanic, 6092	N/A	N/A
6046	Aircraft Maintenance Administration Specialist		Aviation Maintenance Administration Man Class A1 - "A" school	Meridian, MS
			Data Analysis Course - "C" school	Pensacola, FL
6048	Flight Equipment Technician		(AWAT)	Pensacola, FL
			Aircrew Survival Equipmenet Man Common Core Class A1	Pensacola, FL
			Organizational Maintenance	
6049	NALCOMIS Application Administrator/Analyst		NALCOMIS Aviation Maintenance OMA System Administrator/Analyst Pipeline	Pensacola, FL
			NALCOMIS Aviation Maintenance IMA System Administrator/Analyst Pipeline	Pensacola, FL
			NALCOMIS Aviation Maintenance OMA System Administrator/Analyst Optimize	Pensacola, FL
			NALCOMIS Aviation Maintenance IMA System Administrator/Analyst Optimize	Pensacola, FL
6062	Aircraft I-Level Hydraulic/Pneumatic Mechanic		Aviation Warfare Apprentice Training (AWAT)	Pensacola, FL
			Aviation Structural Mechanic Core - "A" school	Pensacola, FL
			USMC Aircraft Hydraulic Components Intermediate Maintenance - "C" school	Pensacola, FL
6072	Aircraft Maintenance Supply Equipment Hydraulic/Pneumatic/Structures Mechanic		As Apprentice Technical Training	Pensacola, FL
			AWAT	Pensacola, FL
			Aviation Support Equipment Technician Class A1	Pensacola, FL
			Support Equipment Engine/Gas Turbine and Related Intermediate Maintenance	San Diego, CA/Jacksonville, FL
6073	Aircraft Maintenance SE Electrician/Refrigeration Mechanic		As Apprentice Technical Training	Pensacola, FL
			AWAT	Pensacola, FL
			Aviation Support Equipment Technician Class A1 - "A" school	Pensacola, FL
			Support Equipment Electrical/Refrigeration Intermediate Mechanic - "C" school	San Diego, CA/Jacksonville, FL
6074	Cryogenics Equipment Operator		Air Separation and Cryogenics Generators and Servicing Equipment Intermediate Maintenance	Cherry Point, NC
6092	Aircraft I-Level Structures Mechanic		AWAT	Pensacola, FL
			Aviation Structural Mechanic Core - "A" school	Pensacola, FL
			Advanced Composite Materials Repair	Virginia Beach, VA
			Airframes Intermediate Maintenance - "C" school	Oceana, VA

Table 7. 61XX: aircraft maintenance, RW required MOS training. Adapted from USMC (2013).

MOS	Title	Required MOS Schools	Location
6112	Helicopter Mechanic, CH-46	CH-46E Power Plants Power Trains and Rotors Organizational Maintenance	Jacksonville, NC
6113	Helicopter Mechanic, CH-53	CH-53E Power Plants Power Trains and Related Systems Maintenance	Jacksonville, NC
6114	Helicopter Mechanic, UH/AH-1	AH-1Z/UH-1Y Flight Line Initial Accession Pipeline Organizational Maintenance Training Track	Camp Pendleton, CA
		AH-1W/UH-1N Power Plants Power Trains and Rotors Maintenance	Camp Pendleton, CA
6116	Tiltrotor Mechanic, MV-22	MV-22 Tiltrotor Mechanics	Jacksonville, NC
6122	Helicopter Power Plants Mechanic, T-58	AWAT	Pensacola, FL
		Aviation Machinists Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinists Mate Helicopter Fundamentals Strand Class A1 - "A" school	Pensacola, FL
		T-58 Engine First Degree Intermediate Maintenance - "C" school	Jacksonville, NC
6123	Helicopter Power Plants Mechanic, T-64	AWAT	Pensacola, FL
		Aviation Machinists Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinists Mate Helicopter Fundamentals Strand Class A1 - "A" school	Pensacola, FL
		H53 Power Plant Intermediate Maintenance - "C" school	Jacksonville, NC
6124	Helicopter Power Plants Mechanic, T-400/T-700	AWAT	Pensacola, FL
		Aviation Machinists Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinists Mate Helicopter Fundamentals Strand Class A1 - "A" school	Pensacola, FL
		T700-GE-401/401C Engine Intermediate Maintenance (First Degree)	Jacksonville, FL/San Diego, CA
6132	Helicopter/Tiltrotor Dynamic Components Mechanic	Helicopter Dynamic Component Repair Intermediate Maintenance	Jacksonville, NC
6152	Helicopter Airframe Mechanic, CH-46	AWAT	Pensacola, FL
		Aviation Structural Mechanic Core - "A" school	Pensacola, FL
		Aviation Structural Mechanic Organizational Level Strand	Pensacola, FL
		CH-46E Structural and Hydraulic Systems Organizational Maintenance - "C" school	Jacksonville, NC
6153	Helicopter Airframe Mechanic, CH-53	AWAT	Pensacola, FL
		Aviation Structural Mechanic Core - "A" school	Pensacola, FL
		Aviation Structural Mechanic Organizational Level Strand	Pensacola, FL
		CH-53E Airframes Organizational Maintenance	Jacksonville, NC
6154	Helicopter Airframe Mechanic, UH/AH-1	AWAT	Pensacola, FL
		Aviation Structural Mechanic Core - "A" school	Pensacola, FL
		Aviation Structural Mechanic Organizational Level Strand	Pensacola, FL
		AH-1Z/UH-1Y Airframes Organizational Maintenance - "C" school	Camp Pendleton, CA
6156	Tiltrotor Airframe Mechanic, MV-22	AWAT	Pensacola, FL
		Aviation Structural Mechanic Core - "A" school	Pensacola, FL
		Aviation Structural Mechanic Organizational Level Strand	Pensacola, FL
		V-22 Aircraft Familiarization Organizational Maintenance - "C" school	Jacksonville, NC

Table 8. 62XX: aircraft maintenance, FW required MOS (6212 – 6227) training. Adapted from USMC (2013).

MOS	Title	Required MOS Schools	Location
6212	Fixed-Wing Aircraft Mechanic, AV-8/TAV-8	AWAT	Pensacola, FL
		Aviation Machinists Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinists Mate Turbojet Fundamentals Strand - "A" school	Pensacola, FL
		AV-8B Aircraft Mechanic Organizational Maintenance - "C" school	Cherry Point, NC
6213	Fixed-Wing Aircraft Mechanic, EA-6	AWAT	Pensacola, FL
		Aviation Machinists Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinists Mate Turbojet Fundamentals Strand - "A" school	Pensacola, FL
		EA-6B Power Plants and Related Systems (Initial) Organizational Maintenance - "C" school	Oak Harbor, WA
6214	Unmanned Aerial Vehicle (UAV) Mechanic		
6216	Fixed-Wing Aircraft Mechanic, KC-130	Aviation Machinist Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinist Mate Turboject Aircraft Fundamentals Strand Class A1 - "A" school	Pensacola, FL
		KC-130J Aircraft Mechanic Initial Accession Maintenance - "C" school	Little Rock, AR
6217	Fixed-Wing Aircraft Mechanic, F/A-18	AWAT	Pensacola, FL
		Aviation Machinist Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinist Mate Turboject Aircraft Fundamentals Strand Class A1 - "A" school	Pensacola, FL
		F/A-18A/B/C/D Power Plants and Related Systems (Initial) Organizational Maintenance - "C" school	Virginia Beach, VA
6218	Fixed-Wing Aircraft Mechanic, F-35B	AWAT	Pensacola, FL
		Aviation Machinists Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinists Mate Turbojet Fundamentals Strand - "A" school	Pensacola, FL
		F-35B Aircraft Mechanic	
6222	Fixed-Wing Aircraft Power Plants Mechanic, F-402	AWAT	Pensacola, FL
		Aviation Machinists Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinists Mate Turbojet Fundamentals Strand - "A" school	Pensacola, FL
		F402-RR-408A/MK.4 CR00305 Gas Turbine Starter (GTS)/F402-44-406A Intermediate Maintenance - "C" school	Cherry Point, NC
6223	Fixed-Wing Aircraft Power Plants Mechanic, J-52	AWAT	Pensacola, FL
		Aviation Machinists Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinists Mate Turbojet Fundamentals Strand - "A" school	Pensacola, FL
		J52 Engine First Degree Intermediate Maintenance - "C" school	Oak Harbor, WA
6226	Fixed-Wing Aircraft Power Plants Mechanic, T-56	Aviation Machinists Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinists Mate Turbojet Fundamentals Strand - "A" school	Pensacola, FL
		Aircraft Power Plants Mechanic T-56	Cherry Point, NC
6227	Fixed-Wing Aircraft Power Plant Mechanic, F-404	AWAT	Pensacola, FL
		Aviation Machinists Mate Common Core Class - "A" school	Pensacola, FL
		Aviation Machinists Mate Turbojet Fundamentals Strand - "A" school	Pensacola, FL
		F404-GD-400/402 Engine First Degree Intermediate Maintenance	Lemoore, CA/Oceana, VA

Table 9. 62XX: aircraft maintenance, FW required MOS (6252 – 6288) training. Adapted from USMC (2013).

MOS	Title	Required MOS Schools	Location
6252	Fixed-Wing Aircraft Airframe Mechanic-AV-8/TAV-8	AWAT	Pensacola, FL
		Aviation Structural Mechanic Core - "A" school	Pensacola, FL
		Aviation Structural Mechanic Organizational Level Strand - "A" school	Pensacola, FL
		AV-8B Airframe Organizational Maintenance Course - "C" school	Cherry Point, NC
6253	Fixed-Wing Aircraft Airframe Mechanic, EA-6	AWAT	Pensacola, FL
		Aviation Structural Mechanic Core - "A" school	Pensacola, FL
		Level Strand - "A" school	Pensacola, FL
		Organizational Maintenance - "C" school	Oak Harbor, WA
6256	Fixed-Wing Aircraft Airframe Mechanic, KC-130	AWAT	Pensacola, FL
		Aviation Structural Mechanic Core - "A" school	Pensacola, FL
		Aviation Structural Mechanic Organizational Level Strand - "A" school	Pensacola, FL
		KC-130J Initial Accession Airframes Mechanic	Little Rock, AR
6257	Fixed-Wing Aircraft Airframe Mechanic, F/A-18	AWAT	Pensacola, FL
		Aviation Structural Mechanic Core - "A" school	Pensacola, FL
		Aviation Structural Mechanic Organizational Level Strand - "A" school	Pensacola, FL
		F/A-18 Aviation Hydraulic/Structural Mechanic (Initial) Organizational Maintenance	Pensacola, FL/Virginia Beach, VA
6258	Fixed-Wing Aircraft Airframe Mechanic, F-35B	AWAT	Pensacola, FL
		Aviation Structural Mechanic Core - "A" school	Pensacola, FL
		Aviation Structural Mechanic Organizational Level Strand - "A" school	Pensacola, FL
		F-35B Aviation Structural Mechanic Strand	Pensacola, FL
		F-35B Aircraft Airframe Mechanic	
6282	Fixed-Wing Aircraft Safety Equipment Mechanic, AV-8/TAV-8	AWAT	Pensacola, FL
		Aviation Structural Mechanic E (Safety Equipment) Core Class A1 - "A" school	Pensacola, FL
		AV-8B Aircraft Safety Equipment Mechanic Organizational Maintenance - "C" school	Cherry Point, NC
6283	Fixed-Wing Aircraft Safety Equipment Mechanic, EA-6	AWAT	Pensacola, FL
		Aviation Structural Mechanic E (Safety Equipment) Core Class A1 - "A" school	Pensacola, FL
		EA-6B Safety Equipment (Initial) Organizational Maintenance	Whidbey Island, WA
6286	Fixed-Wing Aircraft Safety Equipment Mechanic, KC-130/V-22	AWAT	Pensacola, FL
		Aviation Structural Mechanic E (Safety Equipment) Core Class A1 - "A" school	Pensacola, FL
		KC-130J Initial Accession Safety and Survival Systems Technician - "C" school	Little Rock, AR
6287	Fixed-Wing Aircraft Safety Equipment Mechanic, F/A-18	AWAT	Pensacola, FL
		Equipment) Core Class A1 - "A" school	Pensacola, FL
		Equipment (Initial) Organizational Maintenance -	Pensacola, FL/Virginia Beach, VA
6288	Fixed-Wing Aircraft Safety Equipment Mechanic, F-35B	Aviation Structural Mechanic E (Safety Equipment) Core Class A1 - "A" school	Pensacola, FL
		F-35 Aviation Structural Mechanic E (Safety Equipment) Strand	Pensacola, FL
		F-35B Aircraft Safety Equipment Mechanic	

Table 10. 63XX: O-level avionics required MOS (6313 – 6326) training Adapted from USMC (2013).

MOS	Title	Required MOS Schools	Location
6313	Aircraft Communications/Navigation/ Radar Systems Technician, EA-6	Marine Avionics ATT	Pensacola, FL
		AWAT	Pensacola, FL
		Avionics Technician O Level Class A1	Pensacola, FL
		EA-6B ICAP 2/Block 86 COMM/NAV/Radar/ECM Systems (Initial) Organizational Maintenance	Oak Harbor, WA
6314	Avionics/Maintenance Technician, UAS	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Avionics Technician O Level Class A1	Pensacola, FL
		Unmanned Aircraft System Repairer	Ft Huachuca, AZ
6316	Aircraft Communications/Navigation Systems Technician, KC-130	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Avionics Technician O Level Class A1	Pensacola, FL
		KC-130J Communication/Navigation Technician Initial Accession	Little Rock, AR
6317	Aircraft Communications/Navigation/ Radar Systems Technician, F/A-18	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Avionics Technician O Level Class A1	Pensacola, FL
		Pipeline F/A-18 Avionic Systems (Initial) Organizational Maintenance	Pensacola, FL/Virginia Beach, VA
6322	Aircraft Avionics Technician, CH-46	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Avionics Technician O Level Class A1	Pensacola, FL
		CH-46 Communication, Navigation, Identification Systems Organizational Maintenance	Jacksonville, NC
6323	Aircraft Avionics Technician, CH-53	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Avionics Technician O Level Class A1	Pensacola, FL
		CH-53E Communication/Electrical System Organizational Maintenance	Jacksonville, NC
6324	Aircraft Avionics Technician, UH/AH-1	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Avionics Technician O Level Class A1	Pensacola, FL
		H-1 Avionics Systems Organizational Maintenance	Camp Pendleton, CA
6326	Aircraft Avionics Technician, MV-22	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Aviation Electricians Mate Strand Class A1	Pensacola, FL
		V-22 Avionics	Jacksonville, NC

Table 11. 63XX: O-level avionics required MOS (6332 – 6391) training Adapted from USMC (2013).

MOS	Title	Required MOS Schools	Location
6332	Aircraft Avionics Technician, AV-8B	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Aviation Electricians Mate Strand Class A1	Pensacola, FL
		AV-8B Electrical Systems Organizational Maintenance	Cherry Point, NC
6333	Aircraft Electrical Systems Technician, EA-6	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Aviation Electricians Mate Strand Class A1	Pensacola, FL
		EA-6B Initial Electrical and Instrument Systems Organizational Maintenance	Oak Harbor, WA
6336	Aircraft Electrical Systems Technician, KC-130	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Aviation Electricians Mate Strand Class A1	Pensacola, FL
		Electrical Technician Initial Accession	Little Rock, AR
6337	Aircraft Electrical Systems Technician, F/A-18	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Aviation Electricians Mate Strand Class A1	Pensacola, FL
		F/A-18 Electrical/Instrument Systems (Initial) Organizational Maintenance	Pensacola, FL/Virginia Beach, VA
6338	Aircraft Avionics Technician, F-35B	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Aviation Electricians Mate Strand Class A1	Pensacola, FL
		F-35 Aviation Electricians Mate Strand	Pensacola, FL
		F-35B Aircraft Avionics Systems Technician	
6386	Aircraft Electronic Countermeasures Systems Technician, EA-6B	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Avionics Technician O Level Class A1	Pensacola, FL
		EA-6B ECM Initial Organizational Maintenance	Oak Harbor, WA
6391	Avionics Chief	N/A - must complete requirements for one of the PMOSs within 63XX or 64XX fields	N/A

Table 12. 64XX: I-level avionics required MOS training. Adapted from USMC (2013).

MOS	Title	Required MOS Schools	Location
6414	Advanced Aircraft Communications/Navigation Systems Technician		
6423	Aviation Electronic Micro/Miniature Component and Cable Repair Technician	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Aviation Electricians Mate Strand Class A1	Pensacola, FL
		Miniature Electronics Repair	San Diego, CA
6432	Aircraft Electrical/Instrument/Flight Control Systems Technician, Fixed-wing	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Aviation Electricians Mate Strand Class A1	Pensacola, FL
		Aircraft Electrical/Instrument Intermediate Maintenance (IMA)	Cherry Point, NC
6433	Aircraft Electrical/Instrument/Flight Control Systems Technician, Rotary wing		
6434	Advanced Aircraft Electrical/Instrument/Flight Control Systems Tech		
6469	Reconfiguration Transportable Consolidated Automated Supported System (RTCASS) Technician	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Avionics Technician I Level Class A1	Pensacola, FL
		USMC Cass High Power Configuration Operator/Maintainer/Technician	San Diego, CA/Virginia Beach, VA
6483	Communication/Navigation/ Cryptographic/Countermeasures Systems Technician	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Avionics Technician I Level Class A1	Pensacola, FL
		Helicopter Deceptive Electronics Countermeasures Intermediate Maintenance	Cherry Point, NC
6492	Aviation Precision Measurement Equipment (PME) Calibration/Repair Technician	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Avionics Technician I Level Class A1	Pensacola, FL
		Aviation Basic Calibration Technician Pipeline	Biloxi, MS
6499	Mobile Facility Technician	AWAT	Pensacola, FL
		Marine Avionics ATT	Pensacola, FL
		Aviation Electricians Mate Strand Class A1	Pensacola, FL
		Mobile Maintenance Facilities Program	San Diego, CA/Jacksonville, FL

Due to the length of training these schools require, Marines holding 63/64 MOSs are required to complete a five-year contract, while 60/61/62 MOS Marines are expected to complete four years of initial service. Once an enlisted aviation maintenance/avionics Marine joins the operating forces, she is either a Pvt or a PFC. As they continue learning and working in their respective work centers, become promoted to Cpl, and given how well they perform, they will become eligible to complete the CDI training syllabus. Once CDI certified, the Marine will have another year or two continuing to learn and completing CDI tasks/responsibilities. This is the first decision point she encounters: re-enlist for another

four years or separate. Should she continue serving, she will keep working in maintenance departments, and once they promote to Sgt and are deemed the "right" caliber of Marine to hold a second-tier aviation maintenance qualification, she will be certified as a CDQAR. The Marine will then encounter his/her second decision point. At this time, she will have 9–10 years of service on their record. Continuing to serve will bring her closer to obtaining the QAR certification. The Marine will most likely have been promoted to SSgt. During the second and third re-enlistment contracts, these Marines are eligible for special duty assignment: recruiting duty, drill instructor, or MCT instructor. Marines are well aware of these opportunities and must consider the possibility of being selected, taken out of their primary occupation for an entire enlistment period, and having to retrain once they return to their MOS, when deciding whether or not to re-enlist. However, they are still eligible to obtain aviation maintenance qualifications. Figure 5 is a visual depiction of an enlisted aviation maintenance/avionics Marine's potential career progression, with decision points. It starts with at a Marine's first duty station and ends with retirement.

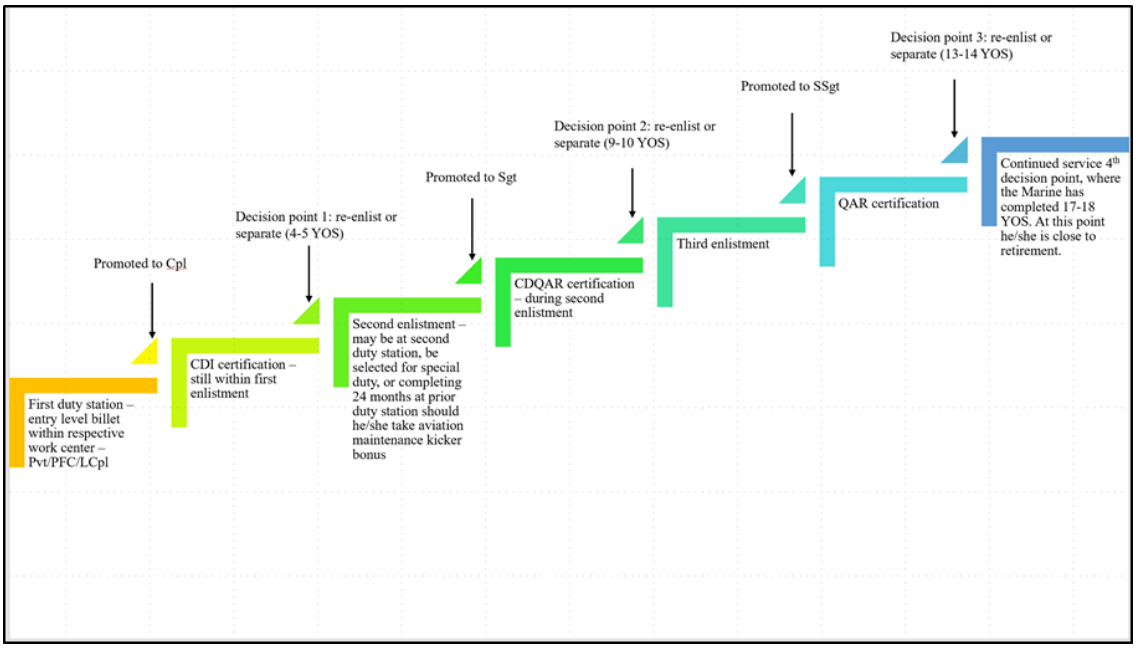

Figure 5. Enlisted aviation maintenance/avionics career progression

B. AVIATION MAINTENANCE IMPACT ON AIRCRAFT READINESS

The other sections of this chapter provide wide-lens information regarding aviation maintenance, department composition and responsibilities, the MOSs comprising the occupational field, and the CDI, CDQAR, and QAR certification process to identify the level of support and training these Marines undergo to ensure the Marine Corps can complete aviation operations.

Per the CNO, aircraft readiness goals are 73 percent mission capable (MC) and 56 percent full mission capable (FMC) across naval aviation (USN, 2017). Each T/M/S has more specific aircraft readiness goals, which are defined by the mission essential subsystem matrix (MESM). "Overall … aircraft readiness is calculated as an average from specific T/M/S MC and FMC rates" (USN, 2017). To fulfill these goals, there are 72 MOSs filling aviation billets in 69 operational squadrons and 12 I-level aviation maintenance activities, supporting over 500 aircraft during training and deployed operations. Due to quantity of aircraft the Marine Corps needs all those MOSs to keep squadrons operational. However, it needs the expertise of CDIs, CDQARs, and QARs to maintain high aircraft readiness of these intricate and diverse weapons systems. "Historically, aviation readiness has been inextricably linked to qualifications and designations of our personnel" (United States Marine Corps (USMC), 2018).

This claim is supported by a prior study where the authors observed the effects enlisted aviation maintenance qualifications have on aircraft readiness. As with this thesis, they focus on CDI, CDQAR, and QAR certifications of aviation maintenance Marines supporting heavy (CH-53), light/attack (UH/AH-1), and tiltrotor squadrons (MV-22). The authors use multivariate statistical modeling to determine that these qualifications "have a positive effect on MC readiness. The advancement of qualifications in a USMC squadron is a linear progression" (Germershausen & Steele, 2015). The authors find as an aviation maintenance Marine progresses through the qualification levels (from CDI to CDQAR to QAR), the magnitude of his/her impact on readiness increases (Germershausen & Steele, 2015). They conclude, overall, aviation maintenance qualifications have a positive impact on aircraft readiness, of studied helicopter squadrons, and recommend that Marine Corps

manpower align its re-enlistment and retention goals with these qualifications directly considered (Germershausen & Steele, 2015).

C. SELECTIVE RETENTION BONUS PROGRAM

For the FY18 SRB program, Marine Corps manpower leadership exercised this recommendation via the aircraft maintenance kicker. "All Corporals through Gunnery Sergeants holding current qualifications of … CDI … CDQAR … QAR … who reenlist for 48 months … will rate a 20,000 kicker in addition to the PMOS bonus amount listed" (Steele, 2017). This initiative was the means to meet goals set by senior leadership within the aviation community—to retain highly trained aviation maintenance Marines as they greatly impact aircraft readiness.

A previous DC, A stated one of the lessons he learned is "that it is imperative to have high-quality, highly trained, motivated and incentivized Marines in the right qualification density to meet and exceed our readiness requirements" (Schogol, 2017c). The DC, A further emphasized this point by stating "One of the Corps' top priorities should be retaining enough of its most experienced enlisted maintainers" (Schogol, 2017c). An urgent push to retain these highly qualified aviation maintenance Marines is to shift the aviation maintenance culture back to highly trained and extremely safe. A rise in aviation ground mishaps is a consequence of this shift of aviation maintainers out of the Marine Corps. Other factors contributing to the rise in mishaps include inadequate technical expertise, lack of safety expertise in the squadrons, and administrative tasks saturating already high-volume workloads (USMC, 2018). These sentiments were made reality with the current DC, A's MOS initiative, published in the 2018 Aviation Plan. This program "will improve our readiness through increased visibility of trained and experienced personnel. The MOS initiative will inform assignment, retention, and promotion processes in an effort to optimize the return on investment in Marine aviation training" (USMC, 2018). Thus, creating the aviation maintenance kicker published in last fiscal year's SRB program message.

1. Design

The reason the SRB program was chosen as the method to complete this goal is due to its design. "SRBs … are monetary incentives paid to enlisted members at the time of re-enlistment to assist in attaining and sustaining the requisite number of career enlisted personnel in designated … PMOSs" (USMC, 2016). The Marine Corps wants to shrink the gap between supply of re-enlistees compared to demand for them, so what better means than a program created just for that reason. Another reason this program was utilized is due to aviation maintenance CDI, CDQAR, and QAR qualified Marines meet the requirements for an SRB designation.

1. The critical personnel shortage in a particular PMOS with respect to at least three of the preceding year groups, as defined by Headquarters Marine Corps (HQMC).
2. The potential impact of the critical personnel shortage on the mission of the Marine Corps.
3. The degree to which retention in particular PMOS does not meet established retention objectives.
4. The high cost of training associated with the PMOS.
5. The relatively arduous or otherwise demanding nature of the PMOS, as compared to other military or civilian alternatives.
6. The degree to which retention is likely to improve in this reenlistment or extension category, as compared to the overall cost of the bonus in a particular PMOS.
7. The high demand for the skill associated with the PMOS in the civilian labor market (USMC, 2016).

2. Zone Eligibility

Where these bonus pays come into effect is at decision points, like those present in Figure 5 (p. 27). After an enlisted Marine's first-term, around the 4/5-year mark, she must decide to re-enlist or separate. If the Marine is eligible for an SRB, that decision is weighted more heavily because now the Marine has to decide, does she want extra money to retain for another 4 years, or take her chances in the civilian labor market. The SRB program categorizes enlisted Marines based on years of service. First-term Marines are those

enlisted members with their decision point at the 4/5-year mark. The SRB program designates them into zone A. "17 months to exactly 6 years active service" (USMC, 2016). The extra year past the normal contract length are for those enlisted Marines who may have served in another branch of the armed forces and transferred to the Marine Corps, or Marines who started their contract time in a different MOS, but laterally transferred to a new one, accumulating an additional year of service due to training. The second decision point faced is by zone B Marines. "6 years and 1 day to exactly 10 years total active service." Decision point three is those comprising zone C. "10 years and 1 day to exactly 14 years of total active service." After another contract zone D enlisted Marines must decide to separate after about 14 years of service or attempt to continue until retirement. "14 years and 1 day to exactly 18 years of total active service." Should a Marine retain to decision point 5, she is close to retirement. Zone E Marines are those with "18 years and 1 day to exactly 20 years of total active service" (USMC, 2016). SRBs are designed to cover every re-enlistment decision point an enlisted Marine may face.

3. Amounts and Payment

The SRB program has criteria limiting the bonus amounts an enlisted Marine is eligible to receive and how it must be paid. The first stipulation is Marines are allowed only one bonus per re-enlistment zone. So, if a zone A Marine takes up a bonus, she is not allowed to opt in to zone A bonus if she re-enlists a second time. SRBs are subject to other criteria, as well: payment caps, must be paid in lump sum amounts, eligible PMOSs and zones will be published, an SRB amount cannot exceed $100,000, and enlisted members may be eligible for more than one bonus (FY18 certain aviation maintenance Marines were eligible for PMOS bonus and the aviation maintenance kicker bonus), but the total combine amounts of the bonuses over the course of a Marine's career cannot exceed $200,000 (USMC, 2016). Figure 6 depicts how SRB caps have changed over the past decade. These changes could be considered the Marine Corps response to retention problems. Raising the total amount an enlisted Marine may be eligible to receive makes re-enlistment a more enticing option.

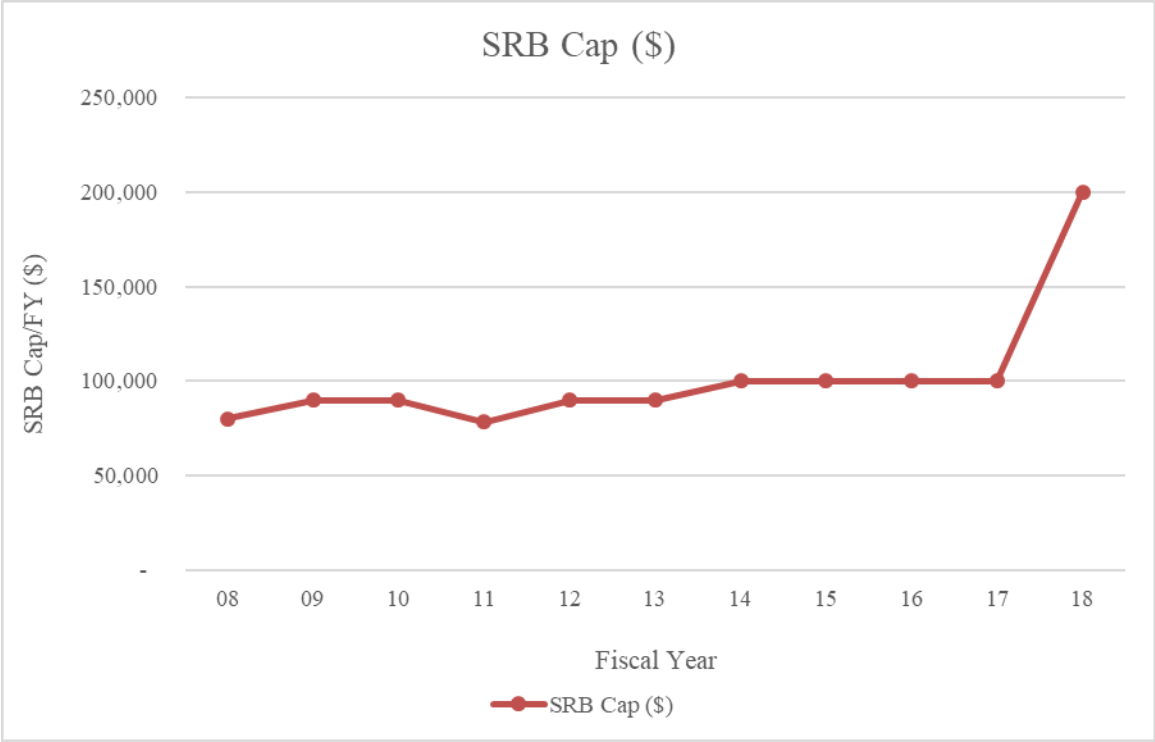

Figure 6. Changes to SRB cap amounts

After eligibility zones, skills, and PMOSs and SRB amount caps have been determined. The Marine Corps designates what each zone, PMOS, and skill is eligible to take-up. To determine these amounts the Marine Corps uses a "The pre-tax flat rate SRB amounts … based on the Marines reenlistment Zone, the Marines grade on the date of reenlistment, the PMOS for which the Marine is reenlisting, and the kicker or initiative the Marine selects (if any)" (Steele, 2017). Unlike the SRB multipliers other service branches use, the one the Marine Corps opts for does not change the amount a Marine is eligible to receive based on years of service or the amount of the time she may re-enlist. Table 11 details which PMOSs, respective zones, and SRB amounts certain enlisted Marines are eligible to take-up, as of FY18.

Table 13. FY18 SRB zones, PMOSs, and amounts. Adapted from Steele (2017).

	Zone A			Zone B		Zone C	
PMOS	E3	E4	E5 ≥	≤ E5	E6 ≥	E6	E7 ≥
6062						$ 7,500	$ 8,250
6114				$ 6,000	$ 6,750		
6116	$ 12,750	$ 14,500	$ 16,000	$ 6,000	$ 6,750		
6156	$ 12,750	$ 14,500	$ 16,000	$ 12,250	$ 13,500		
6217				$ 12,000	$ 13,250		
6218	$ 4,250	$ 4,750	$ 5,250	$ 6,000	$ 6,750		
6257	$ 12,750	$ 14,500	$ 16,000	$ 12,000	$ 13,250		
6258	$ 4,250	$ 4,750	$ 5,250	$ 6,000	$ 6,750		
6286				$ 12,250	$ 13,500		
6287						$ 7,500	$ 8,250
6288	$ 8,500	$ 9,750	$ 10,750	$ 6,000	$ 6,750		
6314	$ 4,250	$ 4,750	$ 5,250	$ 6,000	$ 6,750		
6316	$ 4,250	$ 4,750	$ 5,250	$ 6,000	$ 6,750		
6317				$ 6,000	$ 6,750		
6324				$ 6,000	$ 6,750		
6326	$ 8,500	$ 9,750	$ 10,750	$ 6,000	$ 6,750		
6336				$ 6,000	$ 6,750		
6337				$ 6,000	$ 6,750		
6338	$ 4,250	$ 4,750	$ 5,250	$ 6,000	$ 6,750		
6423				$ 6,000	$ 6,750		
6432				$ 6,000	$ 6,750		
6469				$ 6,000	$ 6,750		
6492				$ 18,250	$ 20,250		
Aviation maintenance kicker		$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000

Columns headed with designators such as E5 ≥ are shorthand for enlisted Marines holding the rank of E5 or above. For those columns headed with a label like ≤ E6 identifies those enlisted Marines holding ranks of E6 or below. The amounts listed under each zone correlate to PMOS codes listed in the first column. Any blank areas before and/or after those amounts identifies those PMOSs are not eligible for bonuses at different zones. The last row of the table identifies the aviation maintenance kicker bonus E4—E7 are eligible to receive should they hold a CDI, CDQAR, or QAR certification, thus correlating to the ranks listed at the top of the table.

Appendix A has tables similar to this. These tables depict the same type of information just for the remaining fiscal years studied in this thesis. Training these Marines cost the Marine Corps money and time, and they possess skills the civilian labor market desires. The only means the Marine Corps currently has of competing with external firms is to induce re-enlistment through bonus pay.

This chapter provides background information explaining personnel supply problems within Marine Corps aviation maintenance; composition of the three maintenance levels; the various MOSs comprising aviation maintenance and their responsibilities; training progression for each MOS; the CDI, CDQAR, and QAR certification process and responsibilities of each qualification holder; aviation maintenance impact on readiness; and the SRB program's purpose and guidelines. This information sets the foundation for Chapter II by identifying the highly technical fields comprising aviation maintenance and bonus pay programs used to induce re-enlistments.

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III. ACADEMIC LITERATURE REVIEW

Chapter II details aviation maintenance and the MOSs responsible for maintaining Marine Corps aviation assets. It also delved into the qualifications aviation maintenance Marines are eligible to obtain, and how these certifications positively impact aircraft readiness. Chapter I explained the primary question of this study, which is how bonus pay elasticities affect re-enlistment rates, or retention. Past studies presented in this chapter not only give details about analytical processes used to design the empirical frameworks used for this research, they also provide economic theories affecting retention within the military. The chapter divides these studies into three categories: reasons for separation; the effects of compensation on retention; determinants of the quantity and quality of re-enlistments.

A. REASONS FOR SEPARATION

1. Survey Responses

After the completion of a fiscal year, personnel within HQMC's manpower office compile and analyze end of active service (EAS) survey results. These questionnaires originally started in FY05 to determine Marines' overall satisfaction with the Marine Corps and military life, as well as find factors that influence retention the most. The target population of these surveys are those active duty Marines, regardless of MOS, in zones A through C who have separation dates in the respective fiscal year (United States Marine Corps, 2015). The zones focused on include enlisted Marines at critical points in their careers, and are the population targeted by SRB programs. Yearly SRBs express bonus pay amounts based on eligibility, which is determined by a Marine's zone and other factors spelled out in the SRB MARADMIN.

Within the survey, Marines are asked to rank reasons driving an individual's decision to separate and reasons causing them to be more likely to re-enlist. The number one reasons influencing a Marine's decision to not re-enlist are civilian job opportunities (United States Marine Corps, 2015). This ranking did not change between FY15 and FY16, but the overall percentage of those Marines stating they are not likely to re-enlist increased

7 percent between the fiscal years (United States Marine Corps, 2015). While only 7 percent of respondents completed the survey, other studies were found describing the same factor influencing retention.

An article in the Marine Corps Times reporting on the FY15 EAS survey and trouble manpower planners were having in the beginning months of FY16 inducing Marines to re-enlist, also points to civilian job opportunities as strong contributor to Marines' lack of interest in continued service (Schogol, 2017c).

> Fewer first-term Marines are signing on for a second re-enlistment compared to this time last year.… The Marine Corps is making slower progress towards re-enlistment targets for fiscal year 2016. … But re-enlistment intent is on the decline across the enlisted ranks, according to the results of the 2015 EAS Enlisted Retention Survey. Of more than 4,200 Marines who took that survey, 38 percent said they were unlikely to sign on for another term, up 7 percent since 2013. Respondents listed civilian job opportunities … as … the top reason influencing their decision to leave the Corps. (Schogol, 2017c)

A second article also describes the same findings as presented in the Marine Corps Times article and FY16 EAS Enlisted Retention Survey. The article being published at the beginning of FY16 breaks down the FY15 EAS survey results, "the very first reason is 'civilian job opportunities.' This is a perennial problem for the military ever since the all-volunteer force debuted in the 1970s. The military is often at the mercy of the economic cycle. When there are more jobs on the outside, fewer people want to be on the inside" (United States Marine Corps, 2015).

2. Alternative Opportunities: The Civilian Economy

a. "An Analysis of Staffing and Special and Incentive Pays in Selected Communities" Study

The first study supporting the survey results is a chapter of the 11th Quadrennial Review of Military Compensation. While the review does not focus on the occupations studied in this thesis, those jobs it studies face the same retention problems. The jobs mentioned in the review include highly trained individuals (which is costly to the DoD) that bring a high level of expertise and knowledge to their respective fields, but also suffer from high turnover rates. The authors of the Quadrennial Review analyze special and

incentive pays in these specialized communities: special operating forces (SOF), mental health professionals, linguists/translators, and remotely piloted vehicle (RPV) operators (Hogan et al., n.d.). Their methodology includes analyses of recruiting and retention experiences, civilian labor market alternatives using annualized cost of leaving (ACOL) models, and retention incentives. The authors collect historical and current pay, personnel, and bonus information, as well as individual community manning problems, civilian labor market supply and demand, and bonus pay response behavior (Hogan et al., n.d.).

When conducting their analyses, the authors use past literature to help guide their study to determine special and incentive (S&I) pays are 5 percent of total compensation. These pays help manpower planners structure the force to meet mission and end strength requirements by targeting specific occupations rather than the entire group. The criteria the authors apply to S&I pays to six categories: "extraordinary civilian earnings opportunities, high training/replacement costs, rapid demand growth, onerous or dangerous conditions of service, special skills and proficiency, and performance and productivity," none of these being mutually exclusive (Hogan et al., n.d.). Their analytical methods include SRB and career pay marginal costs comparisons, identification of civilian opportunities—presence of direct correlations between military and civilian occupations or highly sought skills if there is no comparison, expected growth in occupational fields, and review of workplace environments.

As stated previously, the four occupational fields the review analyses are mental health, linguistics/translations, RPV operations, and SOF (Hogan et al., n.d.). Within the mental health profession, the authors find an increase in labor demand with a need for psychiatrists increasing by 10–12 percent for the Navy, Army, and Air Force. They also find non-physician officer specialties were also growing by 25–40 percent across those same services; and individuals in this profession receive military pay, including bonuses, equivalent to or greater than median civilian earnings (Hogan et al., n.d.). They conclude "retention rates for most mental health specialties are adequate, though retention rates for Navy enlisted and some officer specialties are below those of the other services. Current S&I pays appear to provide satisfactory incentives for managing the force." However, to

remain competitive and meet growth goals, the authors recommend the services "recruit trained professionals using loan forgiveness and accession bonuses" (Hogan et al., n.d.).

Within the linguistics field, the authors find compensation compares favorably with civilian alternatives, although there are shortages being experienced with the Navy and Marine Corps (Hogan et al., n.d.). These shortages are likely correlated to "substantial unmeasured differences in working conditions." The Marine Corps uses the Foreign Language Proficiency Bonus (FLPB) to maintain language proficiency levels, but this incentive does not target specific manning requirement well (Hogan et al., n.d.). The FLPB is simply a stipend added to a Marine's monthly compensation when she tests at specific skill levels. If the Marine scores a 1, she earns an additional $100 per month, with a maximum stipend of $500, based off maximum proficiency (Foreign Language Proficiency Bonus Installment Rates). As such, for the Navy and Marine Corps to have a more effective approach to linguist/translator retention a more aggressive use of SRBs should be implemented (Hogan et al., n.d.).

The SOF occupational field is expected to grow, with 50 percent increased demand for explosive ordnance disposal (EOD) technicians and 39 percent increased demand for SEAL officers (Hogan et al., n.d.). Retention remains high as long as unexpected economic improvements do not occur. Due to this, meeting future personnel requirements will rely more on increased training capacity rather than retention improvements via incentive pays (Hogan et al., n.d.).

Overall, the authors determine that direct civilian counterparts to military occupations affect retention if there is a large difference in compensation. SOF personnel are more likely to continue serving not only due to compensation, but also as a result of "high esprit de corps and commitment to mission" (Hogan et al., n.d.). RPV operators do not have a direct civilian job comparison but do have training and skills desired by civilian firms. Linguists and mental health professionals have high levels of training and experience that make them highly desirable by civilian firms, because those firms "poaching" employees from the military means they are receiving trained individuals and will not have the extra training expense.

b. "The Effect of the Civilian Economy on Recruiting and Retention" Study

The second chapter of the 11th Quadrennial Review studies the relationship between the civilian economy and an individual's probability to serve. The authors describe past studies identifying factors relating to military recruiting and retention and what events affect both (Warner, n.d.). While the study splits its findings into two categories: recruiting and retention, I present the authors' findings concerning retention, as this concept is the focus of this thesis. The first model used in this study was the ACOL framework. This model evaluates financial returns of staying versus leaving (similar to a net present value (NPV) calculation) over all possible future periods. An individual's decision to retain or separate is based on the period with highest value (Warner, n.d.). A positive value is indicative of an individual's preference to continue his/her military service; whereas a negative value indicates his/her favoring separation. The authors do recognize there is an unobservable taste-for-service factor that drives individuals' decisions, but as long as the maximum value is positive continued service is probable (Warner, n.d.).

The authors amend this simple model to be more applicable to panel data, or longitudinal data (n individuals over T periods), using the ACOL-2 model. "Introduction of random shocks at each decision point allows low-taste individuals to remain in service if they draw a 'good' shock and high-taste individuals to leave if they draw a 'bad' shock" (Warner, n.d.). The authors find high-taste personnel are more likely to retain than low-taste individuals, despite these "shocks," as this model accounts for this self-selection.

In this study, the authors expound on the Dynamic Retention Model (DRM). In this framework, "an individual with a given … taste for service evaluates the payoff to all possible future stay-leave sequences and makes a retention decision based on a weighted average of these payoffs compared to the payoff from immediate separation" (Warner, n.d.). Simply, it is a detailed combination the of ACOL and ACOL-2 frameworks. Using these frameworks, the authors conclude that retention rates are elastic with pay levels. "Holding constant civilian sector wage opportunities, a 10 percent increase in overall current and future military compensation is estimated to increase the supply of high-quality enlisted recruits by between 6 and 11 percent (Warner, n.d.). The authors determine such

a rise would increase first-term retention by 15–20 percent, second-term retention by 10–13 percent, and third-term re-enlistments by 5 percent (Warner, n.d.). This finding leads the authors to determine retention is sensitive to the state of the economy, which makes sense as military service may be viewed as a safety net when civilian opportunities are low.

The authors expound on this idea when they describe supply and demand constrained recruits. They state high-quality recruits—those with a high school diploma and an Armed Forces Qualification Test (AFQT) score greater than 50 (average score) are supply constrained, while low-quality—those individuals scoring less than 50 and may or may not have a high school diploma, as demand constrained (Warner, n.d.). High-quality recruits are more likely to be in more technical fields, thus having skills highly desired by civilian firms, resulting in a higher probability of having civilian job opportunities. Logically, this means these individuals are more susceptible to market factors and military/civilian pay opportunities. However, low-quality individuals are demand constrained because more can be recruited as needed. One example is when service branches were recruiting in high volume to sustain forces during Operations Enduring Freedom and Iraqi Freedom (OEF/OIF). Recruiters wanted high-quality individuals, but those people were either already serving or taking advantage of civilian opportunities. Since the military needed bodies, recruiters began signing low-quality individuals. Personnel in this category are less affected by the economy and are more likely to "require" less money to induce them to serve as their civilian opportunities may be less than their high-quality counterparts. While retention is susceptible to civilian economies, the authors determined "retention rates rise with experience and independently of compensation due to a sorting effect" (Warner, n.d.). Those with more experience have a higher taste for service, thus having higher retention. Since they have a higher taste and are more likely to retain, they are less likely to be swayed by compensation changes.

To make military service more competitive with civilian opportunities, inducing personnel to retain to higher experience levels, manpower personnel use incentive pays to target a specific group for retention. In the case of high-quality individuals, they would be the target population. The authors find retention is responsive to bonuses targeted at specific groups, while being cost-effective for the military (Warner, n.d.). This matches the

intent described in the Marine Corps' SRB program, as well as the goal current Marine Corps aviation leadership have of retaining high-quality individuals at the lowest cost.

B. EFFECTS OF COMPENSATION ON RETENTION

1. Elasticity

a. "Why Do Pay Elasticity Estimates Differ?" Study

The purpose of this Center for Naval Analyses (CNA) study is to examine variations in literature concerning enlistment supply pools and relationships between pay elasticities and changes in re-enlistment behavior (Hansen & Wenger, 2002). To determine pay elasticity is useful to manpower planners because "elasticities measure the 'responsiveness' of people to changes in pay, higher elasticities mean larger increases in reenlistment for a given pay change. More simply, percentage changes in re-enlistment behavior for every percentage change in pay or bonus amounts. Similarly, the marginal costs of achieving reenlistment targets depend heavily on the pay elasticity" (Hansen & Wenger, 2002). Using ACOL framework and a dichotomous logit model, the authors examine the compensation and retention relationship.

"In an ACOL model, 'pay' is the discounted difference between expected military compensation (if a person were to reenlist) and expected civilian compensation (if a person were to leave the Navy)" (Hansen & Wenger, 2002). The authors state the advantage of this model is "that it reveals the (person-specific) time horizon over which relative military compensation should be calculated" (Hansen & Wenger, 2002). Essentially, the ACOL framework gives insight into an individual's options at a decision point. Most literature involving ACOL models target base pay, subsistence and housing allowances, and retirement pay. The authors use this same method in their study, but use "predictions of promotion opportunities, future dependency status, and retirement pay" when predicting future military compensation (Hansen & Wenger, 2002). Further adjusting the model, the authors include variables reflecting willingness to serve and civilian labor market prospects. The first variable determining taste-for-service is expected sea-shore rotation, which relates to an individual's work environment. If she likes the environment, they are

more likely to re-enlist than those who do not like their place of work. ACOL models help the authors establish baseline expected compensations.

As the study continues, they use a standard logit regression model (this is a logistic function to model the odds of the dependent variable being 1 or 0. In this study and my research, 1 being re-enlisting and 0 being separating) to estimate the correlation between pay elasticities and retention (Hansen & Wenger, 2002). Interpreting the results of this model is not clear due to nonlinear relationships between explanatory and dependent variables. The authors then measure pay elasticity of reenlistment (Hansen & Wenger, 2002). The authors find "a 1-percent increase in basic pay leads to a 1.5-percent increase in reenlistment," and "a one-level increase in the SRB multiplier is associated with an increase in the reenlistment rate of 2.5 percentage points" (Hansen & Wenger, 2002).

The authors then examine how changes to explanatory variables affect the baseline estimates. First, they exclude individuals not eligible to reenlist. The pool of ineligible personnel is only 2 percent of the sample, so their exclusion from the model leaves the estimates unaltered. The authors suggest other reasons for this lack of change: the possibility of 'adequately controlled for demand differences' and "the true relationship between compensation and retention is identical for all Sailors, regardless of reenlistment eligibility" (Hansen & Wenger, 2002). Initially, race/ethnicity and age are included in only predictions concerning civilian compensation which yielded estimates 40 percent lower than those found in the baseline model. The authors state these findings match prior research suggesting "models using individual-level data are sensitive to the inclusion/ exclusion of these variables" (Hansen & Wenger, 2002).

Through all the models implemented in this study, the authors conclude "baseline… pay elasticity estimate of 1.5 and a one-level increase in SRB multiplier…increase re-enlistment by 2.5 percentage points" are comparable to past studies (Hansen & Wenger, 2002). However, using alternative specifications, the pay elasticities range from 0.4 to 2.9, spanning the variation found in past literature. The authors express since the same data was used to "estimate each alternative model, the variation in estimated pay elasticities do not reflect real changes in the responsiveness" of individuals to pay, "rather the differences in amount of responsiveness the models *attribute* to pay" (Hansen & Wenger, 2002). "Models

with smaller pay elasticities or reenlistment place more emphasis on other variables in their explanations of reenlistment behavior" (Hansen & Wenger, 2002). The authors conclude "pay elasticity of reenlistment has not markedly changed over time," but service members' "responsiveness to pay was different during drawdown years" (Hansen & Wenger, 2002). Knowing how pay elasticities affect re-enlistment, this thesis can then begin describing the two categories comprising military compensation: basic pay and bonuses.

2. Basic Compensation

a. "Military Compensation—Trends and Policy Options" Study

The authors of this study conduct their research to address DoD leadership's concern regarding military compensation and retention. The study reviews current pay and retention situations and analyze specific compensation policies (Rand, 2000). First, the authors assess the current military pay climate examining pay gap magnitudes and other factors affecting retention. The authors estimate the pay gap is at 13.5 percent, but this difference is "the *increase* of civilian pay since FY82 relative to the increase in basic pay since that date" (Rand, 2000). The period covered in the study is FY82 to FY99. Measuring the increase in civilian pay is determined by the Employment Cost Index (ECI). Changes to military pay are measured by an index of basic pay. The authors find the "annual percentage increases in basic pay have been the same regardless of rank or years of service" (Rand, 2000). The authors do discuss how the DoD uses a lagged ECI to track pay gaps. However, they discuss problems with using ECI for military/civilian wage comparisons: "ECI population is not representative of military in key dimensions: age, education, occupation; Civilian wages are known to change differently for different age, education, occupation groups; Therefor, to gauge civilian wage change relevant to the military, the index population should represent the military population; and ECI is a single index and cannot be tailored to groups of interest to the military, e.g., officers, enlisted" (Rand, 2000). This makes sense as the military does not change an individual's wages based on these mentioned characteristics, only when one is promoted to a higher rank.

Knowing how ECI does not facilitate an accurate apples-to-apples comparison, the authors construct a Defense Employment Cost Index (DECI), where the "weights reflect

the composition of active duty personnel by age, education, occupation, gender, and race/ethnicity" (Rand, 2000). The authors offer this new wage index offers a flexibility not available with ECI—now military pay gap estimates can be calculated for specific groups in the military. This allows for a determination of whether a gap for a particular "group is larger or smaller than an overall estimate, and therefore whether to expect more or less stress on retention" (Rand, 2000). The authors then estimate pay gaps for officers and enlisted members using the DECI. The study finds "a substantial difference between officers and enlisted personnel overall: no gap for enlisted personnel but a negative gap for officers. Most enlisted personnel have a high school education," and during the early 1990s wages for high school graduates grew minimally. However, for officers, the pay gap is 20 percent. "Their gap reflects the rapid civilian wage growth of college-educated workers" (Rand, 2000). The findings reflect fluctuating factor trends help determine pay gaps. "The positive gap for enlisted personnel in 1993–1997 means that since 1982 basic pay has grown 5 to 10 percent faster than civilian wages for workers with age, education, and occupations … similar to those of enlisted personnel. The gap computation does not assume that in 1982 enlisted pay *equaled* that of civilian counterparts" (Rand, 2000). The authors conclude that while military pay, during the study period, is above average, decision-makers need to be careful with long-term expectations. "The military wants to recruit and keep high-quality, well-trained personnel, yet military careers involve unusual rigors and at times extremely high risks. What the absolute pay comparisons include … is that to obtain the quantity and quality of personnel needed to meet the challenges of military duty, the services must pay well above the average" (Rand, 2000).

The authors expound on these pay gap estimates by comparing the pay gaps of junior (five or fewer years of service) and senior (those with more than five years of service) enlisted. Using the "mark of the modern military," the authors complete this comparison using education levels based on what is reported in Defense Manpower Data Center (DMDC), since modern militaries desire well-educated personnel (Rand, 2000). The findings include a "pay gap for junior personnel is positive … but the pay gap for senior personnel with some college is negative. This suggests that for junior personnel with intentions of getting further education … whatever pay advantage they enjoy would

dissipate if they remained in service after obtaining the education" (Rand, 2000). This suggests junior enlisted would be less incentivized to remain in service after acquiring their desired education level.

These findings support an incident I experienced. I worked with a Marine (a senior Marine by the study's definition, as he had 10 years of service) who completed his bachelor's degree, then separated a year later. He knew he had better civilian opportunities once completing his college education, thus inducing him to opt out of continued service.

Next, the authors review other factors affecting retention. The main area of concern for Asch and Hosek's study is the findings concerning employment opportunities because these add another factor-level to an individual's decision to re-enlist or separate. Due to economic expansion, new jobs have been created "driving the unemployment rate down from over 7.5 percent in 1992 to around 4.5 percent" in 1998 (Rand, 2000). "Low unemployment increases the odds of finding a job. As a result, a lower unemployment rate increases e*xpected* earnings in the civilian labor market" (Rand, 2000). The authors assume DECI findings "that military pay growth of junior personnel has not lagged civilian pay growth, there is all the more reason to believe that the low unemployment rate has been a factor that has hurt recruiting" (Rand, 2000). These findings support prior literature, discussed previously, focused on the effects of civilian competition on military retention. While past studies discuss that direct military to civilian occupation equivalents affect retention negatively, the "Military Compensation" study presents another aspect affecting civilian job opportunities: unemployment rate. Lower unemployment rates create more civilian job opportunities that may be more appealing to enlisted service members than continued service. This is especially true if civilian wages outpace military compensation.

b. "Military Recruiting and Retention after the Fiscal Year 2000 Military Pay Legislation" Study

This study summarizes the effects of pay legislation changes on military recruiting and retention. Responding to low retention in technical occupations and mid-careerists' unhappiness with the current retirement program, because it was less generous than its predecessor, TRIAD was implemented (Rand, 2002). This program is the result of the

FY00 National Defense Authorization Act (NDAA) that included three provisions related to military compensation: "each year basic pay would be increased by 0.5 percentage points more than the change in the Employment Cost Index…the basic pay table" was restructured "giving somewhat higher raises to more experienced members who reached a specific rank" more quickly than the average service member, eliminating certain "notches" in the pay table; and "allowed members covered by the REDUX and getting a $30,000 bonus at year of service 15 in exchange for a commitment to complete 20 years of service" (Rand, 2002).

The authors are concerned with high-quality recruits and junior enlisted/officer retention. Using past literature, the authors choose a pay elasticity "upper and lower bounds of 2.5 and 0.5," when estimating the effects of TRIAD on re-enlistment (Rand, 2002). Since pay increases are perceived differently by individual service members and a member may be undecided about her future in the military, future pay was discounted. "The discounting recognizes that a dollar tomorrow is worth less than a dollar today and the probability of staying in the military is less than one" (Rand, 2002). Past literature finds discount rates of 20 percent for enlisted personnel, so the authors of this study use this metric when computing the effects of increases to TRIAD on re-enlistment. This results in finding "the increase is greater for people making zone B reenlistment decisions primarily because they are closer in time to the $30,000 retirement bonus" (Rand, 2002).

Regarding military-civilian pay ratio elasticities, a decline in this value for zone A enlisted service members led to a predicted re-enlistment decrease from FY98-FY99 compared to prior fiscal years. However, under "TRIAD, with its larger increase in military/civilian pay, the increase in reenlistment from FY99 to FY00 is larger. The story is the same for zone B, except that predicted reenlistment did not decline prior to TRIAD" (Rand, 2002). So, junior enlisted members, zone A individuals, are more susceptible to changes in military compensation compared to civilian pay than zone B, because they are not as close to retirement or the benefit of a retirement bonus, as well as this point, they may determine there is a range of civilian job opportunities greater than military opportunities. Ultimately, the authors found increases in TRIAD pays and unemployment rates resulted in increased re-enlistment from FY00-FY01 (Rand, 2002).

As far as retention is concerned, the services find three sources: "robust civilian economy that provided attractive opportunities to military personnel, especially to well-educated individuals and individuals in highly technical areas. Demand for trained workers was unusually strong in certain sectors of the civilian economy, such as the airline industry" (Rand, 2002). Second, a large increase in peacetime deployments requiring separation of service members and their families to perform hostile duties affected retention. Finally, how the services managed decreases in end strength also affected retention (Rand, 2002). As a means to address retention concerns, the services use SRBs to increase the probability of enlisted members' re-enlistment.

The services track re-enlistment rates. These metrics are defined as "the percentage of personnel who reenlist or extend among those who reach a reenlistment or extension decision date within the 18-month period that begins at the start of the fiscal year" (Rand, 2002). The authors obtain E1-E6 retention rates from DMDC, and they independently calculate these rates for first-term (zone A) individuals. The authors amend the definition of re-enlistment rates to "the percentage of personnel who make a new obligation 25 months of more, relative to the population nearing the end of a service obligation and not extending" (Rand, 2002). Using this information, the study finds the retention rates of first-term Marines remained steady at 21 percent, between FY95-FY99. In FY00, the rate increased to 25 percent (Rand, 2002). The authors determine that "perhaps as a result of pay increases contained in the FY00 National Defense Authorization Act, *first-term* retention improved for the Air Force, Navy, and Marine Corps in FY00 and held steady for the Army" (Rand, 2002).

Not only did changes to basic pay positively affect retention, changes to bonus pay also affected retention. "The purpose of SRBs is to provide the services with the flexibility to respond to temporary changes in reenlistment rates, such as those resulting from cyclical changes in the civilian economy that alter the flow of personnel to the midcareer and senior ranks" (Rand, 2002). From past literature, the authors find the average value of bonus pays is 8 percent of average cash compensation, but despite this small monetary value, these incentives have a positive effect on retention (Rand, 2002). "Special pays help to maintain the stock … of personnel in different occupation areas by recognizing important

differences in their duty requirement, skill requirements" (Rand, 2002). As such, SRB budgets have grown, over the years, but have also expanded to include more skill areas eligible for bonuses. "Eligible skills have risen from 129 to 176 in the Marine Corps since 1997" (Rand, 2002). Since bonuses positively affect retention, the SRB program expanding to include multiple skills eligible for incentive pay would logically impact retention in a positive manner. As long as the military is able to maintain a high military/civilian pay ratio, or prevent it from reducing, and can continue leveraging SRBs, retention goals should be easily met.

3. Selective Retention Bonuses

a. "Cash Incentives and Military Enlistment, Attrition, and Reenlistment" Study

Prior studies, and the Marine Corps' SRB order, describe these incentive pays as a means to target specific occupations and/or skills enlisted members obtain during their service contracts. Military services use these bonuses to improve retention and meet re-enlistment goals, so incentive pays are a means to supplement basic military compensation to keep military opportunities competitive with civilian job opportunities.

The last study briefly discusses how SRBs had a positive impact on retention, this research further explores bonus effectiveness. The authors estimate a re-enlistment model using Army re-enlistment data from DMDC for the FY02-FY06 range (Rand, 2010). The authors generate a linear probability model of re-enlistment likelihood based off specific variables: SRB multiplier, if an individual received hostile fire pay, an individual's receipt of non-hostile pay for deployment, years of service, education level, gender, AFQT score, race, and rate of promotion (Rand, 2010). Through the analyses conducted in this study, the authors find an absence of incentive pays would reduce re-enlistment rates, and that bonuses actually increase the length of re-enlistment chosen (Rand, 2010). Enlisted soldiers are able to choose the lengths of their next contracts (2-4 years of service), should they continue serving. For services, like the Marine Corps, where re-enlistment length is not left to the individual, bonuses do affect an individual's willingness to re-enlist for an additional 48 months of service. The authors offer this effect of bonus on length of re-enlistment as

diminishing returns. “As the SRB multiplier increases, the length of obligated service increases, but at higher multiplier levels, the positive effect on the length of obligation decreases” (Rand, 2010). Regardless of SRB amounts, an individual will reach a point where benefits of high bonus pay are overshadowed by the length of obligated service. The authors discuss factors causing such an effect: bonus caps, limit the ability of individuals to choose service length, and flexibility.

Service members are aware of bonus caps. There is an excerpt from FY18’s bonus message explaining a Marine can receive no more than $200,000 in bonus pays, over the course of his/her career (Steele, 2017). An enlisted member deciding to separate or retain must account for bonus pays she may opt for this year and how that amount will affect future amounts, should incentives be offered. The Marine Corps also has the same policy the authors list as producing the diminishing effect of bonuses. Individuals are unable to choose contract length. In the bonus messages, Marines are informed should they take-up a bonus they must complete an obligatory 48 months of service. This means Marines do not have the same options as soldiers, where they can choose contract length based on the amount of bonus pay, they wish to accrue. As for the last factor, “re-enlistees faced with a higher multiplier may choose shorter term lengths that give them the flexibility to leave earlier to take advantage of civilian opportunities” (Rand, 2010). First-term Marines may have higher inclinations to take-up bonus amounts because what is an additional 4 years of service when one is 22. In the case of aviation maintenance Marines, they can have 8–9 years-experience and training, making them more appealing to civilian firms, receive a decent sized bonus, and still have civilian job opportunities before 30.

The literature discussion in the previous sections provide information to describe why enlisted Marines separate (competition from civilian labor markets) and how compensation (pay elasticities and SRBs) affects retention. Overall, the studies find re-enlistment rates increase with high military-civilian pay ratios, low competition from civilian labor markets, and increased bonus amounts, to a certain point.

b. Example of Military-Civilian Pay

I conduct a brief analysis of pay differences between military and civilian compensation for an E4 (Cpl) with 4 years' experience. I chose this rank because it is the average grade of an enlisted Marine at decision point 1, the first re-enlistment opportunity. After the first comparison, I add another level of variability by including dependents and changing the Marine's military compensation to reflect the additional money she would receive. The compensation with dependents includes basic pay, basic housing allowance (BAH), and basic allowance for subsistence (BAS) based on a Marine working aboard MCAS New River in Jacksonville, NC. I choose this location to pay homage to my first duty station. In the civilian sector, an avionics technician's median salary is $62,650. Her military compensation, without dependents is $28,440, per 2018 base pay rates. With the additional BAH, her military pay increases to $40,664, and including BAS her total compensation totals to $45,097. Table 12 compares what this Marine would earn were she to re-enlist (without and with dependents), if she took the PMOS and aviation (av) maintenance (mx) kicker bonus, the annual salary comparison at each year (assuming no changes in base pay or BAH), and the total after four years.

Table 14. Military-civilian pay comparison

MOS/Job	Dependents	PMOS bonus	Av. MX kicker	Pay	Y1	Y2	Y3	Y4	Total
6116	N	$14,500	$20,000	$28,440	$62,940	$ 28,440	$ 28,440	$ 28,440	$148,260
6116	Y	$14,500	$20,000	$45,097	$79,597	$ 45,097	$ 45,097	$ 45,097	$214,888
Avionics Technician	N/A	N/A	N/A	$ 62,650	$ 62,650	$ 62,650	$ 62,650	$ 62,650	$ 250,600

The rows identify a Marine's total earnings over a four-year period given she has no dependent (top), has dependents (middle), or not applicable as civilian pay does not adjust based on dependents (bottom). Pay is what she will receive annually: top row is base pay, second row is base pay plus allowances, third row is civilian pay in an equivalent job. Y1 is what she makes in year 1 if she takes the bonus and kicker. Y2-Y4 corresponds to pay since bonuses are paid in a lump sum.

Adapted from Defense Financial and Accounting Service (n.d.); Defense Travel Management Office (n.d.); Glassdoor (n.d.); Steele (2017); and USN (2017).

The totals are a simple sum. Use of NPV is applicable to show the thought process an enlisted Marine should have if she is at a decision point, but for the purposes of comparison I use addition. When accounting for dependents, the civilian job market does

not pay extra for spouses and/or having children, thus these table columns are labeled N/A. Pay is the annual salary the Marine earns given the controls-having dependents and bonus amounts, and Y1 is the total first year salary if she re-enlists or separates. The first row Y1 amount $62,940 is the total of the PMOS bonus, av. mx kicker, and pay columns. I use the same logic for the remaining observations. Y2-Y4 are what she earns in the remaining years. Again, this scenario is comparing what she makes if she re-enlists for an additional 4 years versus what she makes working an equivalent job in the civilian labor market. The total is the sum of all four years earnings. The differences in total earnings is apparent. As an enlisted Marine with no dependents, she earns $102,340 less than working in the civilian labor market, even with the bonus. The gap reduces if the Marine has dependents (Δ = $35,772), but potentially not enough to induce retention.

This example highlights what past literature presents and potential reasons why the Marine Corps is having retention issues, especially in highly technical fields. Per this example, an enlisted Marine earns almost two times as much money in the civilian labor market as she can re-enlisting for an additional four years. Other immeasurable factors do play a role in a Marine's decision to retain job satisfaction, such as overall satisfaction with the Marine Corps, flexibility of hours, etc., but compensation is a primary factor.

This chapter provides insight into past studies examining pay changes and bonus programs' effects on re-enlistment, as well as provides information on civilian market trends posing high levels of competition for military services and quality of service members dependent on times within a year they re-enlist. This information guides this thesis. Chapter III provides multivariate models and analyzes the results which examine how re-enlistment rates change over time, how re-enlistment changes with regards to changes in pay and bonus amounts, and quality of aviation maintenance Marines who re-enlist.

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IV. EMPIRICAL ANALYSIS

A. DATA

1. Data Sources

I put together panel data that includes Marines' re-enlistment, compensation, demographic characteristics, and job performance evaluations. Having data in panel form allows for a more comprehensive analysis of how a subset of Marines reacts to pay and bonus changes over time (elasticities); and how the quality of these Marines change during the study period. Longitudinal or panel data follows the same individual Marine. In the case of this study, re-enlistment, compensation, and evaluation information are panel datasets. My demographic data is in cross-sectional form with observations starting at the beginning of the study.

Each row in the dataset corresponds to an individual's information at the time of the information pull. The sample includes all aviation maintenance Marines (serving and separated) from fiscal years 2008–2018 but using only the latest personal information available in Marine Corps Total Force System (MCTFS). The final set of variables includes cross-sectional data of SRB payments, along with pay receipt dates. This dataset lists the total amount of bonus pays a Marine has taken up, so it is not broken down by monthly snapshots, preventing identification of bonus types taken. Total Force Data Warehouse (TFDW) provides the panel and cross-sectional data. TFDW stores monthly snapshots of Marines' personnel files from (MCTFS). MCTFS captures individual's training and personnel information. TFDW provides historical personnel information to facilitate my answering the study's primary question. I use historical base pay data, for all enlisted Marines over the study period, from Defense Finance and Accounting Service (DFAS). This data allows for military and civilian compensation comparisons and generating pay ratios that affect re-enlistment rates. The U.S. Bureau of Labor Statistics (BLS) provides historical median civilian salaries, from 2008–2018, for three broad occupational fields: avionics, aircraft service and maintenance technician, and aircraft structure, surface, rigging and systems assemblers (aircraft assembly for remainder of study). These are the

only aviation maintenance specific occupations in the historical pay charts, however, they are equivalent to the MOSs in the Marine Corps' aviation maintenance field.

2. Data Processing

I use most of the study's research period cleaning and coding data. I use Excel to create tables for information found on DFAS and BLS. I also use STATA to import all Excel datasets and text data, clean the information, and merge it into various files for analysis, creating three primary databases. The first is an individual re-enlistment data consisting of re-enlistment indicators, pay ratios, and personnel characteristics. The second dataset includes fitness report markings, proficiency/conduct averages, and re-enlistment indicators. This set includes officer information. Some of the observations may be prior enlisted, so fitness report data covers periods of enlistment and post-commissioning. I drop officer observations since the study focuses on enlisted personnel. The third set is strictly compensation information but includes military and civilian pays. Collapsing each dataset prior to running regressions mitigates the multiple entries each observation has, at a given point in time. For example, the original compensation dataset has monthly snapshots of individuals' compensation over the course of their service. So, person 1 may have 20 dates next to her identification number, while person 5 may have 100. The new panel provides information in fiscal year snapshots. Instead of person 1 having 20 observations, she now has 5 corresponding to service fiscal years.

a. Variables

(1) Demographic

Assuming demographic data play a role in a Marine's decision to re-enlist or separate, I include them in the models. The major variable in this data are PMOSs, in tables 1-5 (p. 16–27), especially the MOS code for CDI, QAR, and CDQAR, since the study focuses on how bonus pays affect the re-enlistment of Marines with one of these aviation maintenance qualifications. The numeric variable for the CDI/CDQAR/QAR MOS is 6018; I then create a binary indicator for the 6018 PMOS.

I include the following demographic variables as they are essential in determining what other aspects of a Marine's life affects re-enlistment decisions: age, years of service, rank, number of dependents, and binary indicators for: some college, bachelor's degree, master's degree, doctorates, female," "black, Hispanic, married, military spouse. " are all numeric variables.

(2) Re-enlistment and Pay

I then create re-enlistment eligible and re-enlisted binary variables using re-enlistment data. The re-enlisted variable equates to an occurrence when a re-enlistment date matches a date of re-enlistment eligibility.

I use monthly pay types to create a single compensation variable and generate a compensation plus bonus variable for all Marines who have total SRB amounts associated with their identification number. After merging these variables, I create pay ratios, dividing military compensation by annual civilian pay. All pay ratios and pay variables (including SRB caps) are numeric.

(3) Quality

I use the AFQT scores in the demographic data to create a quality binary variable. Per past research, "high-quality" individuals were those scoring above 50 on their AFQT, while "low-quality" are those scoring below 50. Working off this assumption, I create a quality variable categorizing Marines with AFQT scores of 50 or greater as "high-quality" and those scoring 49 or below as "low-quality." The AFQT score variable, in Table 15, is numeric and shows the range of scores for the sample.

(4) Descriptive Statistics

Although I specifically mention only a few variables in this section, most of the demographic information is crucial to include in the multivariate models in this study. Table 15 presents descriptive statistics of those variables most important to a Marine's decision to re-enlist or separate.

Table 15. Descriptive statistics of key demographic variables

	Observations	Mean	Min.	Max.
Age	320,126	27.158	17	57
		(5.934)		
AFQT Score	320,126	66.883	0	99
		(16.090)		
Aircraft Assembly Civilian Pay	320,146	50,488.050	43,600	55,400
		(3,592.468)		
Aircraft Assembly Mil/Civ Pay Ratio	320,146	0.741	-1.525	6.536
		(0.403)		
Aircraft Maint. Tech. Civ. Pay	320,146	58,244.080	51,650	62,540
		(3,531.766)		
Aircraft Maint. Tech. Pay Ratio	320,146	0.642	-1.294	5.611
		(0.349)		
Asian	320,126	0.025	0	1
		(0.155)		
Aviation Maintenance Qualification	320,134	0.008	0	1
		(0.091)		
Avionics Civilian Pay	320,146	58,054.210	49,360	63,650
		(4,458.543)		
Avionics Mil./Civ. Pay Ratio	320,146	0.645	-1.293	5.593
		(0.351)		
Bachelors Degree	320,126	0.031	0	1
		(0.173)		
Black	320,126	0.085	0	1
		(0.279)		
Doctorate	320,126	0.000	0	1
		(0.008)		
Eligible for Re-enlistment	320,126	1.990	1	2
		(0.099)		

	Observations	Mean	Min.	Max.
Female	320,126	0.063	0	1
		(0.242)		
Hispanic	320,126	0.159	0	1
		(0.366)		
Married	320,134	0.576	0	1
		(0.494)		
Masters Degree	320,126	0.003	0	1
		(0.057)		
Military Spouse - Active Duty	320,134	0.046	0	1
		(0.210)		
Number of Dependents	320,134	1.172	0	12
		(1.363)		
Rank	305,545	10.871	8	13
		(1.307)		
Re-enlisted	320,126	0.303	0	1
		(0.460)		
Some College	320,126	0.037	0	1
		(0.189)		
SRB Cap	320,146	109,543.000	0	200,000
		(39,049.060)		
SRB + Military Compensation	320,146	378.698	0	1,233,918
		(13,603.010)		
Total Military Compensation	320,146	37,359.410	77,829	343,341
		(20,389.910)		
Years of Service	305,545	7.522	0	35
		(5.717)		

b. Data Cleaning

I begin by cleaning the compensation data. There are 12 types of pay in the compensation data, so for analysis I combine certain categories. I also aggregate total annual pays across snapshot month for each year, per person. Once complete, I merge compensation data into the demographic dataset.

Using this new database, I create demographic variables for analysis. I drop variables whose values are mostly missing (e.g., assigned and future billet codes). Marital status includes married, widowed, divorced, separated, single, and annulled, so I create two categories: married and single. Those individuals listed as widowed, divorced, separated, single, or annulled are all grouped as single. I generate indicators for whether the military spouse is in the active forces, reserves, or National Guard. Race and ethnicity variables are cleaned and categorized into white, black, or Asian; and ethnicity as Hispanic or non-

Hispanic. I then codify education variables into indicators for: less than a high school education, high school diploma, GED, some college, Bachelor's degree, Master's degree, or a Doctorate.

Re-enlistment data is the third dataset I clean. This set includes pay entry base date (PEBD), re-enlistment dates, armed forces active duty base date (AFADBD), expiration of current contract (ECC) date, and snapshot dates, which I convert from string variables to numeric. I translate the re-enlistment eligible, source of entry, and present grade variables from string to numeric. The source of entry variables corresponds to an enlistment a Marine is serving (first, second, third, etc.) and I use these to create zones corresponding to the ones in the SRB Program (United States Marine Corps, 2016).

Fitness report data is the final dataset I clean. I create new variables for rank, report occasion, fitness test scores, MOS, duty type, adverse report, special case report, and commendatory material report. I generate first, second, and third-class physical fitness test (PFT) and combat fitness test (CFT) variables using actual scores in the data. Each duty assignment is broken down into one of six categories: school, combat/joint deployment, combat deployment, joint billet, peacetime billet, or MEU/MAGTF deployment. Then, I create variables identifying whether a Marine has a recommendation for accelerated promotion, promotion with peers, or no promotion. I also translate report average, report high, average, and observation period to numeric variables after all other cleaning is complete. Once each Excel sheet is clean, I merge them into one master dataset for analysis.

c. Creating Analysis Variables

Since analysis of pay is in the fiscal year timeline, I create fiscal year variables and array the panel data with respect to fiscal year as opposed to calendar year.

My first set of analyses focus on re-enlistment rates at the aggregate level. For this level of analysis, I generate the denominator as the maximum number of re-enlistment eligible Marines in a fiscal year. The numerator is the sum of Marines who re-enlisted over the fiscal year-month. I then calculate the re-enlistment ratio by dividing the number of who re-enlist that fiscal year-month by the total number of eligible to re-enlist over the fiscal year. Then, I calculate pay ratios. I merge annual civilian pay into the master

demographic-compensation dataset after I extract fiscal years and fiscal year-months from snapshot dates. Then I add SRB maximum amounts to this master file, and I finish collapsing the set into a more streamline panel dataset. Each observation corresponds to one Marine's fiscal year of total compensation value and maximum demographic values. After, I generate a bonus total by adding the compensation total and an SRB amount, if one exists. Then, I calculate three pay ratios using avionics civilian pay, aircraft service and technician civilian pay, and aircraft assembly civilian pay. I then divide total compensation by each pay to create a respective military-civilian pay ratio. Once all cleaning and coding is complete, I begin the multivariate analysis.

B. MULTIVARIATE REGRESSION ANALYSIS

1. Multivariate regression analysis method

Multivariate linear regression (MLR) analyzes the relationships between two or more variables by fitting a linear equation to the data. These types of regressions use explanatory variables (independent characteristics) to help explain variations in the dependent variable, or the outcome.

Outcomes of MLR include estimates, signs, and statistical significance. I use these same aspects to interpret the results of the regressions. The sign identifies whether an explanatory variable causes the dependent variable to increase or decrease. The estimate tells the magnitude at which the dependent variable will change per a 1 unit change to an explanatory variable, holding all other independent variables constant. The statistical significance relies on the independent variable's p-value. P-values have thresholds of 0.05, 0.01, and 0.001, indicating the degree of confidence the explanatory variable is statistically significant. The remainder of this chapter discusses the three aspects the researcher studies with regards to re-enlistment and quality of Marines.

2. Re-enlistment Rates

a. Findings

Through graphical and MLR analysis, this study finds time of year and personal demographics correlate to re-enlistment odds of Marines eligible to re-enlist. The models

show which variables consistently correlate to statistically significant changes in re-enlistment odds. Between both quarters, increased AFQT score and levels of education make the odds of re-enlistment less likely than a Marine with high school diploma or a Marine with a low AFQT score. This follows what I found in the literature. Individuals with high AFQT scores tend to be in more technical fields which tend to have more opportunities outside the military. The skills learned in the highly technical fields are transferrable to an equivalent civilian job, should it exist. The human capital aspect is also promising to civilian firms because hiring a trained military member negates the need for training once in the civilian firm. The firm saves time and money. Higher levels of education also correlate to greater job opportunities. A Marine with an undergraduate or postgraduate degree has potentially better opportunities in the civilian market than in the military because the Marine Corps may not regard civilian education as highly as it does professional military education.

Models for both quarters identify being married, the number of dependents, years of service, rank, fiscal year, and holding an aviation maintenance qualification correlate to higher odds of re-enlistment. Continuing to serve means a Marine's family continues to have free health and dental care. Housing and food allowances continue, and other services remain open to a Marine's family should she re-enlist. Family care correlates to increasing re-enlistment likelihood. Increased rank and years of service push a Marine closer to retirement, so she continues re-enlisting to obtain a retirement pension. Increased fiscal years are equivalent to increased years of service. The more a Marine serves, the closer she is to retirement.

Differences between the models show being African American is statistically significantly increasing the odds a Marine re-enlists during the first quarter, but not during the last quarter. This change identifies African American Marines may be more motivated or higher quality than white Marines, so they re-enlist early. Being female also changes in statistical significance, between the two quarters. At the first of the year, women are not statistically significantly more or less likely to re-enlist than men, but during the last quarter women have higher odds of re-enlisting. Maybe, women family plan during the first of the year and start those families during the later part, so re-enlistment becomes more likely to

secure a job and benefits. Being Hispanic also changes the likelihood. In the first quarter, Hispanic Marines have higher odds to re-enlist than non-Hispanic Marines, but during the last quarter of the year the odds are lower. Potentially, Hispanic Marines are more motivated to re-enlist early, so fewer re-enlistments occur at fiscal year's end.

b. Graphical Analysis

The primary question of this study asks how changes to bonus amounts (elasticities) affect retention rates. The study covers the period of 2008–2018, researching fluctuations in re-enlistment and bonus amounts as the Marine Corps adjusts its force structure. For the remaining analyses, all Marines are from the aviation maintenance occupational field, but I refer to individuals as Marine to reduce confusion and redundancy when speaking of aviation maintenance qualifications. I first create graphs representing how re-enlistment rates vary over the course of a fiscal year, for each zone. Chapter I states zones are what the Marine Corps uses to determine bonus eligible populations. Zone A are generally junior Marines (E1-E4) completing their first enlistment, zone B (E5/E6) complete a second enlistment, and so on, until zone E (E7/E8) where senior enlisted complete a fifth enlistment and potentially retain past 20 years of service. Appendix B contains the graphs for this portion of the study. Figure 7 is the average monthly re-enlistment rate of zone B Marines during FY08.

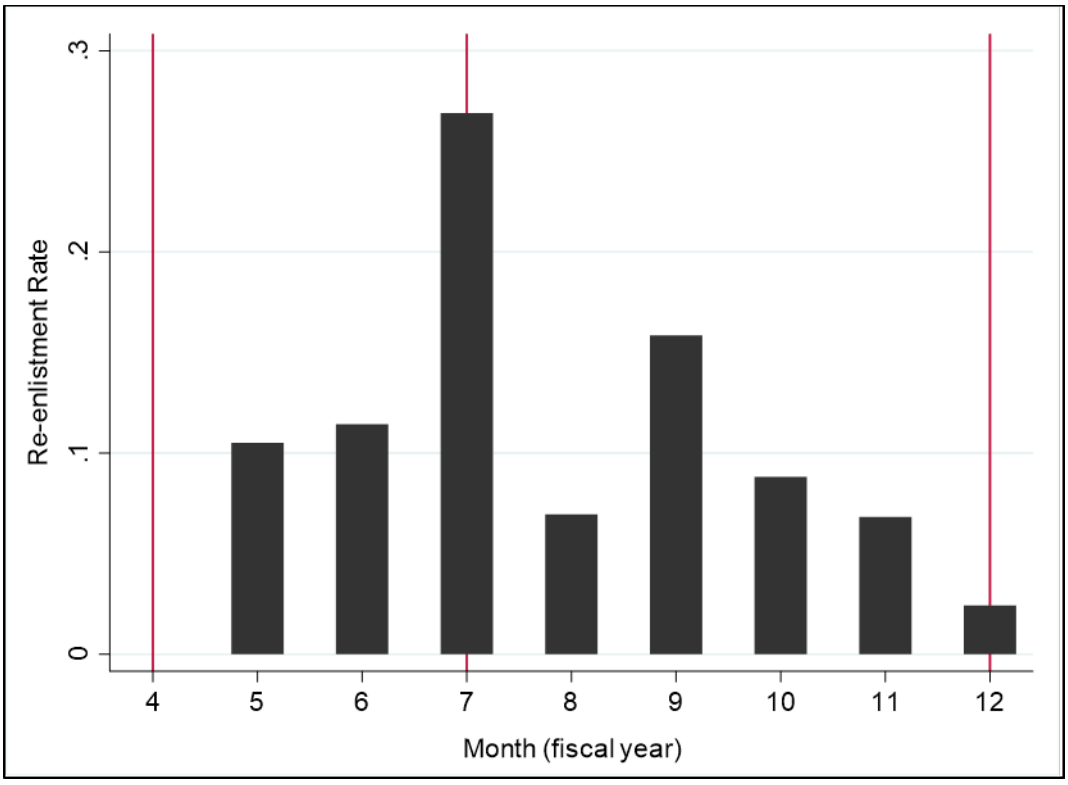

Figure 7. Zone B re-enlistment rates

Appendix B does begin with zone A re-enlistment rates, but the lack observations is not conducive for observing trends. Re-enlistment rates for zone A are so low due to the data. The average age of Marines in this data set is about 27-years-old, which means the average Marine in the sample is older than an average first-term Marine. The data contains numerous observations that have separated after one enlistment. Between these two factors and average years of service being higher than 4, the number of zone A re-enlistments is low. Since the dataset may be older, zone A re-enlistments only occur during the first two fiscal years displayed in Figure 6. My remaining graphs in this appendix examine re-enlistment rates for zones B-E. Since it progresses over a fiscal year, month 4 is January and month 12 is September. This same logic applies to all graphs in appendix B. Generally, the red lines correspond to times throughout the fiscal year the Marine Corps stopped bonus pays for specific MOSs due to meeting re-enlistment goals. In this figure, the line at month 4 corresponds to when the Marine Corps stops all bonuses due to no National Defense Authorization Act (NDAA) approval, as a result of the continuing resolution. However,

NDAA approval occurs at the end of January and bonus pays resume. Month 7 is the first cut-off date for FY08 bonuses. Zone A Marines in specific aviation maintenance MOSs are no longer eligible for those bonuses but can continue re-enlisting. The line at month 12 is a bonus pay suspension given the assumption that since no messages occur prior to this date, and it being the end of the fiscal year. The FY08 re-enlistment rate figures all start at month 4 of that year because the data does not start until January 2008, but not having that first quarter's data does not greatly impact this study.

Each graph is unique, but overall the greatest fluctuations in re-enlistment rates occur at the beginning and end of the fiscal years. This is logical because those highly motivated individuals are more likely to re-enlist tend to do so at the earliest opportunity. Those who wait until the end of the fiscal year may be undecided about their future in the Marine Corps or less motivated to re-enlist.

c. MLR Model—Re-enlistment Rates

Corresponding to the previous monthly graphic analysis, basic MLR models determine how zones, months in the fiscal year, and fiscal years affect re-enlistment rates. The general model examines re-enlistment trends and how they vary across zones and dates. The model I estimate is

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

where

Y= monthly re-enlistment rate

X_1 = vector of zone indicators

X_2 = indicators for month in fiscal year or fiscal year

ε = residual

Each numbered column represents a model, the dependent variable is under the number at the top of each column, the explanatory variables are on the left side of the table, with the constant, number of observations, and R-squared values at the bottom.

Table 16. Linear regression models of fiscal year, month, and zone effects on monthly re-enlistment rates

	(1) Re-enlistment Rate		(2) Re-enlistment Rate	
Zone				
B	0.469	***	0.469	***
	(0.029)		(0.017)	
C	0.545	***	0.545	***
	(0.029)		(0.017)	
D	0.536	***	0.535	***
	(0.029)		(0.017)	
E	0.428	***	0.428	***
	(0.029)		(0.017)	
FY				
2009			0.168	***
			(0.026)	
2010			0.156	***
			(0.026)	
2011			0.309	***
			(0.026)	
2012			0.546	***
			(0.026)	
2013			0.593	***
			(0.026)	
2014			0.497	***
			(0.026)	
2015			0.519	***
			(0.026)	
2016			0.525	***
			(0.026)	
2017			0.545	***
			(0.026)	
2018			0.564	***
			(0.026)	
FY Month				
Month 2 (Nov.)	0.031			
	(0.046)			
Month 3	0.036			
	(0.046)			
Month 4	0.009			
	(0.045)			
Month 5	0.013			
	(0.045)			
Month 6	0.020			
	(0.045)			
Month 7	0.024			
	(0.045)			
Month 8	0.021			
	(0.045)			
Month 9	0.022			
	(0.045)			
Month 10	0.038			
	(0.045)			
Month 11	0.060			
	(0.045)			
Month 12 (Sep.)	0.095	*		
	(0.046)			
Constant	0.025		-0.355	***
	(0.038)		(0.022)	
Observations	644		644	
R-Squared	0.442		0.818	

Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

I use model 1 to evaluate re-enlistment rate differences among zones and the month a Marine chooses to re-enlist. Since zone and month are categorical, each needs a reference group: zone A and October. The constant is a starting point. A zone A Marine in month 1 has a re-enlistment rate of 0.025. This Marine is new to fleet, so having a low re-enlistment rate makes sense. A lot could happen over the course of her first contract affecting her odds of re-enlisting. Holding month constant, Zone B Marines have re-enlistment rates of 0.469 higher than zone A; zone C Marines re-enlist at rates of 0.545 higher than zone A; zone D Marines at 0.536 higher than zone A; and zone E Marines at 0.428 higher than zone A. Magnitudes of zone re-enlistment rates increase, but zones C and D have the highest re-enlistment rates. These Marines are closer to retirement, so if they stay in long enough, they are guaranteed a pension. Zone E Marines re-enlisting for service past 20 years are Sergeant Majors (SgtMaj) or SgtMaj selectee hopefuls. Very few Marines become SgtMajs or wish to serve past 20 years, thus lower zone E re-enlistment rates than zones C or D. All these values are statistically significant, meaning zone greatly correlates to increased re-enlistment rates. Months of re-enlistment are not statistically significant, except for September. As September is the last month a Marine can re-enlist for a specific fiscal year, missing the deadline to submit re-enlistment paperwork by 30th results in an unemployed Marine. While the remaining months are not statistically significant, they do follow the patterns observed in appendix B graphs. The largest magnitudes occur at the early and final months of the fiscal year, so Marines re-enlist at higher rates at the beginning or end of fiscal years.

Since months are not statistically significant, I use model 2 to investigate if each fiscal year and zone correlate to re-enlistment rates. The reference categories for this model are zone A and fiscal year 2008. Each zone is statistically significantly correlated to re-enlistment rates. The magnitudes increase, with zones C and D having the highest re-enlistment rates. Unlike the months in model 1, each fiscal year is statistically significantly correlated to re-enlistment rates. As the fiscal years progress from 2009 to 2018, the re-enlistment rates increase. Compared to 2008, re-enlistment rates in 2009 are 0.168 higher. 2010's rate decreases slightly compared to 2009. This may reflect SRB amount reduction between the fiscal years. The end strength of the Marine Corps did not change, so a

drawdown would not be a potential cause. However, the re-enlistment rate in 2010 is 0.156 higher than the rate in 2008. 2011 re-enlistment rates are 0.309 higher than 2008 re-enlistment rates. Re-enlistment rates in 2012 are 0.546 higher than 2008. 2013 re-enlistment rates are 0.593 higher than 2008. Re-enlistment rates in 2014 are 0.497 higher than 2008 re-enlistment rates. 2015 re-enlistment rates are 0.519 higher than 2008. 2016 re-enlistment rates are 0.525 higher than 2008. Re-enlistment rates in 2017 are 0.545 higher than rates in 2008. 2018 re-enlistment rates are 0.564 higher than 2008 rates. The one fluctuation is 2014 when the re-enlistment rate decreases. 2014 is the year the Marine Corps introduces the Voluntary Enlisted Early Release Program (VEERP) to facilitate a force drawdown, so this decrease might be a result of that program. 2015–2018 re-enlistment rates slightly increase, but overall stay relatively stagnant.

d. Logistic Regression Model—Re-enlistment Rates

I next estimate a logistic regression model using individual level data to determine the likelihood re-enlistment for an individual Marine occurs. Given the more aggregate time trends explored in the previous models, this more robust estimation allows me to determine if demographic and time variables statistically significantly correlate to a Marine's probability of re-enlisting if she is eligible for re-enlistment.

The general models I use estimate how demographics correlate to a Marine's likelihood of re-enlisting during the first and last quarter of the fiscal year, and how date changes correlate to the same probability. The first estimation equation examines how categorical fiscal years correlate to re-enlistment probabilities.

$$Pr(Y)_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14} + \beta_{15} X_{15} + \varepsilon$$

where

Y = probability of re-enlistment

X_1 = active duty

X_2 = AFQT score

X_3 = age

X_4 = Asian

X_5 = aviation maintenance qualification

X_6 = bachelor's degree

X_7 = black

X_8 = fiscal year indicators

X_9 = less than a high school education

X_{10} = married

X_{11} = master's degree

X_{12} = number of dependents

X_{13} = rank

X_{14} = reserves

X_{15} = years of service

ε = residual

For this portion of the analysis, I include only Marines who are eligible for re-enlistment in the first and last quarters of the fiscal years. I note t=1 for the first quarter of the FY, and t=2 for the last quarter. I omit zone from these regressions because I include years of service. Years of service are more telling of a Marine's probability of re-enlisting than zone. Zones encompass four years, but years of service update every year, so a Marine's years of service change more frequently than her zone. I use categorical fiscal years to verify the trend observed in the previous regressions. Table 17 depicts the odds ratios resulting from the models. The odds ratio is the odds of re-enlistment relative to not, with a 1 unit change to an explanatory variable, while holding all other variables constant. Odds ratios greater than 1 signify higher odds the event will occur, while odds ratios less than 1 identify the event is less likely to occur.

Table 17. Logit models of the pr(re-enlisting): Odds ratios

	(1) Pr(Re-enlist) t = 1		(2) Pr(Re-enlist) t = 2		(3) Pr(Re-enlist) t = 1		(4) Pr(Re-enlist) t = 2	
Active Duty Spouse	1.135	**	1.006		1.152	**	1.112	***
	(0.048)		(0.034)		(0.047)		(0.034)	
AFQT Score	0.997	***	0.997	***	0.998	***	0.998	***
	(0.001)		(0.000)		(0.000)		(0.000)	
Age	0.974	***	1.006	*	0.975	***	1.015	***
	(0.004)		(0.003)		(0.004)		(0.003)	
Asian	0.781	***	0.827	***	0.812	**	0.826	***
	(0.049)		(0.034)		(0.050)		(0.033)	
Aviation Maintenance Qualification	1.491	***	2.030	***	1.562	***	2.132	***
	(0.105)		(0.106)		(0.107)		(0.105)	
Bachelors Degree	0.656	***	0.762	***	0.723	***	0.781	***
	(0.027)		(0.024)		(0.028)		(0.022)	
Black	1.114	***						
	(0.033)							
Doctorate			0.079	***			0.980	***
			(0.400)				(0.046)	
Female			1.194	***			1.167	***
			(0.033)				(0.031)	
FY					1.330	***	1.396	***
					(0.005)		(0.003)	
2009			0.002	***				
			(0.000)					
2010	0.028	***	0.007	***				
	(0.002)		(0.000)					
2011	0.032	***	0.070	***				
	(0.002)		(0.002)					
2012	0.365	***	0.502	***				
	(0.015)		(0.011)					
2013	1.375	***	0.590	***				
	(0.045)		(0.013)					
2014	1.302	***	0.579	***				
	(0.042)		(0.013)					
2015	1.348	***	0.577	***				
	(0.043)		(0.012)					
2016	1.358	***	0.535	***				
	(0.044)		(0.012)					
2017	1.389	***	0.484	***				
	(0.045)		(0.011)					
2018	1		1					
	(omitted)		(omitted)					
Hispanic			0.931	***			0.920	***
			(0.015)				(0.014)	
Less than a high school education	0.590	***	0.738	**	0.568	***	0.813	*
	(0.079)		(0.066)		(0.075)		(0.071)	
Married	1.303	***	1.348	***	1.310	***	1.377	***
	(0.033)		(0.025)		(0.032)		(0.024)	
Masters Degree	0.399	***	0.557	***	0.479	***	0.552	***
	(0.048)		(0.050)		(0.052)		(0.042)	
National Guard Spouse			2.179	***			2.049	***
			(0.347)				(0.316)	
Number of Dependents	1.151	***	1.181	***	1.175	***	1.214	***
	(0.009)		(0.007)		(0.009)		(0.007)	
Rank	1.611	***	1.717	***	1.454	***	1.587	***
	(0.022)		(0.017)		(0.019)		(0.015)	
Reserve Spouse	0.738	**	0.988		0.743	**		
	(0.070)		(0.510)		(0.070)			
Some College							0.944	*
							(0.025)	
Years of Service	1.147	***	1.132	***	1.144	***	1.108	***
	(0.005)		(0.004)		(0.005)		(0.003)	
Constant	0.007	***	0.007	***	0.000	***	0.000	***
	(0.001)		(0.000)		(0.000)		(0.000)	
Observations	178,745		281,491		190,449		299,640	
Pseudo R-Squared	0.292		0.339		0.250		0.289	

Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

The comparison group I establish for all models in the table is an 18-year-old single white non-Hispanic male, with no dependents, who graduated high school, and holds an aviation maintenance MOS. These characteristics distinguish the reference group because the average enlisted Marine has these traits. Also, any changes to an explanatory variable that affect the dependent occur while all other variables are held constant. As each model changes, the amount of variation each model explains, and the number of observations also change. Model 1 explains 29.2% of the variation observed in re-enlistment probability of the total 178,745 observed; model 2 explains 25% of that variation of 190,449 observations; model 3 explains roughly 34% of dependent variable variation of 281,491 observations; and model 4 explains about 29% variation of 299,640 observations. The changes in observations between first and last quarter indicate more Marines re-enlist during the last quarter, and more observations occur during that period. Including the respective reference groups in the model increases the number of observations Stata uses to calculate re-enlistment odds.

My prior regressions determine which variables are statistically significant and which are excludable to the final models. Most importantly, Marines with aviation maintenance qualifications have higher re-enlistment odds than non-certified Marines. These Marines are likely ones with relatively more taste for military service to be motivated to complete the certification process. This motivation likely carries over to other aspects of an individual's life, including job. A highly motivated Marine who loves her job has greater odds of re-enlisting. Increasing age 1 year statistically significantly lowers the odds of first quarter re-enlistment but those odds increase during the last quarter. A Marine married to an active duty service member starts as statistically significant, resulting higher odds of re-enlisting than a Marine married to a civilian. However, during the last quarter, active duty spouses are not statistically significantly correlated to a Marine's re-enlistment odds. African American Marines have statistically significantly higher odds of first quarter re-enlistment, 1.114 to 1, than white Marines. "Active duty spouse" is not statistically significantly correlated also during the last quarter. Other interesting relationships are "Doctorate" and "female" are statistically significant during the last quarter, but not during the first. Having a doctorate results in lower odds of re-enlistment, and being a woman

increases those odds. Also, Hispanic Marines have lower odds of re-enlisting during the last quarter, than non-Hispanic Marines, but ethnicity is not a decision factor during the first quarter. National Guard spouses increase the odds a Marine re-enlists during the last quarter, 2.179 to 1, compared to a Marine married to a civilian. While reserve spouses lower the odds a Marine re-enlists, compared to a civilian spouse, the statistical significance is present only during the first quarter. Demographic traits correlate to higher or lower re-enlistment odds during specific times of year, but how do individual years affect those odds once these traits are introduced into the environment?

My fiscal years' results show the willingness to serve or re-enlist increases as the years progress from 2008–2018. The reference group is 2008. No observations exist for 2009, so the first analysis year is 2010. The odds of re-enlisting in 2010 are 0.028 to 1, lower than 2008 odds. The odds in 2011 are lower than 2008. 2012 odds are 0.365 to 1, lower than 2008 odds. However, in 2013 there is a shift where the odds show Marines are more likely to re-enlist than they were in 2008, 1.375 to 1. This change could be the result of the Marine Corps beginning to draw OEF/OIF to a close. 2013 is also the year the VEERP is announced, so Marines may be motivated to complete more years of service to qualify for and apply to the program. 2014 Marines have higher odds of re-enlisting than 2008 Marines. 2015 has higher odds than 2008. 2016 Marines have higher odds of re-enlisting than 2008 Marines, 1.358 to 1. 2017 Marines have greater odds of re-enlisting than 2008 Marines, 1.389 to 1. 2018 results as 1 because only a single observation that met the criteria occurs during those years. Since only one observation exists, there is no prediction Stata calculates that will be different from 1. Fiscal years in this model show the same trend as in model 1, increasing years correlate to increased re-enlistment odds and an increased willingness to serve.

I use models 3 and 4 to examine the same variables as the previous models but use continuous years rather than categorical. Most of models' 1 and 2 trends are in models' 3 and 4. Significant differences I note are "some college" and "fiscal year." Some college is only statistically significant during the last quarter, and completing more college lowers the odds a Marine re-enlists. I relate this to past studies where increased education generates greater numbers of opportunities. The fiscal year variable is also important

because it mirrors categorical years' trends, as years progress Marines are more likely and willing to re-enlist than past years.

I use four models to examine how demographic variables and changes in fiscal year affect the odds a re-enlistment eligible Marine will re-enlist during either the first or last quarter of the fiscal year. I determine the test periods using trends observed in appendix B figures. I include fiscal years because Marines' re-enlistment opportunities are fiscal year based, and the demographic traits I use are similar to ones I found in past studies. Now that part of my primary question has an answer, I examine how pay and bonus elasticities affect re-enlistment rates and odds.

3. Compensation and SRB Pays

a. Findings

Per the models in this section, I find SRB amounts are not statistically significantly correlated to re-enlistment odds, but SRB caps and compensation changes are statistically significantly correlated to re-enlistment probabilities. Only a few variables I include in the estimation models are statistically significantly correlated to the odds of re-enlisting during the first quarter. Fiscal year and changes to total military compensation and SRB caps have statistical significance towards the odds of re-enlisting. Like previous models, increasing fiscal year results in higher odds a Marine will re-enlist. Increasing compensation 1-percent also results in higher odds a Marine will re-enlist. However, increasing SRB caps 1-percent lowers the odds a Marine re-enlists during the first quarter. The difference may be Marines are focused on the "big picture." They understand having a higher salary produces greater long-term benefits than having an additional $10,000 in bonus money they may or may not be eligible to take. Reverse causality could also affect re-enlistment rates. The Marine Corps increases SRB caps in years they have low re-enlistment expectations, leading to a negative estimated relationship between SRB and re-enlistments.

While first quarter re-enlistments are more financially focused, I find last quarter re-enlistment odds correlate to more demographic variables than first quarter odds. Increases in AFQT score, increased education levels, being Asian, being female, and 1-percent increases in SRB caps statistically significantly lower the odds a Marine re-enlists

during this period. Being married, rank, zone, years of service, year progression, age increases, and having an aviation maintenance qualification statistically significantly increase the odds a Marine will re-enlist. Marines re-enlisting during the last quarter have more factors to consider than those who re-enlist early in the year. They have to weigh prospective external options, impact to family, and loss of personal benefits should they miss the re-enlistment deadline.

b. Graphical Analysis

I generate military-civilian pay comparisons and pay ratios figures prior to executing regressions. These diagrams identify pay trends and illustrate how the Marine Corps lessens the gap between military and civilian salaries. Appendix C contains base military pay and annual civilian pay comparisons. Pays increase from 2008–2018, but the average base military pay is much lower than average civilian pays. I discover zones D and E Marines' pay gaps decrease across fiscal years, but Marines make less than civilian counterparts

Appendix D contains average total military annual pay (includes BAH and BAS) and mean civilian annual pay, per zone. I find an interesting outcome: military salaries are still lower than annual civilian salaries. Zones A and B Marines earn less total compensation than their average aviation maintenance counterparts. Zone C Marines from 2008–2015 also earn less than civilian peers, but this difference begins to reduce in FY 2016. The changes to zone C could be due to a 1.30% pay raise (Department of Defense, n.d.). Military base pay continues increasing in 2017 and 2018, matching the higher military pay seen in the later years of that zone. The fortunate Marines consistently earning more than average civilian aviation maintainers are zones D and E Marines. They earn more than the median civilian aviation maintenance salary, but these Marines have anywhere from 14–20 years of service only to make slightly more than an entry-level civilian maintainer. The appendix also contains average base military annual salaries compared to average civilian aviation maintenance pays over a decade, for each zone. Without BAH and BAS, Marines annually earn less than the average civilian aviation

maintainers, but past research uses pay ratios instead of salary comparisons to examine the effects of military versus civilian pays on retention.

The figures in appendix E show pay ratios using total compensation (base pay, BAH, BAS) and bonuses. Zone A pay increases when including BAH and BAS, resulting in elevated ratios, but the trend matches Figure 8's pattern, these Marines earn less than civilian counterparts. The remaining zones follow a pattern similar to the one observed in appendix D diagrams. The actual ratios increase due to military pay, but military members earn less than civilian aviation maintainers. Including BAH and BAS increases the total compensation a Marine earns, lessening the gap between military and civilian compensation. However, with extra padding from allowances, the Marine Corps underpays its Marines. Since bonus pays are integral to this study, I include graphs in this appendix depicting pay ratios using bonus amounts plus total compensation. Zone A does not have a graph due to no Marines taking up bonuses. Zone B shows ratios are high from 2009–2012, then decrease from 2013–2016, with none being taken in 2017, and a dramatic increase in 2018. While the bonuses keep the ratios high, the decrease is most likely due to drawdown efforts. Marines may deem it more lucrative to get out during the drawdown, find an equivalent job earning more money, than take a bonus and stay in an organization that was looking for reasons to separate people. Zones C and D follow this same pattern, but zone E has spikes at 2009 and 2010 with no data present for the remaining periods. Those Marines have either retired or are no longer eligible for bonus pays.

c. MLR Model—Pay Ratios

I now examine how zone, fiscal year, and pay elasticities affect re-enlistment rates after completing re-enlistment-pay trends visualizations. Table 18 identifies the initial and final models of re-enlisting given fiscal year quarter and pay ratios being greater than zero.

Table 18. Pay ratio MLR models

	(1) Re-enlist t = 1		(2) Re-enlist t = 2		(3) Re-enlist	
Zone	0.133	***	0.091	***	0.117	***
	(0.001)		(0.005)		(0.001)	
FY	-0.007	***	-0.012	***	-0.046	***
	(0.000)		(0.002)		(0.001)	
Aircraft Assembly Pay Ratio					3.936	***
					(0.980)	
Aircraft Maintenance Pay Ratio					6.58	***
					(0.115)	
Avionics Pay Ratio					-11.051	***
					(0.163)	
Constant	14.621	*	24.099	***	92,876	***
	(0.840)		(3.518)		(1.392)	
Observations	130,616		6,889		143,921	
R-Squared	0.139		0.047		0.158	
Standard errors in parentheses						
* p < 0.05, ** p < 0.01, *** p < 0.001						

I use models 1–3 to examine the affects zone, fiscal year, and pay ratios have on re-enlistment rates. I include observations occurring during the first quarter to examine re-enlistment rates. Model 1 explains 13.9% of the variation in 130,616 observations. However, in model 2, I use only those observations occurring during the last quarter of the fiscal year. This model explains 4.7% of the variation in 6,889 observations. I use model 3 to examine how my entire sample varies after including pay ratios into the estimation equation. Model 3 explains 15.8% of the variation in 143,921 observations. As the results

of the models are not odds ratios, estimate signs determine whether the dependent variable increases or decreases. The estimation equation for the models is

$$Y_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

where

Y= re-enlist

X_1 = zone

X_2 = fiscal year

X_3 = aircraft assembly pay ratio

X_4 = aircraft maintenance pay ratio

X_5 = avionics pay ratio

ε = residual

t = 1 if first quarter or 2 if last quarter

During the first quarter, increasing zone 1 unit has higher re-enlistment rates of 0.133, but the magnitude decreases during the last quarter. Increasing zone 1 unit in the year's last three months results in higher re-enlistment rates of only 0.091. "Fiscal year" shows 1 year increases lower re-enlistment rates. This is the opposite trend from what I observe from the re-enlistment models where increasing fiscal years shows increased odds of re-enlisting; however, when accounting for pay elasticities, civilian pay outpacing military compensation reduces the willingness to serve.

I implement model 3 using a similar format to model 2, but I include pay ratio variables. Zone and fiscal year are statistically significant, and the magnitude of fiscal year increases, but still shows decreasing re-enlistment rates. If civilian pay continually outpaces military pay, each year, Marines have potential for greater financial success external to the service. In the first two models, I examine how zone and fiscal year correlate to re-enlistment rates while holding pay ratio constant. However, I want to explore how military-civilian pay ratios affect my sample. So, I break pay ratios into three categories equivalent to the civilian jobs I researched: aircraft assembly, aircraft maintenance, and

avionics. My results show all pay ratios are statistically significant but correlate to re-enlistment rates differently. If aircraft assembly pay ratios increase 1 unit, re-enlistment rates are 3.936 higher than if no change occurs. Increasing aircraft maintenance pay ratios 1 unit increases re-enlistment rates 6.580. However, a 1 unit increase in avionics pay reduces re-enlistment rates 11.051. Two-thirds of my ratios behave in an expected manner, as they increase, the willingness to re-enlist increases. The only unexpected outcome is the avionics pay ratio. Maybe increasing military pay is not enough leverage to induce avionics Marines to re-enlist. These Marines have the most technical jobs and tend to be more cerebral than other aviation maintainers, so they may be more sensitive to poor leadership and work environments. Resulting in a lower willingness to chance future assignments.

As with the re-enlistment rate models, zone and fiscal year are statistically significantly correlated to re-enlistment rates. Once I include pay ratios, I find they are statistically significantly correlated to re-enlistment rates. My pay ratio results are similar to past literature stating that as the military-civilian pay ratio increases, service members are more likely to re-enlist because compensation is on par with or greater than civilian compensation.

d. Logistic Regression Model—Pay Elasticities

After establishing how pay ratios correlate to re-enlistment rates, I examine how pay elasticities and demographic characteristics correlate to the odds a Marine will re-enlist. Table 19 shows various iterations of models examining how changes to military compensation, SRB amounts, and SRB caps correlate to re-enlistment probabilities during the fiscal year's first and last quarters while pay ratios are greater than 0. The estimation equation is

$$Pr(Y)_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{13} X_{13} + \beta_{14} X_{14} + \beta_{15} X_{15} + \varepsilon$$

where

Y = probability of re-enlistment

X_1 = AFQT score

X_2 = age

X_3 = Asian

X_4 = aviation maintenance qualification

X_5 = bachelor's degree

X_6 = female

X_7 = log(military compensation)

X_8 = log(SRB amount)

X_9 = log(SRB cap)

X_{10} = married

X_{11} = master's degree

X_{12} = rank

X_{13} = some college

X_{14} = years of service

X_{15} = zone

ε = residual

t = 1 if first quarter or 2 if last quarter

Table 19. Logit models of Pr(Re-enlisting) given compensation and demographic data: Odds ratios

	(1) Pr(Re-enlist) t = 1		(2) Pr(Re-enlist) t = 2		(3) Pr(Re-enlist) t = 2	
AFQT Score			0.993	***	1.010	
			(0.000)		(0.114)	
Age			1.024	***	0.913	
			(0.003)		(0.072)	
Asian			0.887	**	1.128	
			(0.040)		(1.409)	
Aviation Maintenance Qualification			1.438	***	1.849	
			(0.087)		(0.267)	
Bachelor Degree			0.616	***	0.064	**
			(0.019)		(0.064)	
Compensation FY	1.336	***	1.064	***		
	(0.044)		(0.004)			
Female			0.819	***	0.223	*
			(0.021)		(0.153)	
Log(Military Compensation)	1.470	***	0.988		0.923	
	(0.118)		(0.014)		(0.705)	
Log(SRB Amount)					0.661	
					(0.208)	
Log(SRB Cap)	0.357	**	0.367	***	68.000	**
	(0.113)		(0.012)		(92.354)	
Married			1.215	***	0.448	
			(0.018)		(0.208)	
Masters Degree			0.653	***	1	
			(0.061)		(omitted)	
Rank			1.501	***	1.180	
			(0.015)		(0.385)	
Some College			0.834	***	0.911	
			(0.025)		(0.675)	
Years of Service			1.043	***	1.200	
			(0.005)		(0.139)	
Zone	0.926		1.122	***	1.663	
	(0.048)		(0.016)		(0.693)	
Constant	0.000	***	0.000	***	0.000	*
	(0.000)		(0.000)		(0.000)	
Observations	1,847		137,473		245	
Pseudo R-Squared	(0.027)		(0.157)		(0.158)	

Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

Models 1–3 show how demographic characteristics, time, and pay changes interact with re-enlistment probabilities. When I refer to pay, I include military compensation, bonus amounts, and bonus totals Marines may receive over an entire service. My observations vary as I transition between time periods: model 1 examines first quarter re-enlistment odds, explaining 2.7% of the variation in 1,847 observations; model 2 examine last quarter odds, explaining 15.7% of the variation in 137,473 observations; and model 3 also examines last quarter occurrences, explaining 15.8% of 245 observations. The number of observations drastically decrease between models 2 and 3 because of the regression criteria I set. Model 3 includes individual bonus elasticities, whereas model 2 does not. Since only a small subset of my sample has SRB amount occurrences, the number of observations is much lower. My reference group for the models is an 18-year-old non-Hispanic single white male, who graduated high school, with an aviation maintenance MOS, has no dependents and who did not take up bonus pays.

My results show that during the first quarter, only fiscal year and compensation and SRB cap elasticities are statistically significant. Increasing fiscal year 1-year results in greater odds of re-enlisting. This is different from the previous model, but I associate that with using military compensation elasticities instead of pay ratios. Marines may be less knowledgeable of equivalent civilian jobs' salaries, so increasing military pay each fiscal year does increase their re-enlistment odds. A 1-percent increase in military compensation results in higher re-enlistment odds than no change and increasing SRB caps 1-percent lowers the odds of re-enlistment. Increasing SRB caps may induce more Marines to re-enlist, making boat spaces more competitive, so fewer people are willing or able to re-enlist. But the average person does not make decisions in a vacuum, or based off a single variable, she includes personal characteristics when weighing her options.

I incorporate demographic characteristics in the last quarter that are not statistically significantly correlated to re-enlistment odds during the first quarter. I find SRB cap elasticities produce the same results, but compensation changes are not statistically significantly correlated to re-enlistment odds. If a Marine waits until the last quarter to re-enlist, she may assume any future pay increases are sunk costs due to low re-enlistment ability during a time when boat spaces are limited, and competition is high. Factors other

than pay affect re-enlistment odds. As with prior models, increasing education levels and AFQT scores lower the odds of re-enlistment. Individuals fitting these criteria tend to have higher potential external opportunities. Female and Asian Marines also have lower odds of re-enlisting. These Marines may be the ones with higher AFQT scores or higher education levels, so they have greater civilian market prospects. Other personal characteristics correlating to higher re-enlistment odds include 1-unit increases in rank, zone, and years of service; being married; 1-year increases in age and fiscal year; and holding an aviation maintenance qualification. These traits express which factors lower or raise the odds a Marine re-enlists during the last quarter, but the last variable I examine answers my primary question.

My final model includes SRB amount elasticities during the last quarter. I omit the SRB amount variable from my first quarter model because no observations have SRB amounts, so the variable is only in model 3. However, I find SRB amounts are not statistically significantly correlated to re-enlistment odds. The bonus variable that is statistically significantly correlated is SRB caps. A 1-percent increase in SRB caps increase the odds a Marine re-enlists 68 to 1. The results of this model may be overstated because the sample subset used are those observations where SRBs occur. The SRB data includes very few observations and is a total of bonus pays individuals receive over the course of the study. Since the subset is so small, the correlation of SRB amounts and caps to re-enlistment probabilities may not be an accurate reflection of the entire sample. However, per the models SRB amounts do not statistically significantly correlate to re-enlistment odds, but SRB caps and compensation changes statistically significantly correlate to re-enlistment probabilities. I examine different traits and decision factors a Marine may use when making re-enlistment decisions, and I have answers to my primary question and a couple of my secondary questions. My last question to answer examines how quality correlates to re-enlistment.

4. Quality of Marines

a. Findings

I find quality of Marine is not statistically significantly correlated to changes in SRB amounts or caps. Other factors affect what quality of Marine re-enlists, though. Generally, increases in education levels tend to lower the odds that a Marine re-enlists. Overall, high-quality Marines tend to have lower odds of re-enlisting because they tend to have greater human capital than low-quality Marines. Marines of this caliber are high performers who continuously expand their capital because they are motivated to be and do better. They strive for excellence. We define "high-quality" as those individuals with AFQT scores greater than 50, and "low-quality" as individuals with AFQT scores less than 50. High-quality Marines generally work in more technical fields, so they receive more extensive and greater volumes of training to qualify for their pre-determined occupations. As such, some of these fields require continued education and training to earn certifications allowing them continued work in their current occupation or to progress to the next rank. This continual build of knowledge and skills broadens these Marines' talent and strengthens their resumes should they opt for civilian job market opportunities. Because of these various factors, high-quality Marines have more options outside the Marine Corps than low-quality Marines. The following sections explain my findings.

b. Graphical Analysis—Quality

My diagrams in appendix F show fitness report averages, over the span of time I use for the study, for Sgts, SSgts, GySgts, MSgts, and MGySgts. The quality of all aviation maintenance Marines receiving fitness reports, except for GySgts, decrease. The averages decrease from 2008–2018. GySgt averages decrease up to 2017, then in 2018 a slight spike occurs. This change could indicate senior SNCOs are improving. Decreasing averages for Sgts and SSgts may indicate Marines promote too quickly in order to fill the gaps left by those leaving the service. The decreases in MSgts and MGySgts averages could be the cause of fewer enlisted Marines at those levels currently, than ten years ago. These figures identify NCO and SNCO quality is decreasing, but I still need to examine what factors affect first-term re-enlistment.

c. MLR—Quality

(1) Re-enlistment on Marine Quality

In this section, I examine how zone and Marine quality correlate to re-enlistment rates. Table 20 shows my findings. I defined quality of Marine by AFQT scores in this study using the same parameters as past studies. The estimation model I use is

$$Y_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

where

Y = re-enlistment

X_1 = quality of Marine or quality of SRB taking Marine

X_2 = zone

ε = residual

t = 1 if first quarter of fiscal year or 2 if last quarter of fiscal year

Table 20. Effects of zone and qualities of Marines on re-enlistment

	(1) Re-enlist		(2) Re-enlist		(3) Re-enlist	
Quality of Marine	-0.037	***			-0.047	***
	(0.002)				(0.003)	
Quality of Marine Taking SRB			0.395			
			(0.026)			
Zone					0.061	***
					(0.001)	
Constant	0.335	***	0.230	***	0.590	***
	(0.002)		(0.001)		(0.004)	
Observations	320,134		421,530		129,344	
R-Squared	0.001		0.001		0.027	
Standard errors in parentheses						
* p < 0.05, ** p < 0.01, *** p < 0.001						

My first model examines how changing the quality of Marine affects re-enlistment rates. Increasing quality 1-point results in re-enlistment rates statistically significantly decreasing. Model 2 examines how quality of Marines taking bonus pays correlate to re-enlistment rates. This quality variable is not statistically significantly correlated to re-enlistment rates. Marine A, who takes a bonus, is not higher or lower quality than Marine B, who also takes a bonus. I find both variables in model 3 are statistically significant. Increasing quality 1-point lowers re-enlistment rates, but increasing zone 1-unit (i.e., moving from zone A to zone B) results in 0.061 higher re-enlistment rates than junior zones. So, more senior Marines have higher re-enlistment rates than junior Marines. The increased rates are most likely the result of those senior Marines striving for retirement. However, high-quality Marines have lower re-enlistment rates than low-quality individuals. Next, I examine how SRB elasticities correlate to Marine quality.

(2) Quality of Marine Given Re-enlistment

Table 21 displays how changes in SRB amounts and caps correlate to the quality of re-enlisting Marines. I use the following estimation equation for this portion of the study.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

where

Y = quality of Marine

X_1 = log(SRB amount)

X_2 = log(SRB cap)

ε = residual

Table 21. Quality of re-enlisted Marine

	(1)		(2)	
	Quality of Marine		Quality of Marine	
Log(SRB amount)			0.001	
			(0.002)	
Log(SRB Cap)	0.001			
	(0.002)			
Constant	0.849	***	0.849	***
	(0.001)		(0.001)	
Observations	320,134		320,134	
R-Squared	0.000		0.000	
Standard errors in parentheses				
* p < 0.05, ** p < 0.01, *** p < 0.001				

I find SRB amounts do not statistically significantly correlate to quality of those who re-enlist nor do SRB caps. Since neither of these variables correlate to quality of Marine, I conclude bonus pays do not induce one quality of Marine to re-enlist at higher rates than another quality of Marine. My remaining regressions investigate how evaluations and demographic traits affect the odds high-quality Marines re-enlist versus low-quality Marines.

d. Logistic Regression—Quality

This portion of the study examines how demographic characteristics and E1-E4 evaluations correlate to the probability a Marine re-enlists given her quality and quarter of re-enlistment.

(1) Re-enlistment Probabilities of High-Quality Marines

My results in Table 22 identify the odds a high-quality Marine re-enlists, comparing first quarter to the last quarter of the fiscal year. My results are odds ratios, so estimates

less than 1 indicate a reduction in odds re-enlistment occurs. Estimates greater than 1 correlate to increased odds in re-enlistment probability. My reference group for this study portion is the same as the past two: an 18-year-old single white non-Hispanic male with a high school diploma, no dependents, and no aviation maintenance certification. My estimation model is

$$Pr(Y)_t = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}X_{11} + \beta_{12}X_{12} + \beta_{13}X_{13} + \beta_{14}X_{14} + \varepsilon$$

where

Y = probability of re-enlistment

X_1 = age

X_2 = Asian

X_3 = aviation maintenance qualification

X_4 = bachelor's degree

X_5 = compensation fiscal year

X_6 = conduct evaluation

X_7 = female

X_8 = married

X_9 = master's degree

X_{10} = proficiency evaluation

X_{11} = rank

X_{12} = some college

X_{13} = years of service

X_{14} = zone

ε = residual

t = 1 if first quarter or 2 if last quarter

Table 22. Probability a high-quality Marine re-enlists: Odds ratios

	(1) Pr(Re-enlist) t = 1		(2) Pr(Re-enlist) t = 2	
Age	1.022	***		
	(0.004)			
Asian	0.855	**		
	(0.043)			
Aviation Maintenance Qualificat	1.279	***		
	(0.087)			
Bachelor Degree	0.632	***	0.558	***
	(0.020)		(0.055)	
Compensation FY	1.023	***	1.438	***
	(0.003)		(0.014)	
Conduct Evaluation	0.228	***	0.583	***
	(0.036)		(0.010)	
Female	0.829	***		
	(0.025)			
Married	1.120	***	1.731	***
	(0.019)		(0.075)	
Masters Degree	0.762	**		
	(0.074)			
Proficiency Evaluation	3.351	***		
	(0.525)			
Rank	1.112	***		
	(0.014)			
Some College	0.856	***		
	(0.028)			
Years of Service	1.062			
	(0.005)			
Zone	1.163	***		
	(0.018)			
Constant	0.000	***	0.000	***
	(0.000)		(0.000)	
Observations	105,012		32,620	
Pseudo R-Squared	0.130		0.475	

Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

Since this section focuses on quality, my model mainly includes evaluation and educational levels creating a more complete picture of quantifiable quality. I omit AFQT score from the model because I use the scores to generate the quality variable used in this section. Once I complete the regression, I find the following variables are statistically significantly correlated to re-enlistment odds.

Importantly, increasing proficiency evaluations 0.10 points results in higher odds of re-enlistment. High-quality Marines tend to have above average proficiency, so those with higher proficiency markings may be more motivated than the average high-quality Marine. Earning high proficiency ratings motivates those Marines because they are being rewarded for their efforts, thus they are more likely to re-enlist. Conversely, increasing conduct evaluations by 0.10 points lowers the odds a high-quality Marine re-enlist early in the fiscal year. This difference may be attributed to leadership. If these Marines observe they receive the same treatment from leadership as a Marine with lower conduct markings, they may be less inclined to re-enlist because their good behavior is rarely rewarded. These two variables are crucial in determining the odds a first-term Marine re-enlists, because this group is who the Marine Corps wants to retain.

Like the previous models, other factors play a role in a Marine's re-enlistment decision. During the first quarter, 1-year increases in age, years of service, and fiscal year result in higher re-enlistment odds. Married Marines, those who move from one zone to the next, and Marines with aviation maintenance qualifications also have higher odds of first quarter re-enlistments. The highlight of these results is those with aviation maintenance certifications have higher odds of re-enlisting. Again, this is the population the Marine Corps strives to retain, so the increased likelihood they re-enlist is beneficial to the firm. Increasing education levels, Asian Marines, and female Marines all have lower odds a high-quality Marine re-enlists during the first quarter. However, in the last quarter, "married," "bachelor's degree," "fiscal year," and "conduct evaluation" are the only statistically significant variables correlating to re-enlistment odds, and the estimates' effects on this correlation do not change. Marines with bachelor's degrees have lower odds of re-enlisting than Marines with high school diplomas. A 0.10-point increase in conduct evaluations lower the odds a Marine re-enlists. Increasing fiscal year 1-year results in

higher odds of re-enlisting and being married results in higher odds of re-enlisting than a single Marine.

In the beginning of the fiscal year, Marines have more time to evaluate the different aspects driving a re-enlistment decision. High-quality Marines typically have higher levels of education, increasing the number of civilian job market opportunities available, so increased education reduces the odds a high-quality Marine re-enlists. Increased rank, zone, and years of service increase the likelihood of re-enlistment because these Marines are closer to retirement, and a pension, than more junior Marines, making senior enlisted more motivated to re-enlist. If money is not a significant decision factor for an individual, simple motivation and love of the Corps may be the reason for re-enlistment at senior enlisted levels.

During the final months of the fiscal year, time is short so only a few decision factors affect Marines' re-enlistment decisions: undergraduate education level, fiscal year, having a spouse, and conduct markings. Education levels correlation to high-quality re-enlistment follows the same logic during this period as it does during the first quarter. Those with more education have more knowledge and skills tending to increase civilian job market opportunities than Marines with a high school diploma. Marriage is significant because the spouse may be convincing the service member to re-enlist, or the Marine is concerned with continued family care benefits if no opportunities outside the Marine Corps are available. My results show that regardless of quarter, high-quality Marines re-enlistment odds are dependent on conduct evaluations, fiscal year, spouses, and education levels. How do low-quality re-enlistment odds compare? I answer this question in the next section.

(2) Re-enlistment Probabilities of Low-Quality Marines

Table 23 displays the results of this section's estimation equations examining how demographic and evaluation variables correlate to low-quality Marine re-enlistments. The estimation model is

$$Pr(Y)_t = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \varepsilon$$

where

Y = probability of re-enlistment

X_1 = compensation fiscal year

X_2 = conduct evaluation

X_3 = married

X_4 = master's degree

X_5 = proficiency evaluation

X_6 = rank

X_7 = some college

X_8 = zone

ε = residual

t = 1 if first quarter or 2 if last quarter

Table 23. Probability a low-quality Marine re-enlists: Odds ratios

	(1) Pr(Re-enlist) t = 1		(2) Pr(Re-enlist) t = 2	
Age	1.016			
	(0.009)			
Asian	1.318			
	(0.207)			
Aviation Maintenance Qualificat	1.342			
	(0.210)			
Bachelor Degree	1.138			
	(0.147)			
Black	0.808	***		
	(0.040)			
Compensation FY			1.395	***
			(0.029)	
Conduct Evaluation	0.078	***	0.600	***
	(0.033)		(0.026)	
Married	1.239	***	1.905	***
	(0.051)		(0.195)	
Masters Degree	0.254	***		
	(0.087)			
Proficiency Evaluation	9.529	***		
	(4.071)			
Rank	1.351	***	2.822	***
	(0.034)		(0.139)	
Some College	0.756	**		
	(0.079)			
Zone	1.266	***		
	(0.031)			
Constant	0.291	***	0.000	***
	(0.030)		(0.000)	
Observations	19,656		5,730	
Pseudo R-Squared	0.141		0.487	

Standard errors in parentheses
* p < 0.05, ** p < 0.01, *** p < 0.001

Proficiency and conduct evaluations play a significant role in affecting the odds a low-quality Marine re-enlists during the beginning months of a fiscal year. A 0.10-point increase in proficiency markings increase a low-quality Marine's odds of re-enlisting 9.529 to 1. Like high-quality individuals, those performing at high-aptitude levels receive a reward. This recognition tends to motivate the Marine to continue serving. If a low-quality Marine performs at above-average levels, the Marine Corps is more willing to allow a re-enlistment; doing so cuts down on future training costs of replacing that individual and probability the replacement performs at a lower level. However, while conduct is statistically significant, a 0.10-point increase in that evaluation decreases the odds of re-enlistment 0.078 to 1. Similar to high-quality individuals, if these Marines are not seeing any benefit of behaving more professionally than a peer, they are less likely to re-enlist.

Model 2 examines how demographics affect last quarter low-quality re-enlistments. I find increasing fiscal year by 1 year increases the odds a low-quality Marine re-enlists 1.395 to 1. Being married increases the odds a Marine re-enlists 1.905 to 1, compared to a single Marine, and increasing rank 1 unit increases the odds of re-enlistment 2.822 to 1. Increasing conduct evaluations by 0.10 points lowers the odds a Marine re-enlists 0.600 to 1. Quality of Marine differs by AFQT scores, but these Marines are similar with regards to which attributes affect their re-enlistment decisions.

Since high-quality Marines typically have higher levels of education, proficiency, and skill, they tend to have greater civilian job market opportunities than low-quality Marines. As such, any success in the Marine Corps had by low-quality Marines motivates their continued service and increases likelihoods to re-enlist compared to high-quality individuals. Overall, a Marine's quality cannot be determined based off pay elasticities, but different qualities of Marines have similar characteristics influencing their re-enlistment odds. Chapter V summarizes my findings and provides recommendations for future research and ways forward.

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. SUMMARY

Maintaining highly qualified and highly trained aviation maintenance Marines, specifically those holding CDI, QAR, and CDQAR certifications is critical to the success of Marine Corps aviation. Having modern jets, helicopters, tiltrotors, and UAVs is not an economical use of the Marine Corps' limited budget if the skills needed to keep them flying are non-existent. My thesis finds aviation maintenance specific skill certified Marines are more likely to re-enlist when eligible, compared to aviation maintenance Marines without a CDI, CDQAR, or QAR certification, with the odds increasing in the final months of a fiscal year. I also find changes to compensation and SRB caps compound onto the likelihood these Marines re-enlist, especially in the fiscal year's last quarter. Marines re-enlisting during this period may be waiting to re-enlist to identify potential pay changes for the subsequent fiscal year, then weighing their options between future civilian and military earnings. My results continue by finding that increasing quality of Marine decreases the odds she will re-enlist because she has human capital transferrable to numerous civilian job market opportunities. The correlation between re-enlistment and pay and bonus cap elasticities correlate to increased re-enlistment probabilities, but they are not causal. My thesis uses aviation maintenance Marines' personal and financial data to identify re-enlistment trends and predict re-enlistment odds.

B. CONCLUSIONS

The following conclusions are summarized using questions I present in Chapter I.

1. Primary Research Question

- How have bonus elasticities affected retention rates since 2008?

My MLR analyses show changes to SRB caps positively influence the probability of re-enlistment, but SRB amount elasticity is not statistically significantly correlated to re-enlistment. However, my findings may be underestimated due to the small subset of the sample that took bonus pays. Since very few of my observations have bonus occurrences,

the influence bonus amounts had on their re-enlistment may be overshadowed by the majority of observations without bonus pays.

Secondary Research Questions

- Are Marines that have taken advantage of bonus pay the "high-quality" the Marine Corps strives to retain through its bonus pay programs?

Increased elements of quality, like education levels, lower the odds a Marine will re-enlist. As a Marine develops new skills and thought processes through various education levels, her total human capital increases and generates greater numbers of civilian job market opportunities allowing her to be more transferrable with greater potential success outside the Marine Corps. My regressions using SRB caps and amounts find these elasticities are not statistically significantly correlated to quality. Bonus pays do not influence what quality of Marine takes incentive pays.

- Is the Marine Corps able to meet is goals during times of high competition—low military-civilian pay?

Based on my analysis, the majority of pay ratios have steadily increased, and increasing them does statistically significantly affect the probability a Marine will re-enlist. My findings show base compensation is much lower than the median equivalent civilian aviation maintenance salaries. The ratio increases once allowances are added to base pay, but total military compensation does not exceed median civilian earnings until a Marine is nearing the 15-year mark. This difference may influence knowledgeable Marines, but Marines deciding whether to re-enlist or separate may not pursue civilian job opportunities in the aviation maintenance field, so the pay ratios may not be entirely relevant to their decision.

- Do other factors—such as marital status, number of dependents, race, test scores, compensation, age, years of service, holding a maintenance certification—affect the probability of an aviation maintenance Marine re-enlisting?

My analysis shows the traits that consistently influence re-enlistment odds are marital status, number of dependents, ethnicity, age, sex, years of service, rank, aviation maintenance qualifications, and level of education. These variables statistically correlate

to the probability of re-enlistment. Certification, spouses, increases to number of dependents, years of service, rank, and age, all increase the odds a Marine re-enlists, regardless of quality or pay. Ethnicity, race, and gender typically lower the odds of re-enlistment. For there to be a positive outcome, or a Marine re-enlists, the effects of the first 6 characteristics must outweigh the effects of the last three.

C. RECOMMENDATIONS

1. Changes

The Marine Corps has started to align its workforce with strategic goals—incentivizing aviation maintenance qualifications through bonus pays. FY 2018 is the first year an aviation maintenance specific kicker bonus is available to this population of Marines. Its target population is those Marines with CDI, CDQAR, or QAR certifications, and its purpose is to incentivize their continued service. Despite my findings, I know this program is too new to make recommendations for changes. The aviation maintenance kicker bonus should continue being offered to enlarge the data pool. However, one suggestion is to defer those Marines who hold one of those qualifications from being pulled from a maintenance department to fill a billet at a recruiting depot or drill field. Deferring such orders prevents loss of qualified aviation maintainers at the O- and I-levels. Speaking with a prior-enlisted Marine, he states one of his main reasons for separating is not wanting to be a drill instructor or recruiter for 3–4 years instead of continuing his job as a communications technician. If aviation maintenance Marines have the same feelings, deferring them from being placed on one of these secondary duties might induce a greater number of future re-enlistments.

2. Areas for Future Study

I recommend further study of this same topic after the kicker bonus has been offered for more than four years. I also suggest exploring what tiers of Marines are taking up bonuses and the rates they are being taken to help with future force structure planning. Since the Marine Corps fills boat spaces bycategorizing Marines in tiers—1 are top performers, 2 are average performers, and 3 are below average performers. The lowest tier is used to fill any remaining boat spaces to meet end strength goals. Determining rates at

which each tier re-enlists or takes up bonuses could help manpower planners schedule incentives more efficiently.

Other areas of interest include studying the amount of time it takes aviation maintenance Marines to complete CDI, QAR, and CDQAR certifications. I also suggest examining aviation and maintenance mishaps trends during the periods of end strength fluctuations. Further study of these areas could lead to models appropriately incentivizing human capital gains that could be used for other highly technical areas.

APPENDIX A. SRB TABLES

Table 24. FY17 SRB amounts. Adapted from Steele (2016).

	Zone A			Zone B		Zone C	
PMOS	E3	E4	E5 ≥	≤ E5	E6 ≥	E6	E7 ≥
6042				$ 12,000	$ 13,250		
6073				$ 12,000	$ 13,250		
6116	$ 12,500	$ 14,250	$ 15,750	$ 18,000	$ 19,750		
6156	$ 8,250	$ 9,500	$ 10,500	$ 12,000	$ 13,250		
6216				$ 12,000	$ 13,250		
6217				$ 12,000	$ 13,250		
6257	$ 12,500	$ 14,250	$ 15,750	$ 12,000	$ 13,250		
6287						$ 7,250	$ 8,000
6288	$ 12,500	$ 14,250	$ 15,750				
6314				$ 12,000	$ 13,250		
6316				$ 12,000	$ 13,250		
6317				$ 12,000	$ 13,250		
6326	$ 12,500	$ 14,250	$ 15,750				
6338				$ 12,000	$ 13,250		
6492				$ 12,000	$ 13,250		
6499				$ 12,000	$ 13,250		

Table 25. FY16 SRB amounts. Adapted from Spafford (2015).

	Zone A			Zone B	
PMOS	E3	E4	E5 ≥	≤ E5	E6 ≥
6042				$ 11,750	$ 13,000
6116	$ 12,000	$ 14,000	$ 15,000	$ 17,500	$ 19,250
6156	$ 12,000	$ 14,000	$ 15,000	$ 17,500	$ 19,250
6216				$ 11,750	$ 13,000
6217				$ 11,750	$ 13,000
6218	$ 12,000	$ 14,000	$ 15,000	$ 17,500	$ 19,250
6256	$ 8,250	$ 9,250	$ 10,250	$ 11,750	$ 13,000
6257	$ 8,250	$ 9,250	$ 10,250	$ 11,750	$ 13,000
6258	$ 12,000	$ 14,000	$ 15,000	$ 17,500	$ 19,250
6282				$ 11,750	$ 13,000
6288	$ 12,000	$ 14,000	$ 15,000	$ 17,500	$ 19,250
6314	$ 8,250	$ 9,250	$ 10,250		
6316	$ 8,250	$ 9,250	$ 10,250	$ 11,750	$ 13,000
6317				$ 11,750	$ 13,000
6326	$ 8,250	$ 9,250	$ 10,250	$ 11,750	$ 13,000
6336	$ 8,250	$ 9,250	$ 10,250		
6338	$ 8,250	$ 9,250	$ 10,250	$ 11,750	$ 13,000
6492				$ 11,750	$ 13,000
6499				$ 11,750	$ 13,000

Table 26. FY15 SRB amounts. Adapted from Callahan (2014).

	Zone A			Zone B	
PMOS	E3	E4	E5 ≥	≤ E5	E6 ≥
6042				$ 11,750	$ 13,000
6046	$ 4,000	$ 4,750	$ 5,000		
6072	$ 4,000	$ 4,750	$ 5,000		
6074	$ 4,000	$ 4,750	$ 5,000		
6113	$ 4,000	$ 4,750	$ 5,000		
6114	$ 4,000	$ 4,750	$ 5,000		
6116	$ 16,250	$ 18,500	$ 20,500	$ 17,500	$ 19,250
6124	$ 4,000	$ 4,750	$ 5,000		
6132	$ 12,250	$ 14,000	$ 15,250		
6153	$ 4,000	$ 4,750	$ 5,000		
6154	$ 4,000	$ 4,750	$ 5,000		
6156	$ 16,250	$ 18,500	$ 20,500	$ 17,500	$ 19,250
6213	$ 20,250	$ 23,250	$ 25,500		
6216	$ 12,250	$ 14,000	$ 15,250	$ 11,750	$ 13,000
6217	$ 8,250	$ 9,250	$ 10,250	$ 11,750	$ 13,000
6218	$ 12,250	$ 14,000	$ 15,250	$ 17,500	$ 19,250
6227	$ 8,250	$ 9,250	$ 10,250		
6253	$ 8,250	$ 9,250	$ 10,250		
6256	$ 16,250	$ 18,500	$ 20,500	$ 11,750	$ 13,000
6257	$ 8,250	$ 9,250	$ 10,250	$ 11,750	$ 13,000
6258	$ 12,250	$ 14,000	$ 15,250	$ 17,500	$ 19,250
6282				$ 11,750	$ 13,000
6287					
6288	$ 12,250	$ 14,000	$ 15,250	$ 17,500	$ 19,250
6314	$ 24,500	$ 28,000	$ 30,750		
6316	$ 12,250	$ 14,000	$ 15,250	$ 11,750	$ 13,000
6317	$ 8,250	$ 9,250	$ 10,250	$ 11,750	$ 13,000
6323	$ 4,000	$ 4,750	$ 5,000		
6326	$ 24,500	$ 28,000	$ 30,750	$ 11,750	$ 13,000
6312	$ 12,250	$ 14,000	$ 15,250		
6332	$ 12,250	$ 14,000	$ 15,250		
6333	$ 12,250	$ 14,000	$ 15,250		
6336	$ 12,250	$ 14,000	$ 15,250		
6337	$ 8,250	$ 9,250	$ 10,250		
6338	$ 16,250	$ 18,500	$ 20,500	$ 11,750	$ 13,000
6423	$ 8,250	$ 9,250	$ 10,250		
6432	$ 8,250	$ 9,250	$ 10,250		
6469	$ 4,000	$ 4,750	$ 10,250		
6483	$ 8,250	$ 9,250	$ 10,250		
6492	$ 8,250	$ 9,250	$ 10,250	$ 11,750	$ 13,000
6499	$ 8,250	$ 9,250	$ 10,250	$ 11,750	$ 13,000

Table 27. FY14 SRB amounts. Adapted from Hovey (2013).

	Zone A			Zone B	
PMOS	E3	E4	E5 ≥	≤ E5	E6 ≥
6042				$ 11,500	$ 12,750
6046	$ 4,000	$ 4,500	$ 5,000		
6072	$ 4,000	$ 4,500	$ 5,000		
6074	$ 4,000	$ 4,500	$ 5,000		
6112	$ 4,000	$ 4,500	$ 5,000		
6113	$ 8,000	$ 9,250	$ 10,000		
6116				$ 17,250	$ 19,250
6124	$ 8,000	$ 9,250	$ 10,000		
6132	$ 12,000	$ 13,750	$ 15,250		
6156	$ 12,000	$ 13,750	$ 15,250		
6213	$ 16,000	$ 18,500	$ 20,250		
6216	$ 16,000	$ 18,500	$ 20,250		
6218	$ 8,000	$ 9,250	$ 10,000		
6227	$ 8,000	$ 9,250	$ 10,000		
6253	$ 8,000	$ 9,250	$ 10,000		
6256	$ 12,000	$ 13,750	$ 15,250		
6258	$ 4,000	$ 4,500	$ 5,000		
6282				$ 11,500	$ 12,750
6288	$ 8,000	$ 9,250	$ 10,000		
6313	$ 4,000	$ 4,500	$ 5,000		
6314	$ 20,250	$ 23,000	$ 25,250		
6316	$ 12,000	$ 13,750	$ 15,250	$ 11,500	$ 12,750
6317	$ 8,000	$ 9,250	$ 10,000		
6322	$ 8,000	$ 9,250	$ 10,000		
6323	$ 4,000	$ 4,500	$ 5,000		
6326	$ 24,250	$ 27,750	$ 30,250		
6332	$ 12,000	$ 13,750	$ 15,250		
6333	$ 12,000	$ 13,750	$ 15,250		
6336	$ 12,000	$ 13,750	$ 15,250		
6337	$ 8,000	$ 9,250	$ 10,000		
6338	$ 12,000	$ 13,750	$ 15,250		
6423	$ 8,000	$ 9,250	$ 10,000		
6432	$ 4,000	$ 4,500	$ 5,000		
6483	$ 4,000	$ 4,500	$ 5,000		
6492	$ 4,000	$ 4,500	$ 5,000	$ 11,500	$ 12,750
6499	$ 8,000	$ 9,250	$ 10,000	$ 11,500	$ 12,750

Table 28. FY13 SRB amounts. Adapted from Hovey (2012).

	Zone A			Zone B	
PMOS	E3	E4	E5 ≥	≤ E5	E6 ≥
6074	$ 8,000	$ 9,000	$ 10,000		
6112	$ 8,000	$ 9,000	$ 10,000		
6113	$ 4,000	$ 4,500	$ 5,000		
6116	$ 4,000	$ 4,500	$ 5,000		
6124	$ 12,000	$ 13,500	$ 15,000		
6152	$ 19,750	$ 22,750	$ 24,750		
6156	$ 15,750	$ 18,250	$ 20,000		
6213	$ 15,750	$ 18,250	$ 20,000		
6216	$ 8,000	$ 9,000	$ 10,000		
6227	$ 12,000	$ 13,500	$ 15,000		
6253	$ 12,000	$ 13,500	$ 15,000		
6256	$ 4,000	$ 4,500	$ 5,000		
6282				$ 34,250	$ 37,750
6283				$ 34,250	$ 37,750
6312	$ 8,000	$ 9,000	$ 10,000		
6313	$ 8,000	$ 9,000	$ 10,000		
6314	$ 8,000	$ 9,000	$ 10,000		
6316	$ 12,000	$ 13,500	$ 15,000		
6317	$ 4,000	$ 4,500	$ 5,000	$ 17,000	$ 18,750
6322	$ 27,750	$ 31,750	$ 34,750		
6323	$ 4,000	$ 4,500	$ 5,000		
6326	$ 23,750	$ 27,250	$ 29,750		
6332	$ 8,000	$ 9,000	$ 10,000		
6333	$ 8,000	$ 9,000	$ 10,000		
6336	$ 15,750	$ 18,250	$ 20,000		
6337	$ 12,000	$ 13,500	$ 15,000		
6338	$ 12,000	$ 13,500	$ 15,000		
6386	$ 4,000	$ 4,500	$ 5,000	$ 11,500	$ 12,500
6432	$ 8,000	$ 9,000	$ 10,000		
6483	$ 8,000	$ 9,000	$ 10,000		

Table 29. FY12 SRB amounts. Adapted from Barber (2011).

	Zone A			Zone B		Zone C		
PMOS	E3	E4	E5 ≥	≤ E5	E6 ≥	E5	E6	E7 ≥
6062	$ 27,250	$ 31,250	$ 34,250	$ 11,250	$ 12,250			
6073						$ 6,000	$ 6,750	$ 7,500
6074	$ 7,750	$ 9,000	$ 9,750	$ 11,250	$ 12,250			
6112	$ 11,750	$ 13,500	$ 14,750					
6113	$ 11,750	$ 13,500	$ 14,750					
6114	$ 7,750	$ 9,000	$ 9,750					
6116	$ 7,750	$ 9,000	$ 9,750					
6124	$ 19,500	$ 22,250	$ 24,500					
6132				$ 16,750	$ 18,500			
6152	$ 27,250	$ 31,250	$ 34,250					
6154	$ 7,750	$ 9,000	$ 9,750					
6156	$ 27,250	$ 31,250	$ 34,250					
6213	$ 23,500	$ 26,750	$ 29,500					
6227	$ 15,500	$ 17,750	$ 19,500					
6252	$ 11,750	$ 13,500	$ 14,750					
6253	$ 27,250	$ 31,250	$ 34,250					
6256	$ 7,750	$ 9,000	$ 9,750					
6258	$ 11,750	$ 13,500	$ 14,750					
6282				$ 16,750	$ 18,500			
6283	$ 4,000	$ 4,500	$ 5,000	$ 16,750	$ 18,500			
6312	$ 11,750	$ 13,500	$ 14,750					
6313	$ 23,500	$ 26,750	$ 29,500					
6314	$ 27,250	$ 31,250	$ 34,250	$ 16,750	$ 18,500			
6316	$ 23,500	$ 26,750	$ 29,500					
6317	$ 15,500	$ 17,750	$ 19,500	$ 16,750	$ 18,500			
6322	$ 11,750	$ 13,500	$ 14,750	$ 33,500	$ 37,000			
6323	$ 11,750	$ 13,500	$ 14,750					
6324	$ 23,500	$ 26,750	$ 29,500	$ 11,250	$ 12,250			
6326	$ 35,000	$ 40,250	$ 44,000					
6332	$ 31,250	$ 35,750	$ 39,250	$ 11,250	$ 12,250			
6333	$ 23,500	$ 26,750	$ 29,500					
6336	$ 27,250	$ 31,250	$ 34,250			$ 11,750	$ 13,500	$ 15,000
6337	$ 23,500	$ 26,750	$ 29,500					
6338	$ 23,500	$ 26,750	$ 29,500					
6386	$ 19,500	$ 22,250	$ 24,500	$ 22,500	$ 24,750			
6414	$ 7,750	$ 9,000	$ 9,750					
6423	$ 4,000	$ 4,500	$ 5,000					
6432	$ 23,500	$ 26,750	$ 29,500					
6433	$ 19,500	$ 22,250	$ 24,500					
6434						$ 11,750	$ 13,500	$ 15,000
6463	$ 23,500	$ 26,750	$ 29,500	$ 28,000	$ 31,000			
6464	$ 23,500	$ 26,750	$ 29,500					
6466				$ 28,000	$ 31,000			
6467	$ 23,500	$ 26,750	$ 29,500	$ 28,000	$ 31,000			
6469	$ 23,500	$ 26,750	$ 29,500	$ 28,000	$ 31,000			
6483	$ 4,000	$ 4,500	$ 5,000					
6484	$ 23,500	$ 26,750	$ 29,500	$ 28,000	$ 31,000			
6492	$ 4,000	$ 4,500	$ 5,000					

Table 30. FY11 SRB amounts. Adapted from Barber (2010).

	Zone A			Zone B		Zone C		
PMOS	E3	E4	E5 ≥	≤ E5	E6 ≥	E5	E6	E7 ≥
6046	$ 7,750	$ 8,750	$ 9,750	$ 11,000	$ 12,250			
6048	$ 3,750	$ 4,500	$ 4,750	$ 11,000	$ 12,250			
6062	$ 11,500	$ 13,250	$ 14,500	$ 11,000	$ 12,250			
6072				$ 16,500	$ 18,250	$ 5,750	$ 6,750	$ 7,500
6073						$ 5,750	$ 6,750	$ 7,500
6074	$ 11,500	$ 13,250	$ 14,500					
6092	$ 7,750	$ 8,750	$ 9,750	$ 16,500	$ 18,250			
6113	$ 19,250	$ 22,000	$ 24,250	$ 5,500	$ 6,000			
6114	$ 27,000	$ 30,750	$ 33,750	$ 11,000	$ 12,250	$ 5,750	$ 6,750	$ 7,500
6116	$ 30,750	$ 35,250	$ 38,750	$ 16,500	$ 18,250			
6123	$ 3,750	$ 4,500	$ 4,750	$ 5,500	$ 6,000			
6124	$ 27,000	$ 30,750	$ 33,750	$ 11,000	$ 12,250			
6132	$ 7,750	$ 8,750	$ 9,750	$ 5,500	$ 6,000			
6152				$ 5,500	$ 6,000			
6153	$ 7,750	$ 8,750	$ 9,750	$ 5,500	$ 6,000			
6154	$ 19,250	$ 22,000	$ 24,250	$ 5,500	$ 6,000			
6156	$ 34,500	$ 39,500	$ 43,500	$ 27,500	$ 30,500			
6212	$ 3,750	$ 4,500	$ 4,750					
6213	$ 15,500	$ 17,500	$ 19,250	$ 16,500	$ 18,250			
6214	$ 30,750	$ 35,250	$ 38,750					
6216				$ 16,500	$ 18,250			
6217				$ 11,000	$ 12,250			
6218	$ 19,250	$ 22,000	$ 24,250	$ 27,500	$ 30,500			
6222	$ 15,500	$ 17,500	$ 19,250					
6223	$ 3,750	$ 4,500	$ 4,750	$ 11,000	$ 12,250			
6227	$ 3,750	$ 4,500	$ 4,750	$ 11,000	$ 12,250			
6252	$ 11,500	$ 13,250	$ 14,500					
6253	$ 23,000	$ 26,500	$ 29,000	$ 11,000	$ 12,250			
6257				$ 16,500	$ 18,250			
6258	$ 19,250	$ 22,000	$ 24,250	$ 27,500	$ 30,500			
6282	$ 15,500	$ 17,500	$ 19,250	$ 5,500	$ 6,000			
6286	$ 7,750	$ 8,750	$ 9,750	$ 11,000	$ 12,250			
6288	$ 19,250	$ 22,000	$ 24,250	$ 27,500	$ 30,500			
6312	$ 7,750	$ 8,750	$ 9,750	$ 16,500	$ 18,250			
6313	$ 7,750	$ 8,750	$ 9,750	$ 16,500	$ 18,250			
6314	$ 30,750	$ 35,250	$ 38,750	$ 5,500	$ 6,000			
6316	$ 15,500	$ 17,500	$ 19,250	$ 5,500	$ 6,000			
6317	$ 15,500	$ 17,500	$ 19,250	$ 16,500	$ 18,250	$ 5,750	$ 6,750	$ 7,500
6322	$ 7,750	$ 8,750	$ 9,750	$ 22,000	$ 24,500			
6323	$ 27,000	$ 30,750	$ 33,750	$ 16,500	$ 18,250			
6324	$ 30,750	$ 35,250	$ 38,750					
6326	$ 34,500	$ 39,500	$ 43,500	$ 16,500	$ 18,250			
6332	$ 30,750	$ 35,250	$ 38,750	$ 5,500	$ 6,000			
6333	$ 23,000	$ 26,500	$ 29,000					
6336	$ 7,750	$ 8,750	$ 9,750					
6337	$ 30,750	$ 35,250	$ 38,750					
6338	$ 34,500	$ 39,500	$ 43,500	$ 33,250	$ 36,500			
6386	$ 27,000	$ 30,750	$ 33,750	$ 16,500	$ 18,250			
6414	$ 7,750	$ 8,750	$ 9,750		$ 18,250			
6423	$ 11,500	$ 13,250	$ 14,500					
6432	$ 7,750	$ 8,750	$ 9,750					
6433	$ 30,750	$ 35,250	$ 38,750					
6434					$ 18,250	$ 5,750	$ 6,750	$ 7,500
6463	$ 27,000	$ 30,750	$ 33,750					
6466	$ 3,750	$ 4,500	$ 4,750	$ 5,500				
6467	$ 30,750	$ 35,250	$ 38,750	$ 11,000				
6469					$ 36,500		$ 13,250	$ 14,750
6483	$ 15,500	$ 17,500	$ 19,250					
6484	$ 27,000	$ 30,750	$ 33,750	$ 33,250	$ 36,500			
6492	$ 19,250	$ 22,000	$ 24,250	$ 5,500	$ 6,000			
6493	$ 34,500	$ 39,500	$ 43,500	$ 33,250	$ 36,500			

Table 31. FY10 SRB amounts. Adapted from Bock (2009).

	Zone A			Zone B		Zone C		
PMOS	≤ E3	E4	E5 ≥	≤ E5	E6 ≥	E5	E6	E7 ≥
6042	$ 7,000	$ 8,000	$ 9,000	$ 25,500	$ 28,500			
6046	$ 7,000	$ 8,000	$ 9,000	$ 25,500	$ 28,500			
6048	$ 14,500	$ 16,500	$ 18,000	$ 25,500	$ 28,500			
6062	$ 10,500	$ 12,500	$ 13,500	$ 25,500	$ 28,500			
6072				$ 20,500	$ 22,500			
6073				$ 10,500	$ 11,500			
6074	$ 25,000	$ 28,500	$ 31,500	$ 20,500	$ 22,500			
6092	$ 14,500	$ 16,500	$ 18,000	$ 20,500	$ 22,500			
6112				$ 20,500	$ 22,500			
6113	$ 25,000	$ 28,500	$ 31,500	$ 20,500	$ 22,500			
6114	$ 36,000	$ 41,000	$ 45,000	$ 31,000	$ 34,000			
6116	$ 39,500	$ 45,000	$ 49,500	$ 20,500	$ 22,500	$ 38,000	$ 43,500	$ 48,000
6122				$ 10,500	$ 11,500			
6123	$ 7,000	$ 8,000	$ 9,000	$ 15,500	$ 17,000			
6124	$ 32,000	$ 37,000	$ 40,500	$ 15,500	$ 17,000			
6132	$ 10,500	$ 12,500	$ 13,500	$ 15,500	$ 17,000			
6152				$ 15,500	$ 17,000			
6153	$ 18,000	$ 20,500	$ 22,500	$ 25,500	$ 28,500			
6154	$ 25,000	$ 28,500	$ 31,500	$ 25,500	$ 28,500			
6156	$ 32,000	$ 37,000	$ 40,500	$ 31,000	$ 34,000	$ 22,000	$ 25,000	$ 27,500
6212	$ 18,000	$ 20,500	$ 22,500	$ 10,500	$ 11,500			
6213	$ 18,000	$ 20,500	$ 22,500	$ 20,500	$ 22,500			
6214	$ 53,500	$ 61,500	$ 67,500	$ 20,500	$ 22,500			
6216				$ 25,500	$ 28,500			
6217				$ 25,500	$ 28,500			
6218				$ 36,000	$ 40,000			
6222	$ 18,000	$ 20,500	$ 22,500					
6223	$ 10,500	$ 12,500	$ 13,500	$ 20,500	$ 22,500			
6227				$ 25,500	$ 28,500			
6252	$ 18,000	$ 20,500	$ 22,500	$ 5,000	$ 5,500			
6253	$ 18,000	$ 20,500	$ 22,500	$ 20,500	$ 22,500			
6257				$ 25,500	$ 28,500			
6258				$ 36,000	$ 40,000			
6282	$ 28,500	$ 33,000	$ 36,000					
6283				$ 10,500	$ 11,500			
6286				$ 10,500	$ 11,500			
6288				$ 36,000	$ 40,000			
6312	$ 21,500	$ 24,500	$ 27,000	$ 36,000	$ 40,000			
6313	$ 21,500	$ 24,500	$ 27,000	$ 25,500	$ 28,500			
6314	$ 53,500	$ 61,500	$ 67,500	$ 25,500	$ 28,500	$ 16,500	$ 18,500	$ 20,500
6316	$ 25,000	$ 28,500	$ 31,500	$ 20,500	$ 22,500			
6317	$ 25,000	$ 28,500	$ 31,500	$ 31,000	$ 34,000			
6318				$ 36,000	$ 40,000			
6322	$ 21,500	$ 24,500	$ 27,000	$ 31,000	$ 34,000			
6323	$ 32,000	$ 37,000	$ 40,500	$ 25,500	$ 28,500			
6324	$ 36,000	$ 41,000	$ 45,000	$ 5,000	$ 5,500			
6326	$ 43,000	$ 49,000	$ 54,000	$ 15,500	$ 17,000	$ 16,500	$ 18,500	$ 20,500
6332	$ 28,500	$ 33,000	$ 36,000	$ 41,000	$ 45,500			
6333	$ 32,000	$ 37,000	$ 40,500	$ 20,500	$ 22,500			
6336	$ 3,500	$ 4,000	$ 4,500	$ 20,500	$ 22,500			
6337	$ 32,000	$ 37,000	$ 40,500	$ 10,500	$ 11,500			
6338				$ 36,000	$ 40,000			
6386	$ 25,000	$ 28,500	$ 31,500	$ 25,500	$ 28,500			
6414	$ 28,500	$ 33,000	$ 36,000		$ 28,500		$ 12,500	$ 14,000
6423				$ 20,500				
6432	$ 14,500	$ 16,500	$ 18,000					
6433	$ 18,000	$ 20,500	$ 22,500					
6434					$ 28,500			
6463	$ 14,500	$ 16,500	$ 18,000	$ 5,000				
6466	$ 7,000	$ 8,000	$ 9,000	$ 31,000				
6467	$ 46,500	$ 53,000	$ 58,500	$ 20,500			$ 25,000	$ 27,500
6469					$ 40,000		$ 25,000	$ 27,500
6482	$ 18,000	$ 20,500	$ 22,500					
6483	$ 10,500	$ 12,500	$ 13,500	$ 10,500	$ 11,500			
6484	$ 25,000	$ 28,500	$ 31,500	$ 36,000	$ 40,000			
6492	$ 7,000	$ 8,000	$ 9,000	$ 10,500	$ 11,500			
6493	$ 28,500	$ 33,000	$ 36,000	$ 36,000	$ 40,000			

Table 32. FY09 SRB amounts. Adapted from Bock (2008).

	Zone A			Zone B		Zone C			Zone D	
PMOS	≤ E3	E4	E5 ≥	≤ E5	E6 ≥	E5	E6	E7 ≥	≤ E7	E8 ≥
6042	$ 22,500	$ 25,500	$ 29,500	$ 17,000	$ 20,500	$ 16,500	$ 18,000	$ 21,000		
6046	$ 27,500	$ 31,500	$ 36,000	$ 24,500	$ 28,500	$ 11,000	$ 12,000	$ 14,000		
6048	$ 24,000	$ 27,500	$ 31,500	$ 17,000	$ 20,500	$ 11,000	$ 12,000	$ 14,000		
6062	$ 20,500	$ 23,500	$ 27,000	$ 34,000	$ 40,000	$ 19,500	$ 21,000	$ 24,500		
6072	$ 22,500	$ 25,500	$ 29,500	$ 29,000	$ 34,500	$ 25,000	$ 26,500	$ 31,500		
6073	$ 22,500	$ 25,500	$ 29,500	$ 24,500	$ 28,500	$ 25,000	$ 26,500	$ 31,500		
6074	$ 7,000	$ 8,000	$ 9,000	$ 24,500	$ 28,500	$ 19,500	$ 21,000	$ 24,500	$ 12,000	
6092	$ 29,000	$ 33,500	$ 38,500	$ 27,000	$ 31,500	$ 19,500	$ 21,000	$ 24,500		
6112	$ 9,000	$ 10,000	$ 11,500	$ 19,500	$ 23,000	$ 19,500	$ 21,000	$ 24,500		
6113	$ 36,000	$ 41,000	$ 47,500	$ 34,000	$ 40,000	$ 19,500	$ 21,000	$ 24,500		
6114	$ 41,000	$ 47,000	$ 54,000	$ 22,000	$ 26,000	$ 19,500	$ 21,000	$ 24,500		
6116	$ 36,000	$ 41,000	$ 47,500	$ 53,000	$ 62,500	$ 22,000	$ 23,500	$ 28,000		
6122	$ 9,000	$ 10,000	$ 11,500	$ 19,500	$ 23,000	$ 14,000	$ 15,000	$ 17,500		
6123	$ 22,500	$ 25,500	$ 29,500	$ 22,000	$ 26,000	$ 19,500	$ 21,000	$ 24,500		
6124	$ 47,500	$ 55,000	$ 63,000	$ 17,000	$ 20,500	$ 25,000	$ 26,500	$ 31,500		
6132	$ 34,000	$ 39,000	$ 45,000	$ 19,500	$ 23,000	$ 22,000	$ 23,500	$ 28,000		
6152	$ 9,000	$ 10,000	$ 11,500	$ 19,500	$ 23,000	$ 25,000	$ 26,500	$ 31,500		
6153	$ 29,000	$ 33,500	$ 38,500	$ 24,500	$ 28,500	$ 19,500	$ 21,000	$ 24,500		
6154	$ 34,000	$ 39,000	$ 45,000	$ 31,500	$ 37,500	$ 19,500	$ 21,000	$ 24,500	$ 12,000	
6156	$ 34,000	$ 39,000	$ 45,000	$ 31,500	$ 37,500	$ 19,500	$ 21,000	$ 24,500		
6212	$ 27,500	$ 31,500	$ 36,000	$ 29,000	$ 34,500	$ 16,500	$ 18,000	$ 21,000		
6213	$ 19,000	$ 21,500	$ 25,000	$ 29,000	$ 34,500	$ 8,500	$ 9,000	$ 10,500		
6214	$ 56,500	$ 65,000	$ 74,500							
6216	$ 22,500	$ 25,500	$ 29,500	$ 17,000	$ 20,500	$ 16,500	$ 18,000	$ 21,000		
6217	$ 29,000	$ 33,500	$ 38,500	$ 27,000	$ 31,500	$ 11,000	$ 12,000	$ 14,000		
6222	$ 27,500	$ 31,500	$ 36,000	$ 10,000	$ 11,500	$ 11,000	$ 12,000	$ 14,000		
6223	$ 20,500	$ 23,500	$ 27,000	$ 10,000	$ 11,500					
6226	$ 19,000	$ 21,500	$ 25,000	$ 10,000	$ 11,500					
6227	$ 19,000	$ 21,500	$ 25,000	$ 10,000	$ 11,500					
6252	$ 30,500	$ 35,500	$ 40,500	$ 22,000	$ 26,000	$ 16,500	$ 18,000	$ 21,000		
6253	$ 32,500	$ 37,500	$ 43,000	$ 31,500	$ 37,500	$ 30,000	$ 32,500	$ 38,000		
6256	$ 5,500	$ 6,000	$ 7,000	$ 17,000	$ 20,500	$ 14,000	$ 15,000	$ 17,500		
6257	$ 20,500	$ 23,500	$ 27,000	$ 29,000	$ 34,500	$ 14,000	$ 15,000	$ 17,500		
6282	$ 27,500	$ 31,500	$ 36,000	$ 22,000	$ 26,000					
6283	$ 17,000	$ 19,500	$ 22,500							
6286	$ 12,500	$ 14,000	$ 16,000	$ 22,000	$ 26,000					
6287	$ 5,500	$ 6,000	$ 7,000	$ 22,000	$ 26,000	$ 11,000	$ 12,000	$ 14,000		
6312	$ 36,000	$ 41,000	$ 47,500	$ 36,500	$ 43,000	$ 14,000	$ 15,000	$ 17,500		
6313	$ 30,500	$ 35,500	$ 40,500	$ 36,500	$ 43,000					
6314	$ 61,500	$ 71,000	$ 81,000	$ 36,500	$ 43,000	$ 14,000	$ 15,000	$ 17,500		
6316	$ 36,000	$ 41,000	$ 47,500	$ 36,500	$ 43,000					
6317	$ 37,500	$ 43,000	$ 49,500	$ 38,500	$ 45,500	$ 14,000	$ 15,000	$ 17,500		
6322	$ 32,500	$ 37,500	$ 43,000	$ 17,000	$ 20,500	$ 14,000	$ 15,000	$ 17,500		
6323	$ 41,000	$ 47,000	$ 54,000	$ 29,000	$ 34,500	$ 14,000	$ 15,000	$ 17,500		
6324	$ 47,500	$ 55,000	$ 63,000	$ 29,000	$ 34,500	$ 14,000	$ 15,000	$ 17,500	$ 12,000	
6326	$ 51,000	$ 59,000	$ 67,500	$ 17,000	$ 20,500	$ 14,000	$ 15,000	$ 17,500	$ 15,000	
6332	$ 44,000	$ 51,000	$ 58,500	$ 34,000	$ 40,000	$ 14,000	$ 15,000	$ 17,500		
6333	$ 41,000	$ 47,000	$ 54,000	$ 31,500	$ 37,500					
6336	$ 24,000	$ 27,500	$ 31,500	$ 31,500	$ 37,500	$ 19,500	$ 21,000	$ 24,500		
6337	$ 37,500	$ 43,000	$ 49,500	$ 24,500	$ 28,500	$ 19,500	$ 21,000	$ 24,500		
6386	$ 47,500	$ 55,000	$ 63,000	$ 24,500	$ 28,500	$ 8,500	$ 9,000	$ 10,500		
6412				$ 19,500						
6413				$ 19,500						
6414							$ 9,000	$ 10,500		
6423				$ 34,000						
6432	$ 17,000	$ 19,500	$ 22,500	$ 22,000						
6433						$ 11,000				
6434					$ 26,000		$ 12,000	$ 14,000		
6461				$ 22,000						
6462				$ 10,000						
6463	$ 22,500	$ 22,500	$ 29,500	$ 10,000						
6466	$ 26,000	$ 29,500	$ 34,000	$ 19,500						
6467	$ 53,000	$ 61,000	$ 70,000	$ 27,000						
6469					$ 31,500		$ 9,000	$ 10,500		
6482	$ 27,500	$ 31,500	$ 36,000	$ 27,000	$ 31,500					
6483	$ 14,000	$ 16,000	$ 18,000	$ 27,000	$ 31,500	$ 25,000	$ 26,500	$ 31,500		
6484	$ 32,500	$ 37,500	$ 43,000	$ 27,000	$ 31,500					
6492	$ 17,000	$ 19,500	$ 22,500	$ 24,500	$ 28,500	$ 11,000	$ 12,000	$ 14,000		
6493	$ 36,000	$ 41,000	$ 47,500	$ 36,500	$ 43,000					

Table 33. FY08 SRB amounts. Adapted from Morgan (2007).

	Zone A			Zone B		Zone C		
PMOS	≤ E3	E4	E5 ≥	≤ E5	E6 ≥	E5	E6	E7 ≥
6042	$ 19,500	$ 22,500	$ 26,000	$ 14,000	$ 16,500	$ 15,500	$ 17,000	$ 19,500
6046	$ 19,500	$ 22,500	$ 26,000	$ 23,000	$ 27,500	$ 10,000	$ 11,500	$ 13,000
6048	$ 19,500	$ 22,500	$ 26,000	$ 18,500	$ 22,000	$ 10,000	$ 11,500	$ 13,000
6062	$ 19,500	$ 22,500	$ 26,000	$ 23,000	$ 27,500	$ 15,500	$ 17,000	$ 19,500
6072	$ 19,500	$ 22,500	$ 26,000	$ 23,000	$ 27,500	$ 20,500	$ 22,500	$ 26,000
6073	$ 19,500	$ 22,500	$ 26,000	$ 18,500	$ 22,000	$ 15,500	$ 17,000	$ 19,500
6074	$ 26,000	$ 30,000	$ 34,500	$ 18,500	$ 22,000	$ 15,500	$ 17,000	$ 19,500
6092	$ 19,500	$ 22,500	$ 26,000	$ 18,500	$ 22,000	$ 15,500	$ 17,000	$ 19,500
6112	$ 23,000	$ 26,500	$ 30,500	$ 14,000	$ 16,500	$ 15,500	$ 17,000	$ 19,500
6113	$ 26,000	$ 30,000	$ 34,500	$ 23,000	$ 27,500	$ 20,500	$ 22,500	$ 26,000
6114	$ 29,500	$ 34,000	$ 39,000	$ 18,500	$ 22,000	$ 20,500	$ 22,500	$ 26,000
6116	$ 26,000	$ 30,000	$ 34,500	$ 23,000	$ 27,500	$ 20,500	$ 22,500	$ 26,000
6122	$ 19,500	$ 22,500	$ 26,000	$ 23,000	$ 27,500	$ 20,500	$ 22,500	$ 26,000
6123	$ 23,000	$ 26,500	$ 30,500	$ 23,000	$ 27,500	$ 20,500	$ 22,500	$ 26,000
6124	$ 32,500	$ 37,500	$ 43,500	$ 23,000	$ 27,500	$ 20,500	$ 22,500	$ 26,000
6132	$ 19,500	$ 22,500	$ 26,000	$ 23,000	$ 27,500	$ 20,500	$ 22,500	$ 26,000
6152	$ 23,000	$ 26,500	$ 30,500	$ 28,000	$ 33,000	$ 25,500	$ 28,500	$ 32,500
6153	$ 23,000	$ 26,500	$ 30,500	$ 28,000	$ 33,000	$ 20,500	$ 22,500	$ 26,000
6154	$ 23,000	$ 30,000	$ 34,500	$ 23,000	$ 27,500	$ 20,500	$ 22,500	$ 26,000
6156	$ 29,500	$ 34,000	$ 39,000	$ 23,000	$ 27,500	$ 20,500	$ 22,500	$ 26,000
6212	$ 19,500	$ 22,500	$ 26,000	$ 28,000	$ 33,000	$ 20,500	$ 22,500	$ 26,000
6213	$ 26,000	$ 30,000	$ 34,500	$ 28,000	$ 33,000	$ 20,500	$ 22,500	$ 26,000
6214	$ 32,500	$ 37,500	$ 43,500	$ 28,000	$ 33,000	$ 20,500	$ 22,500	$ 26,000
6216	$ 19,500	$ 22,500	$ 26,000	$ 18,500	$ 22,000	$ 10,000	$ 11,500	$ 13,000
6217	$ 23,000	$ 26,500	$ 30,500	$ 28,000	$ 33,000	$ 10,000	$ 11,500	$ 13,000
6222	$ 23,000	$ 26,500	$ 30,500	$ 10,000	$ 11,000	$ 10,000	$ 11,500	$ 13,000
6223	$ 19,500	$ 22,500	$ 26,000	$ 10,000	$ 11,000	$ 10,000	$ 11,500	$ 13,000
6226	$ 19,500	$ 22,500	$ 26,000	$ 10,000	$ 11,000	$ 10,000	$ 11,500	$ 13,000
6227	$ 19,500	$ 22,500	$ 26,000	$ 10,000	$ 11,000	$ 10,000	$ 11,500	$ 13,000
6252	$ 23,000	$ 26,500	$ 30,500	$ 23,000	$ 27,500	$ 15,500	$ 17,000	$ 19,500
6253	$ 26,000	$ 30,000	$ 34,500	$ 32,500	$ 38,500	$ 30,000	$ 34,000	$ 39,000
6256	$ 13,000	$ 15,000	$ 17,500	$ 18,500	$ 22,000	$ 15,500	$ 17,000	$ 19,500
6257	$ 19,500	$ 22,500	$ 26,000	$ 28,000	$ 33,000	$ 15,500	$ 17,000	$ 19,500
6282	$ 19,500	$ 22,500	$ 26,000	$ 18,500	$ 22,000	$ 15,500	$ 17,000	$ 19,500
6283	$ 26,000	$ 30,000	$ 34,500	$ 32,500	$ 38,500	$ 30,000	$ 34,000	$ 39,000
6286	$ 19,500	$ 22,500	$ 26,000	$ 18,500	$ 22,000	$ 15,500	$ 17,000	$ 19,500
6287	$ 19,500	$ 22,500	$ 26,000	$ 18,500	$ 22,000	$ 15,500	$ 17,000	$ 19,500
6312	$ 26,000	$ 30,000	$ 34,500	$ 32,500	$ 38,500	$ 15,500	$ 17,000	$ 19,500
6313	$ 29,500	$ 34,000	$ 39,000	$ 28,000	$ 33,000	$ 10,000	$ 11,500	$ 13,000
6314	$ 32,500	$ 37,500	$ 43,500	$ 28,000	$ 33,000	$ 15,500	$ 17,000	$ 19,500
6316	$ 19,500	$ 22,500	$ 26,000	$ 23,000	$ 27,500	$ 15,500	$ 17,000	$ 19,500
6317	$ 26,000	$ 30,000	$ 34,500	$ 23,000	$ 27,500	$ 15,500	$ 17,000	$ 19,500
6322	$ 29,500	$ 34,000	$ 39,000	$ 18,500	$ 22,000	$ 15,500	$ 17,000	$ 19,500
6323	$ 32,500	$ 37,500	$ 43,500	$ 23,000	$ 27,500	$ 15,500	$ 17,000	$ 19,500
6324	$ 29,500	$ 34,000	$ 39,000	$ 18,500	$ 22,000	$ 10,000	$ 11,500	$ 13,000
6326	$ 39,000	$ 45,000	$ 52,000	$ 18,500	$ 22,000	$ 15,500	$ 17,000	$ 19,500
6332	$ 32,500	$ 37,500	$ 43,500	$ 28,000	$ 33,000	$ 10,000	$ 11,500	$ 13,000
6333	$ 32,500	$ 37,500	$ 43,500	$ 37,000	$ 44,000	$ 30,000	$ 34,000	$ 39,000
6336	$ 29,500	$ 34,000	$ 39,000	$ 18,500	$ 22,000	$ 15,500	$ 17,000	$ 19,500
6337	$ 29,500	$ 34,000	$ 39,000	$ 18,500	$ 22,000	$ 15,500	$ 17,000	$ 19,500
6386	$ 29,500	$ 34,000	$ 39,000	$ 23,000	$ 27,500	$ 10,000	$ 11,500	$ 13,000
6412	$ 16,500	$ 19,000	$ 21,500	$ 14,000		$ 10,000		
6413	$ 16,500	$ 19,000	$ 21,500	$ 14,000		$ 10,000		
6414					$ 27,500		$ 11,500	$ 13,000
6423	$ 16,500	$ 19,000	$ 21,500	$ 23,000		$ 10,000		
6432	$ 23,000	$ 26,500	$ 30,500	$ 23,000		$ 10,000		
6433	$ 13,000	$ 15,000	$ 17,500	$ 23,000		$ 10,000		
6434					$ 27,500		$ 11,500	$ 13,000
6461	$ 23,000	$ 26,500	$ 30,500	$ 23,000		$ 10,000		
6462	$ 19,500	$ 22,500	$ 26,000	$ 10,000		$ 10,000		
6463	$ 26,000	$ 30,000	$ 34,500	$ 10,000		$ 10,000		
6464				$ 10,000		$ 10,000		
6466	$ 16,500	$ 19,000	$ 21,500	$ 10,000		$ 10,000		
6467	$ 32,500	$ 37,500	$ 43,500	$ 23,000		$ 10,000		
6469					$ 27,500		$ 11,500	$ 13,000
6482	$ 16,500	$ 19,000	$ 21,500	$ 23,000	$ 27,500	$ 15,500	$ 17,000	$ 19,500
6483	$ 19,500	$ 22,500	$ 26,000	$ 23,000	$ 27,500	$ 20,500	$ 22,500	$ 26,000
6484	$ 19,500	$ 22,500	$ 26,000	$ 28,000	$ 33,000	$ 10,000	$ 11,500	$ 13,000
6492	$ 16,500	$ 19,000	$ 21,500	$ 18,500	$ 22,000	$ 10,000	$ 11,500	$ 13,000
6493	$ 26,000	$ 30,000	$ 34,500	$ 32,500	$ 38,500	$ 20,500	$ 22,500	$ 26,000

APPENDIX B. RE-ENLISTMENT RATES BY FISCAL YEAR

A. FISCAL YEAR 2008

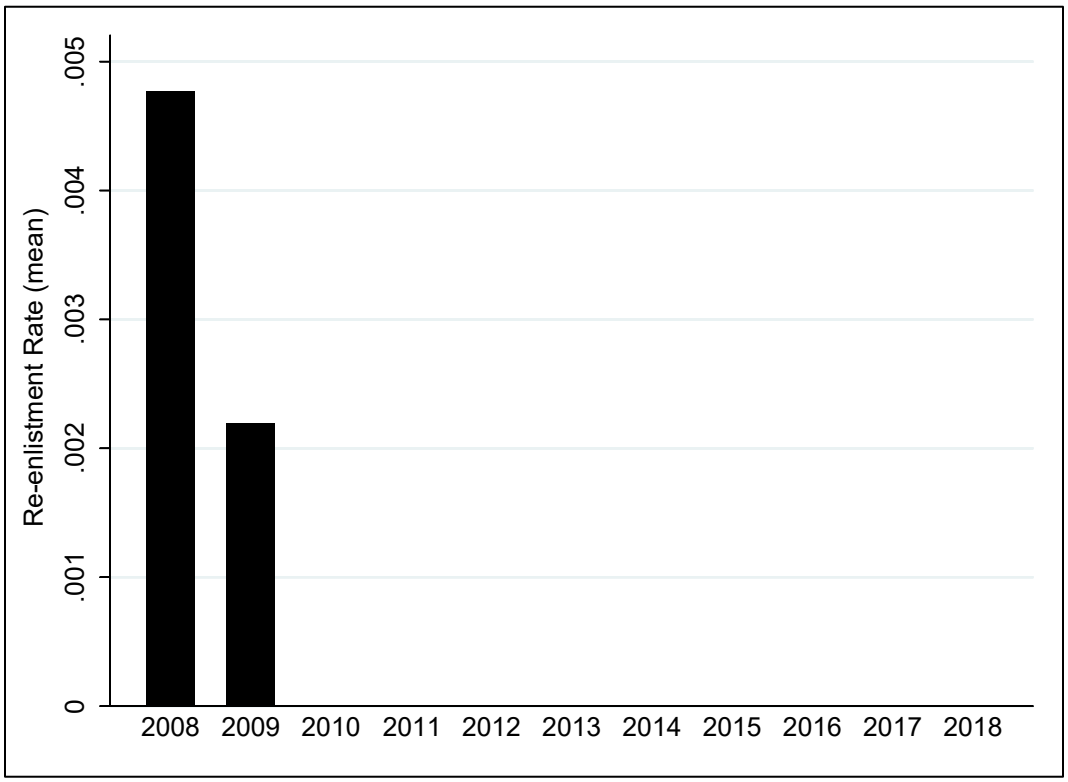

Figure 8. Zone A re-enlistment rates across period of study

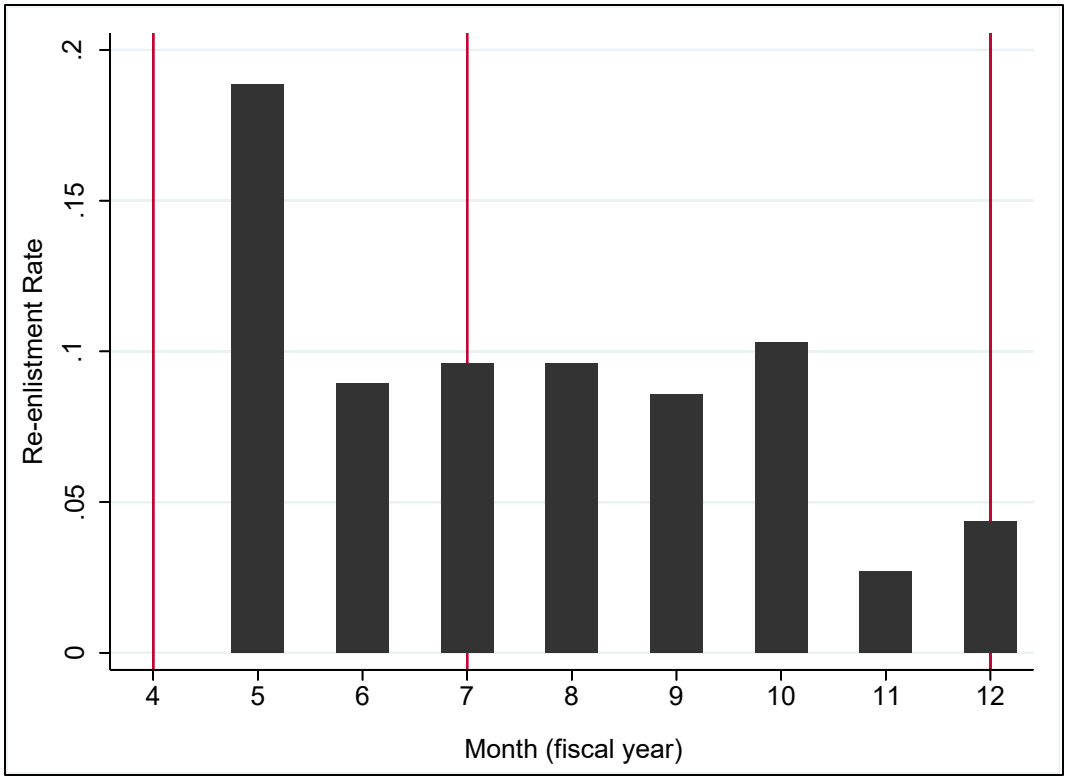

Figure 9. Zone C re-enlistment rates

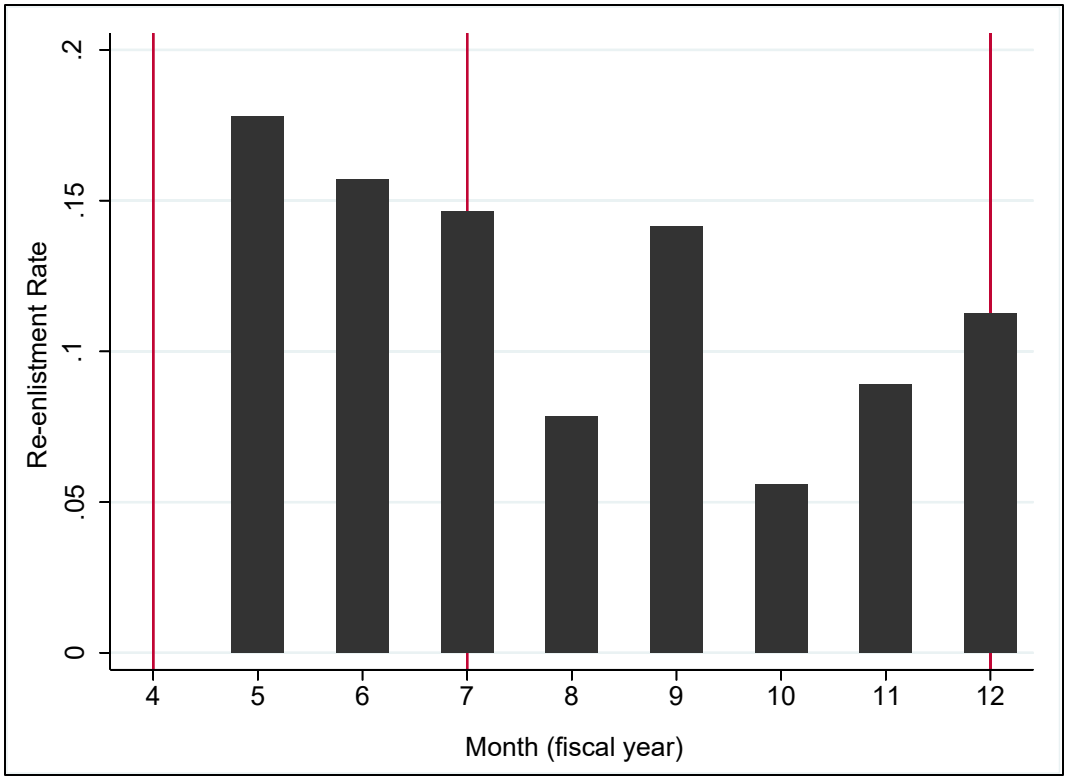

Figure 10. Zone D re-enlistment rates

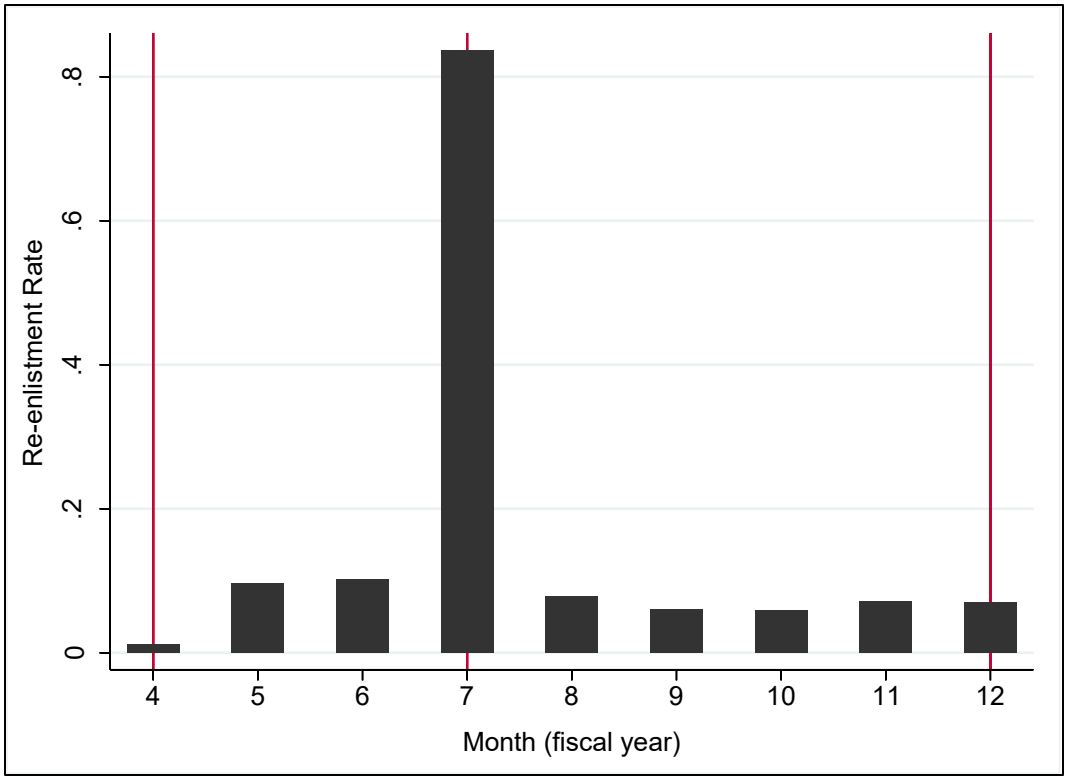

Figure 11. Zone E re-enlistment rates

B. FISCAL YEAR 2009

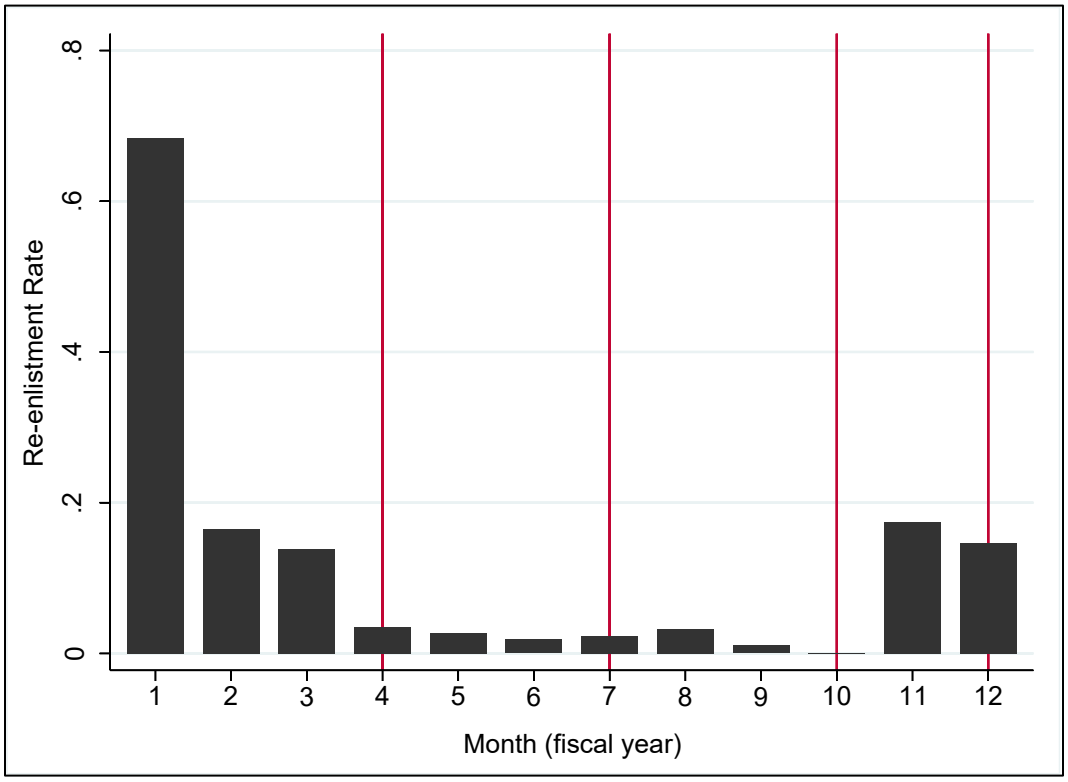

Figure 12. Zone B re-enlistment rates

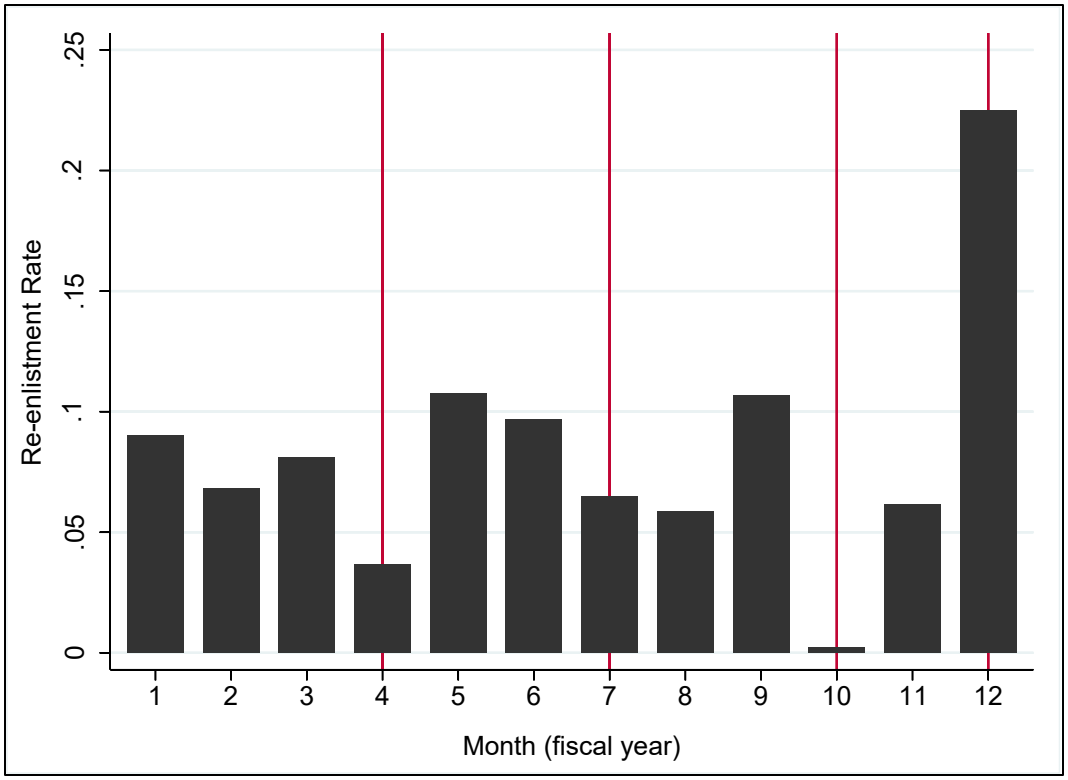

Figure 13. Zone C re-enlistment rates

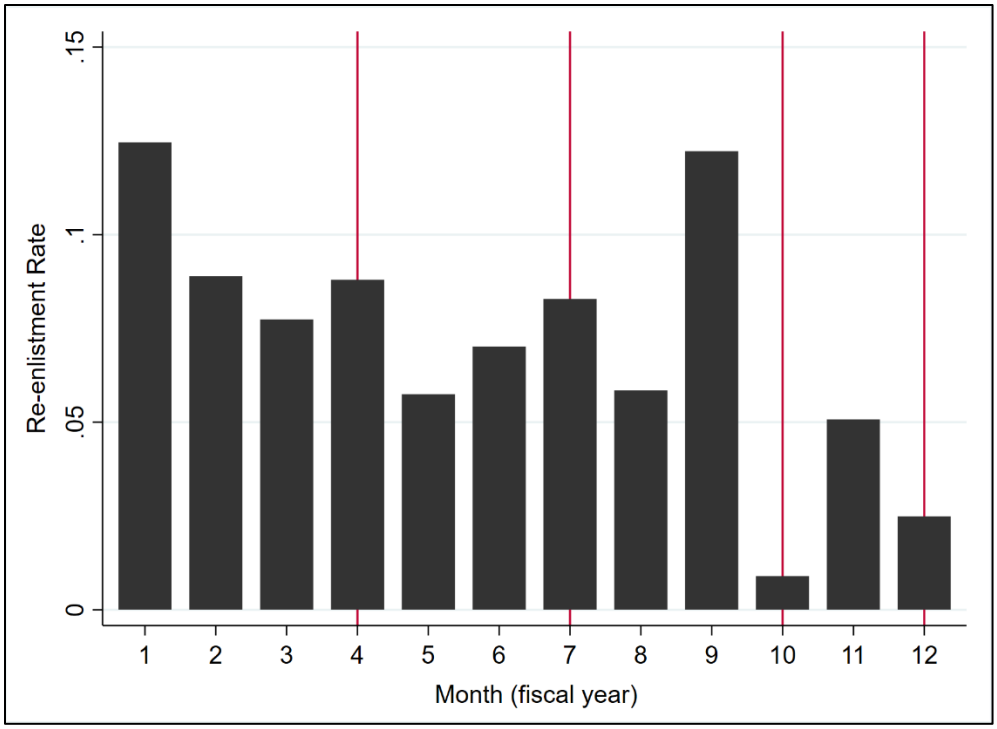

Figure 14. Zone D re-enlistment rates

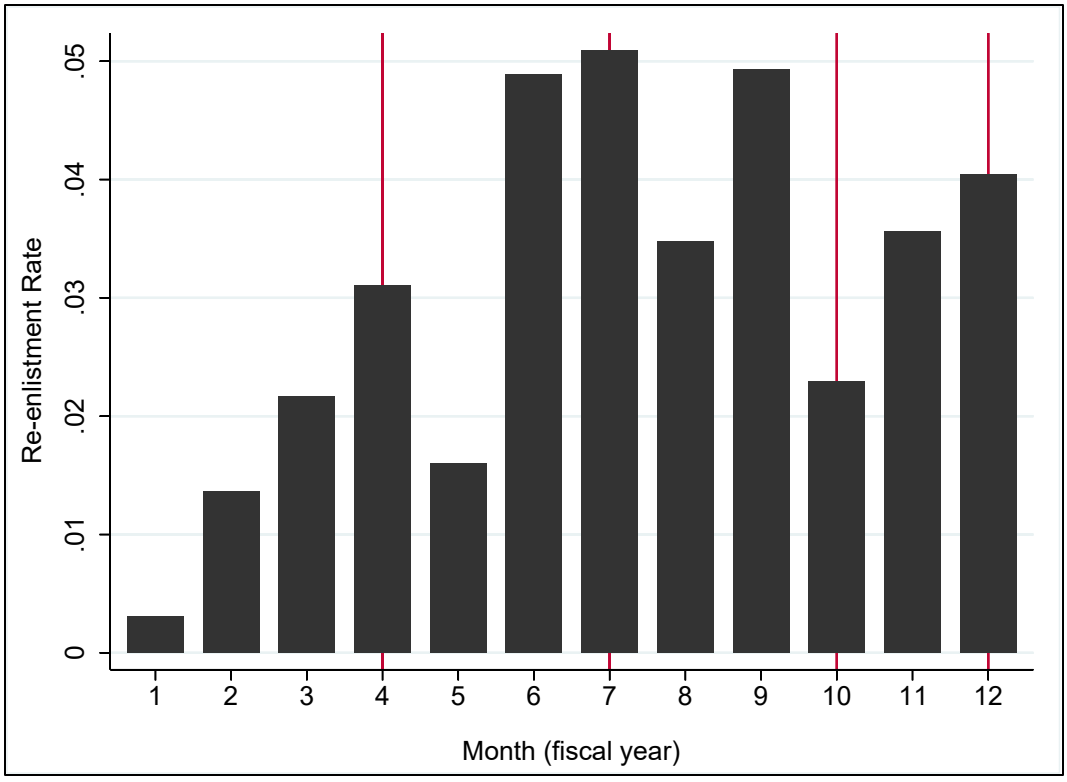

Figure 15. Zone E re-enlistment rates

C. FISCAL YEAR 2010

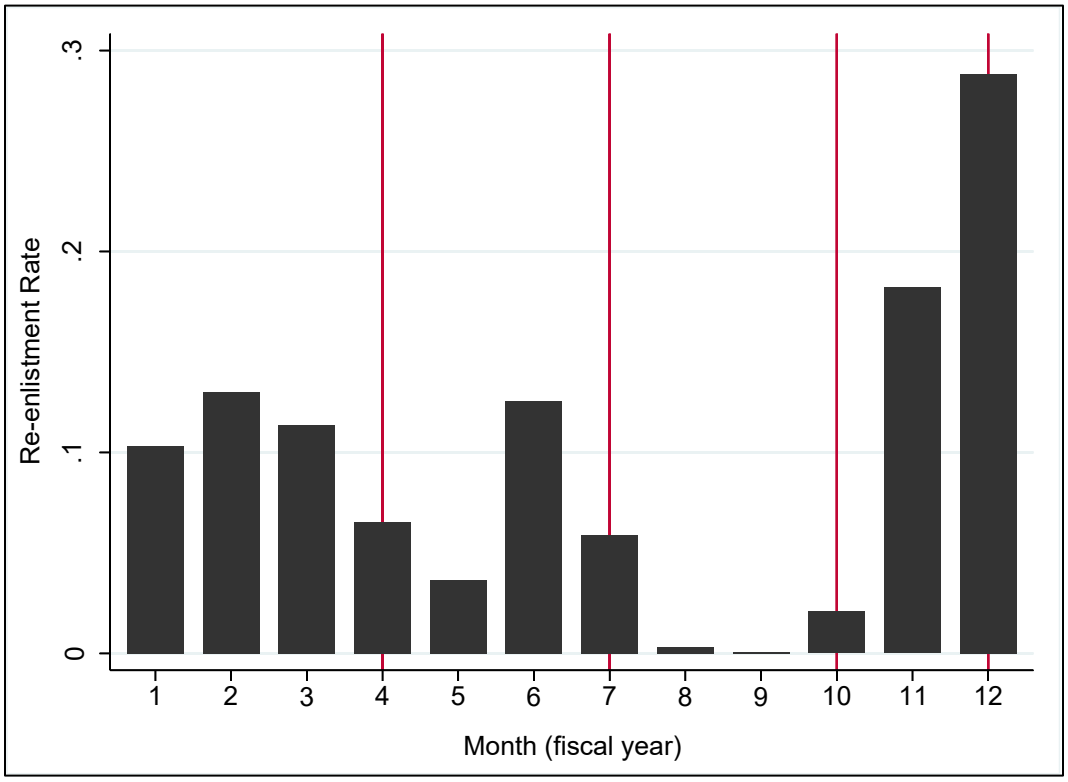

Figure 16. Zone B re-enlistment rates

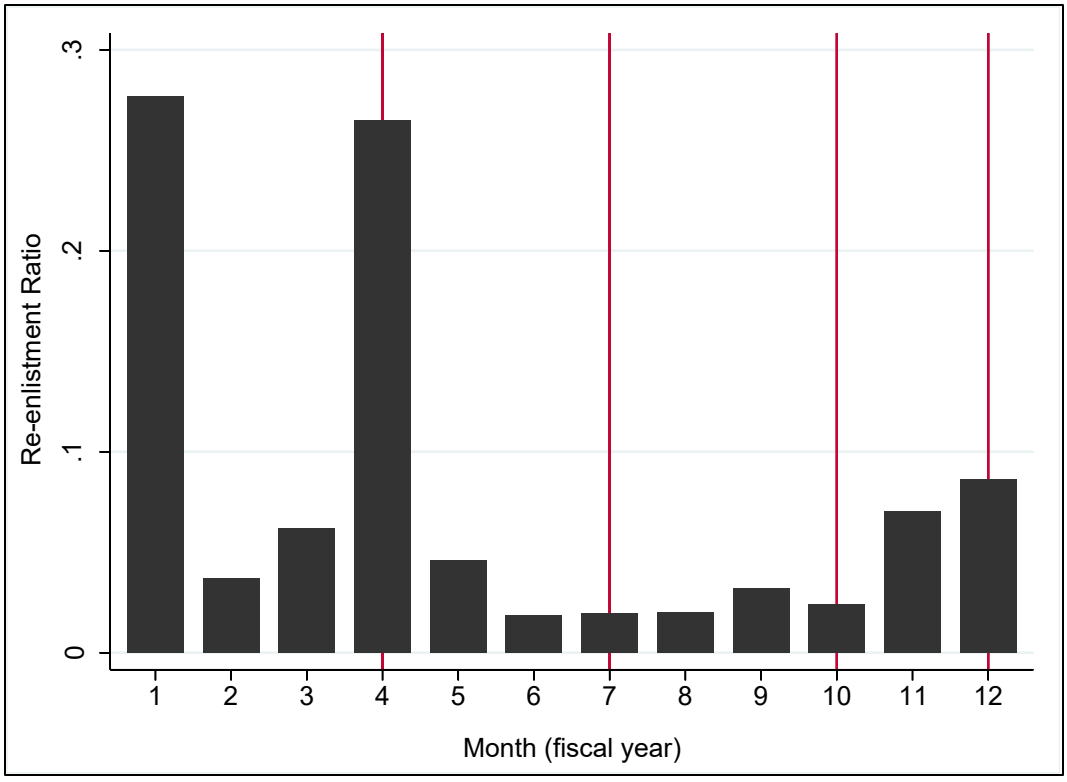

Figure 17. Zone C re-enlistment rates

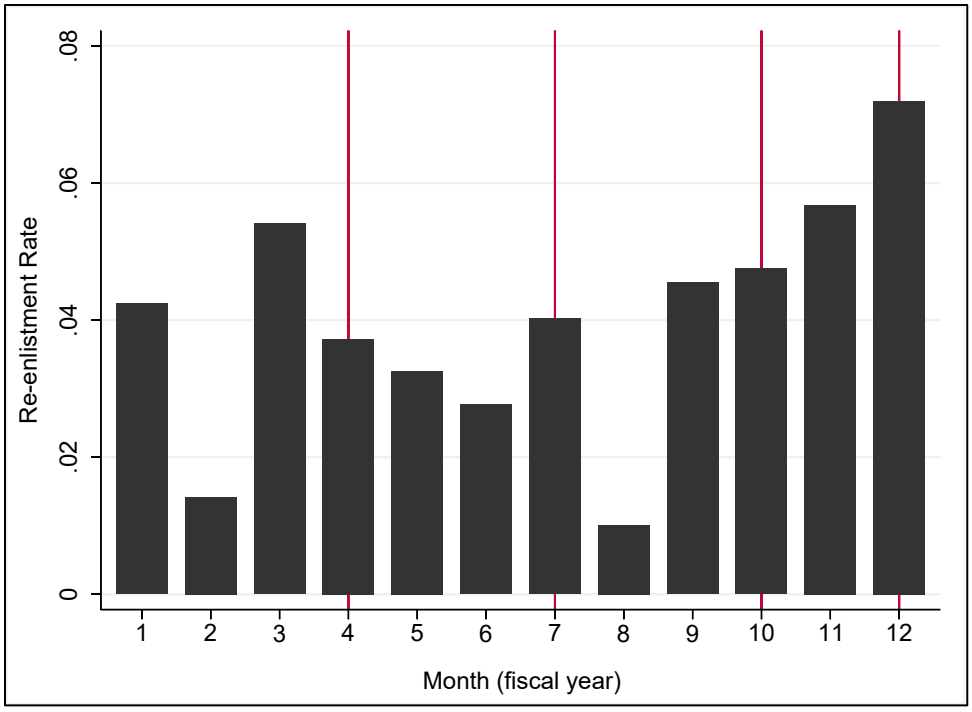

Figure 18. Zone D re-enlistment rates

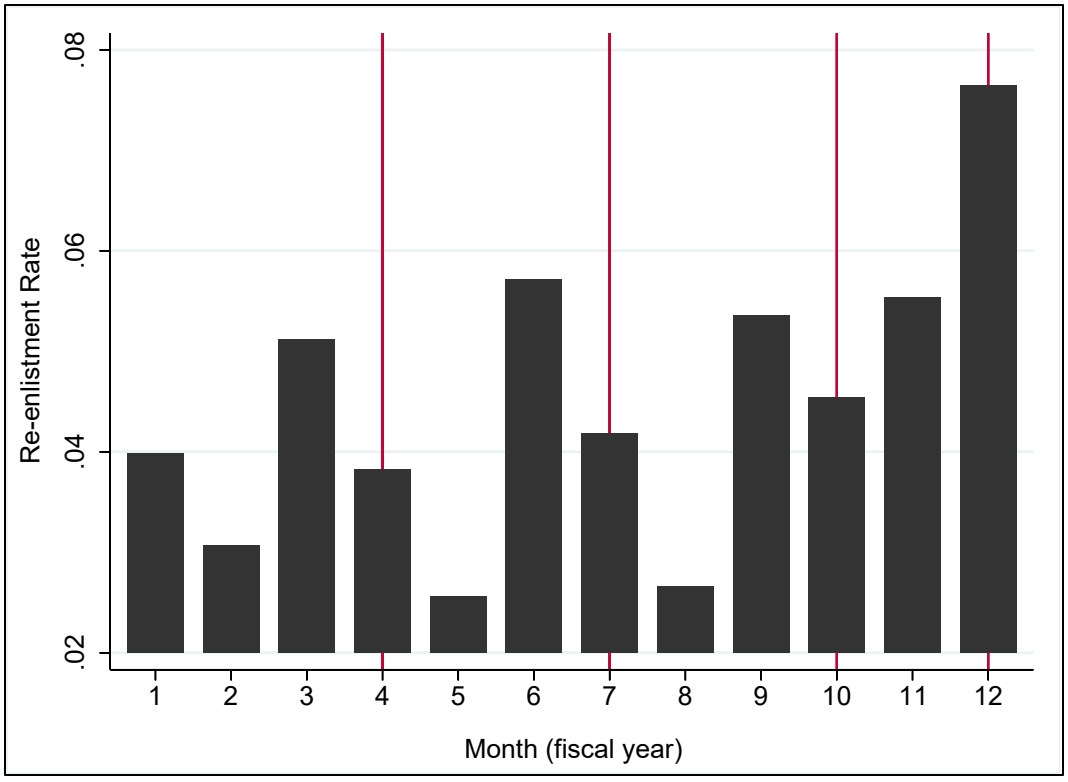

Figure 19. Zone E re-enlistment rates

D. FISCAL YEAR 2011

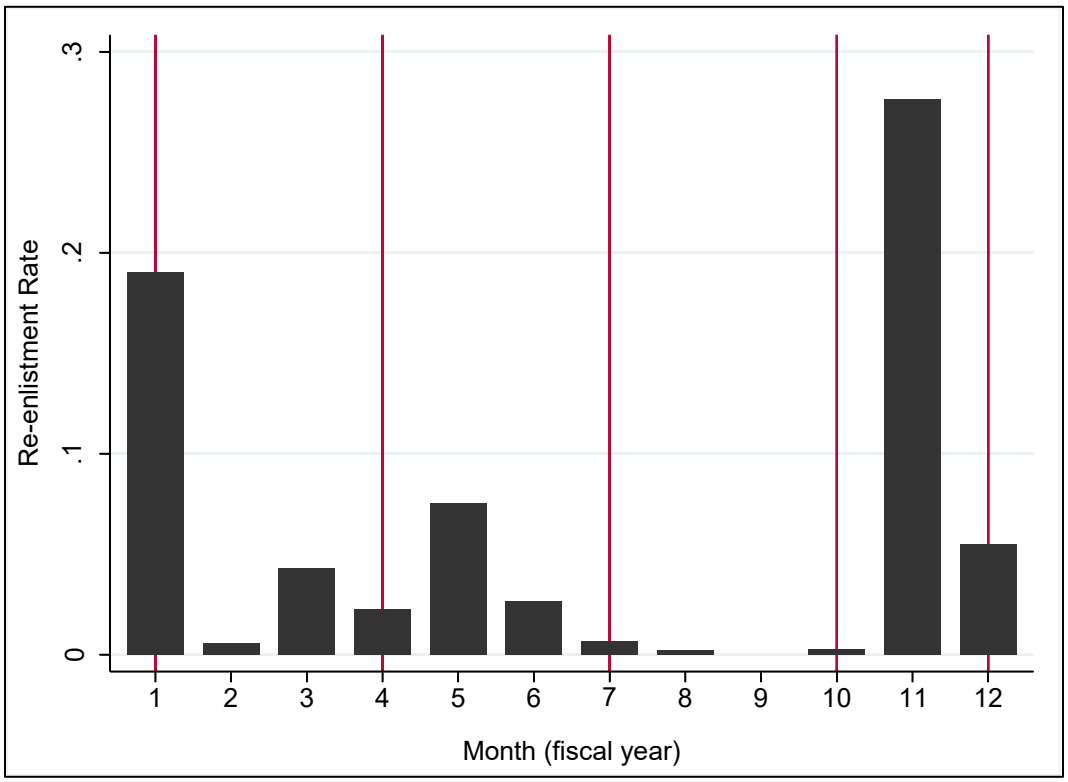

Figure 20. Zone B re-enlistment rates

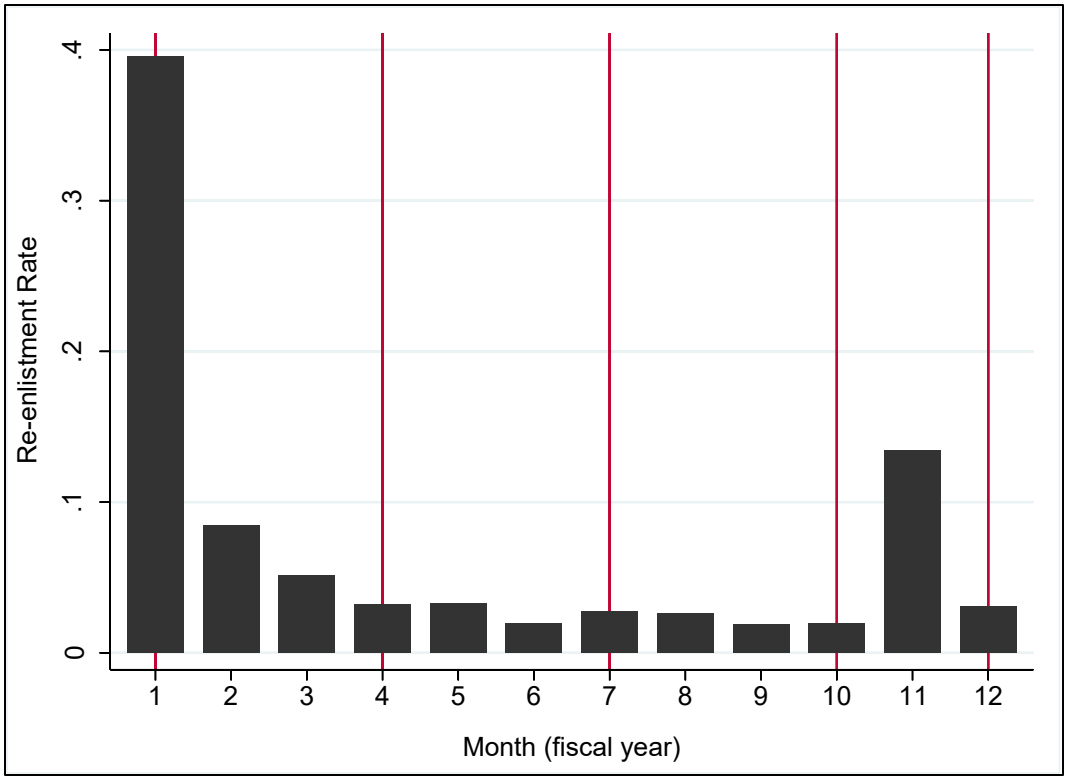

Figure 21. Zone C re-enlistment rates

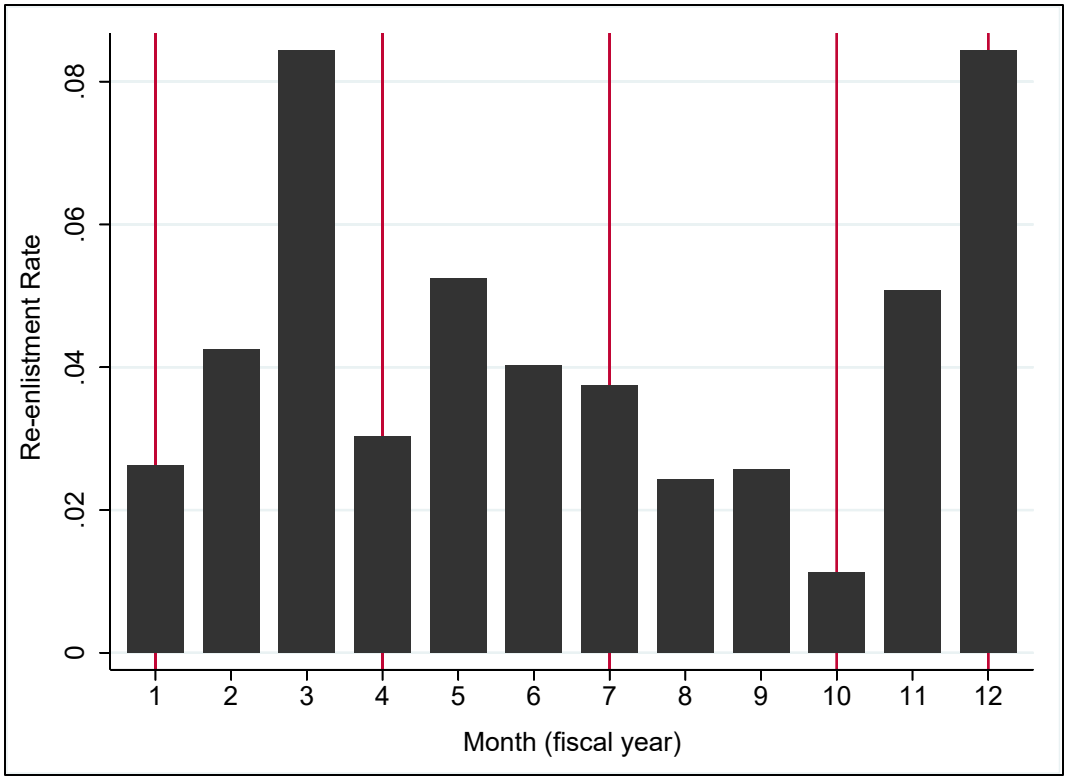

Figure 22. Zone D re-enlistment rates

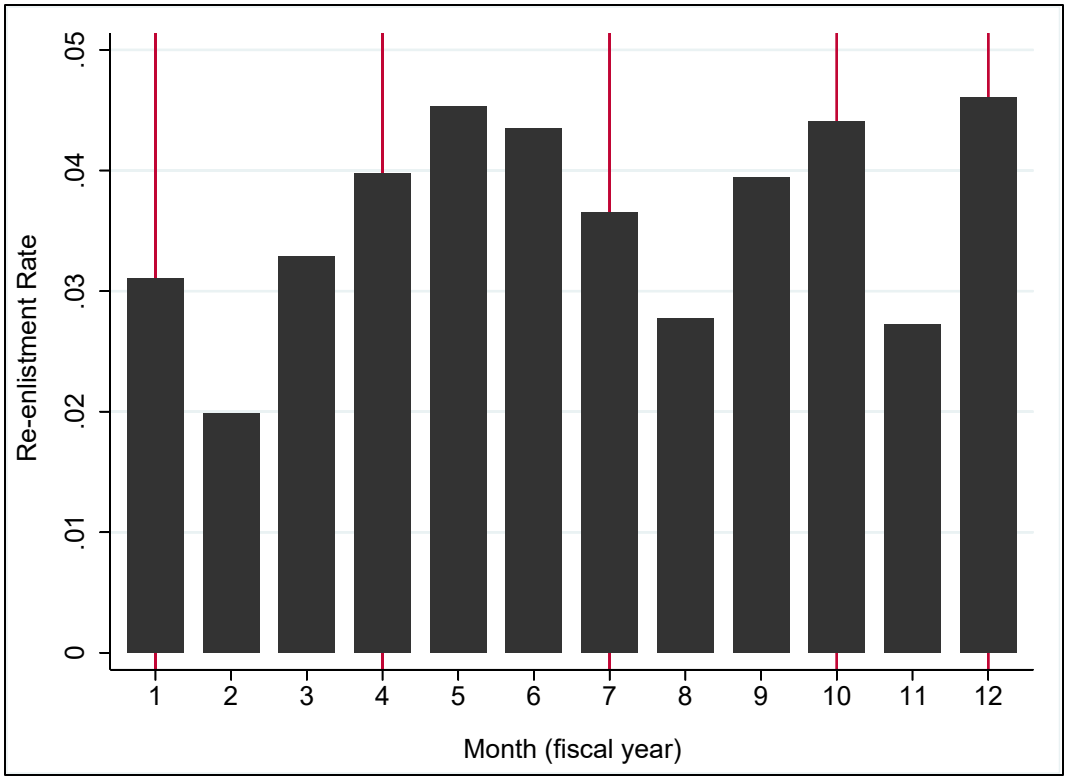

Figure 23. Zone E re-enlistment rates

E. FISCAL YEAR 2012

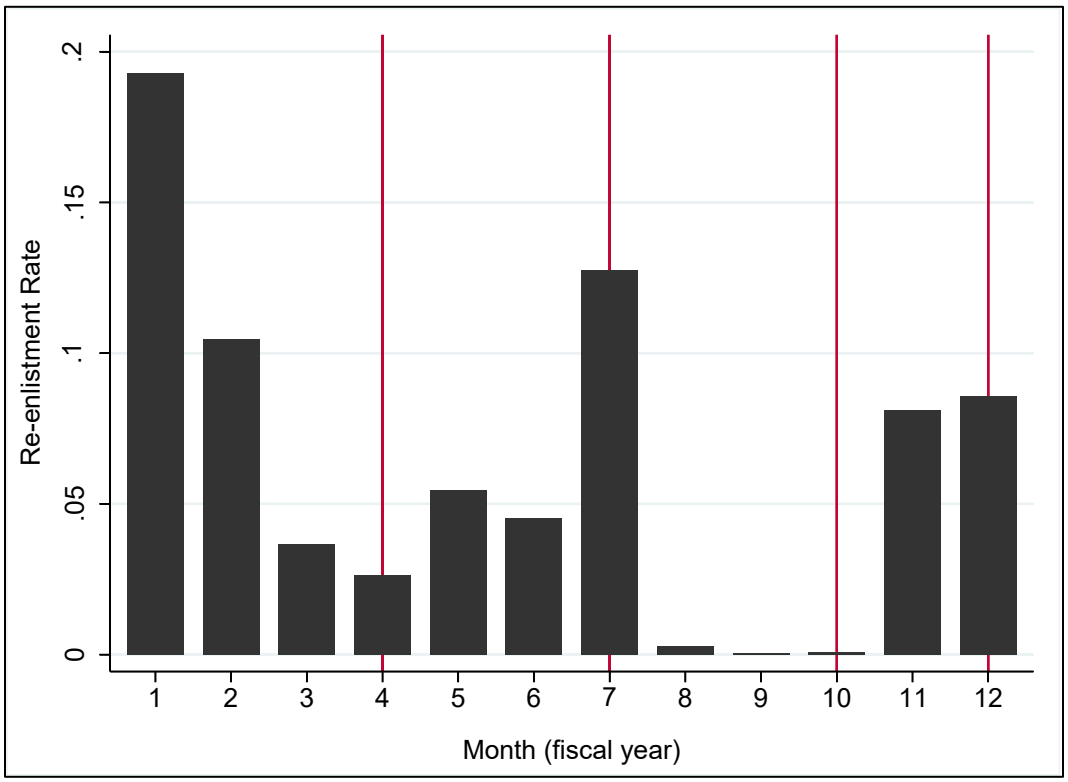

Figure 24. Zone B re-enlistment rate

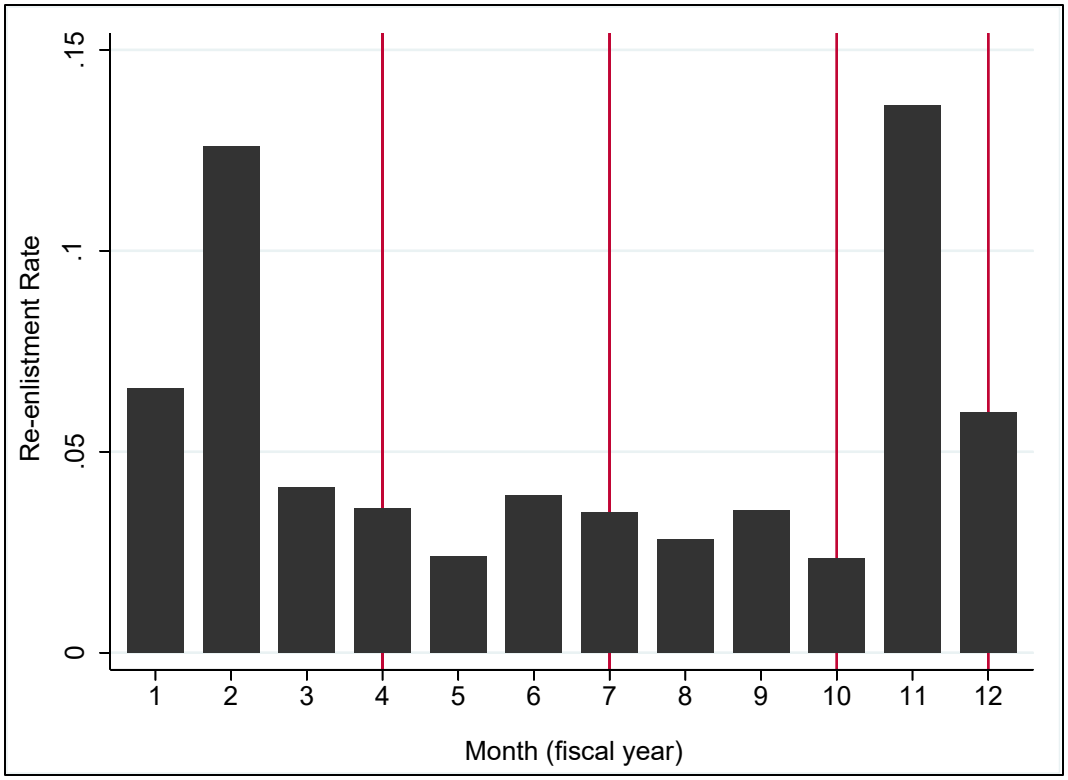

Figure 25. Zone C re-enlistment rates

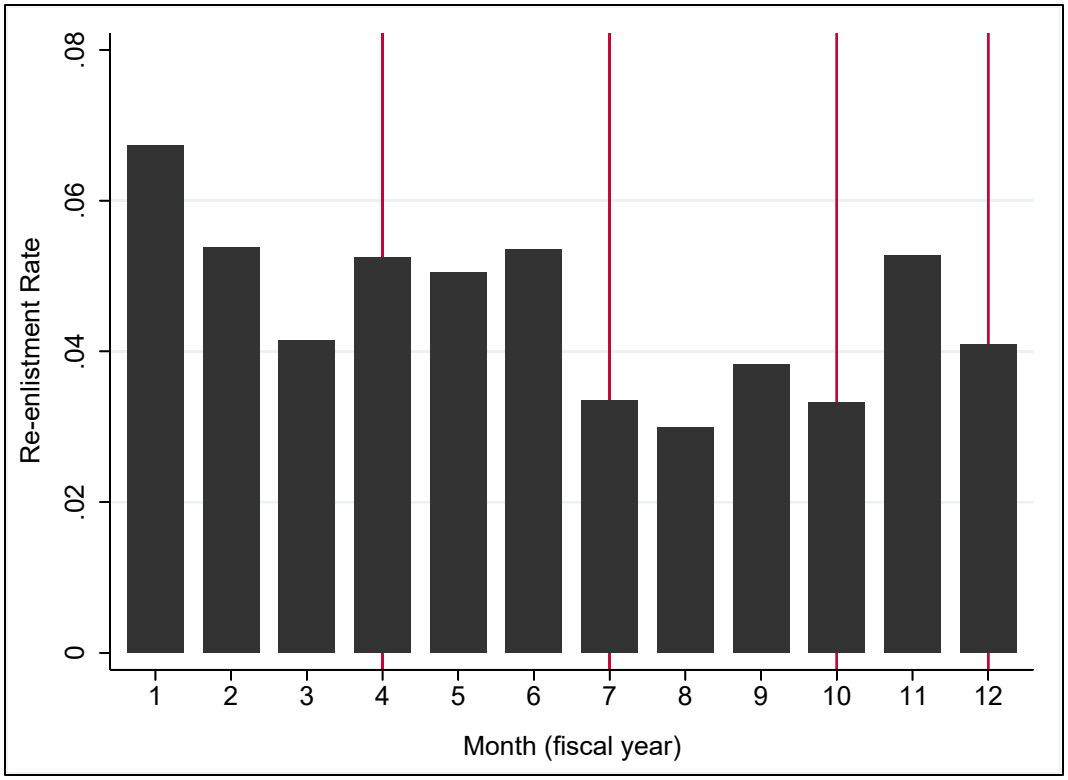

Figure 26. Zone D re-enlistment rates

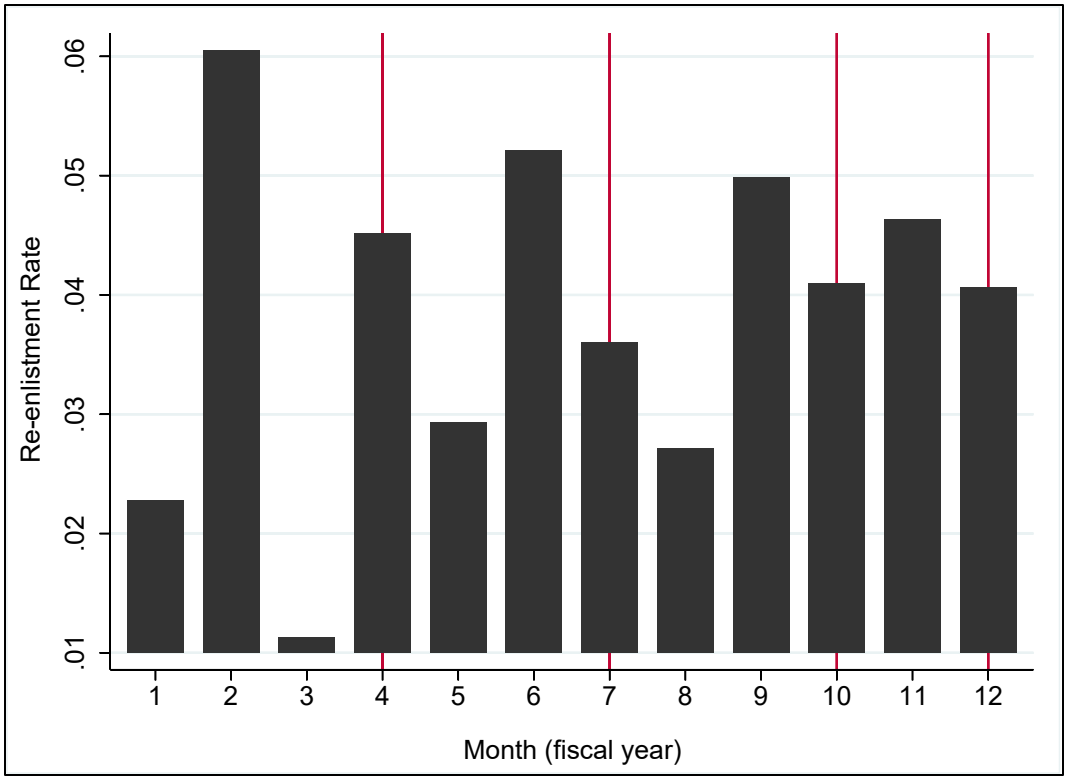

Figure 27. Zone E re-enlistment rates

F. FISCAL YEAR 2013

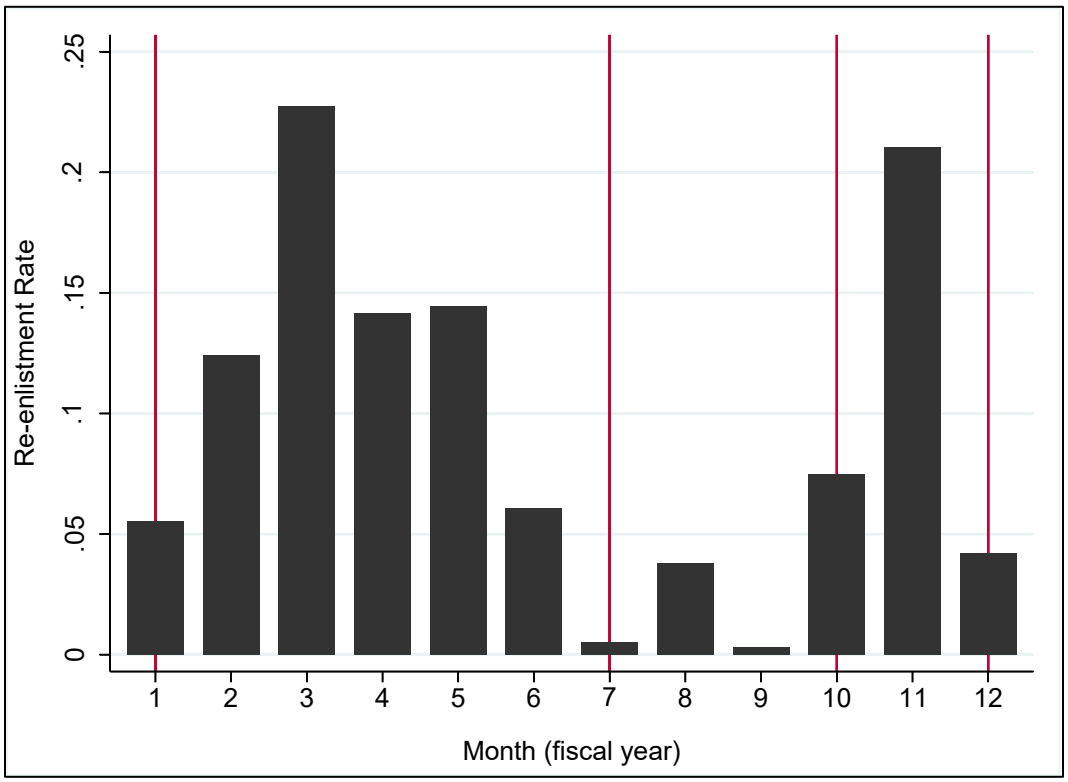

Figure 28. Zone B re-enlistment rates

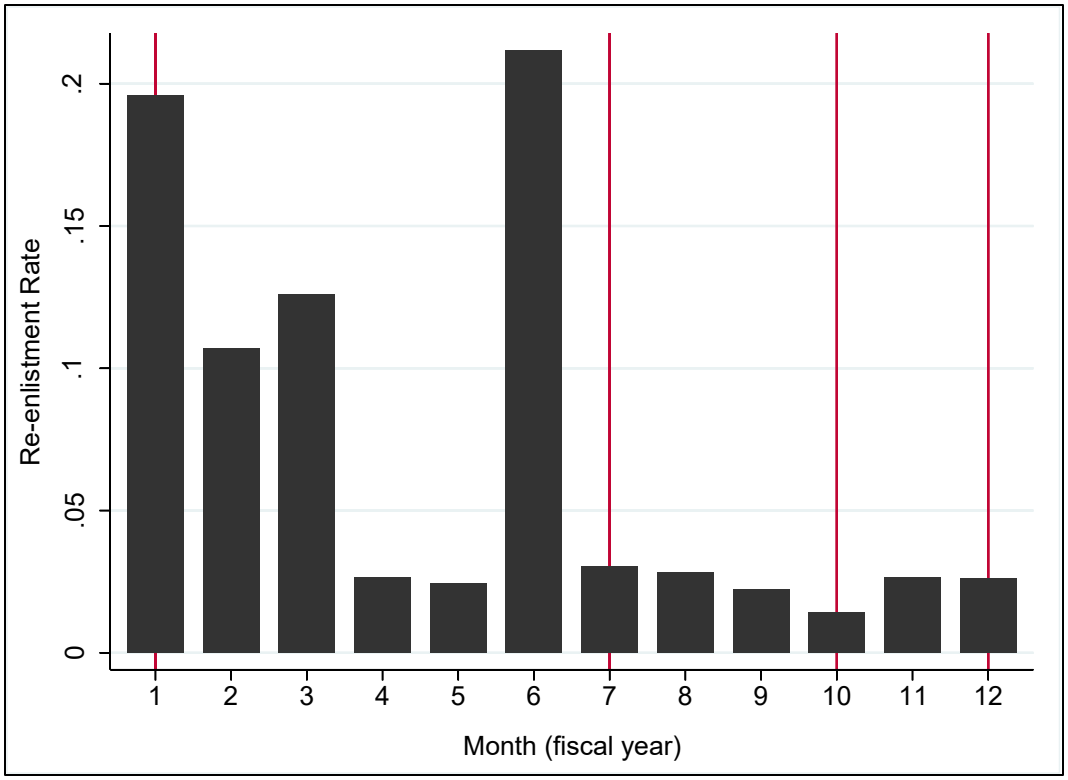

Figure 29. Zone C re-enlistment rates

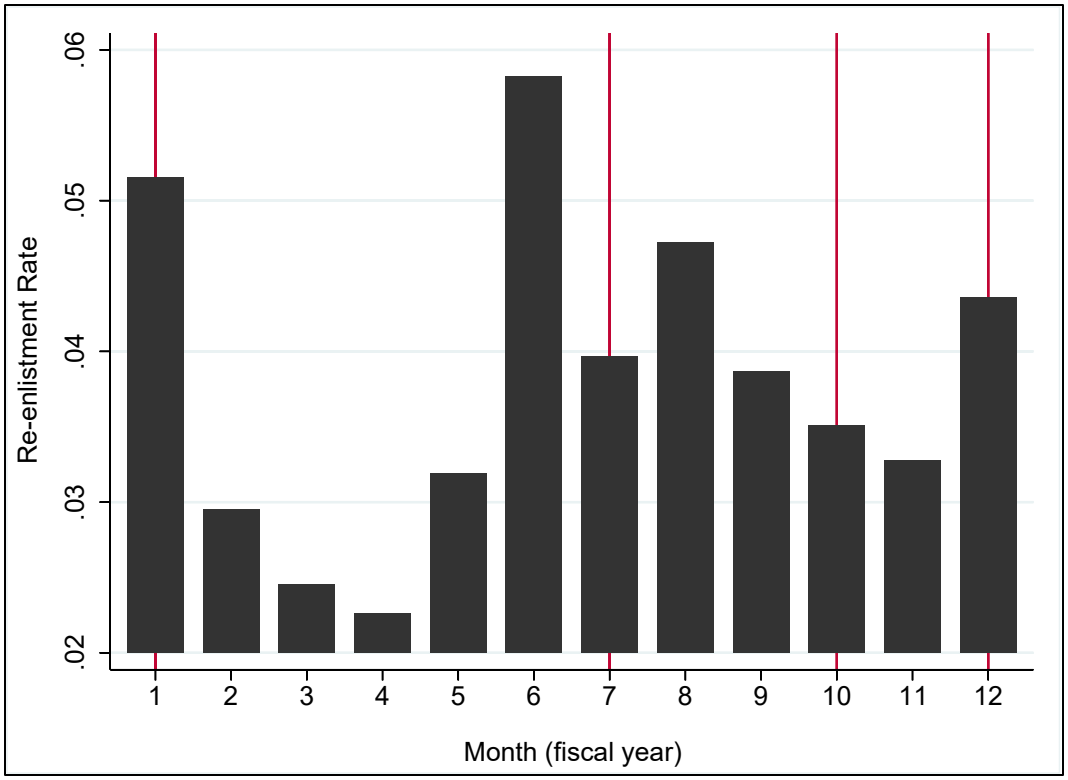

Figure 30. Zone D re-enlistment rates

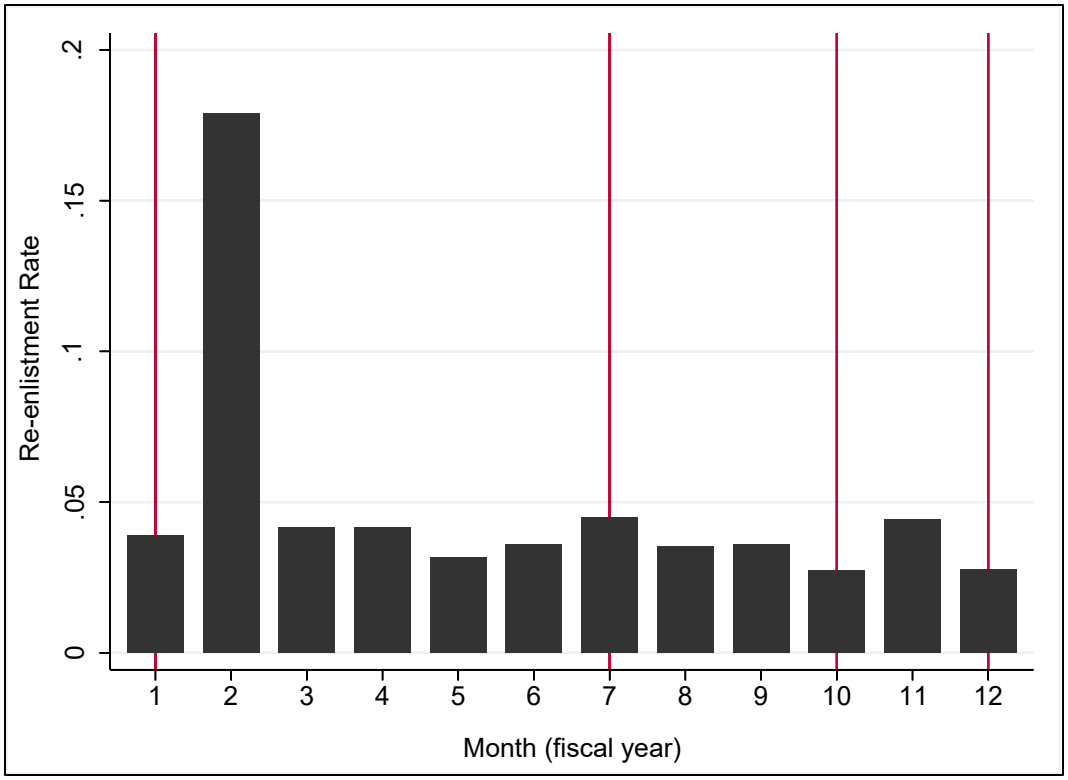

Figure 31. Zone E re-enlistment rates

G. FISCAL YEAR 2014

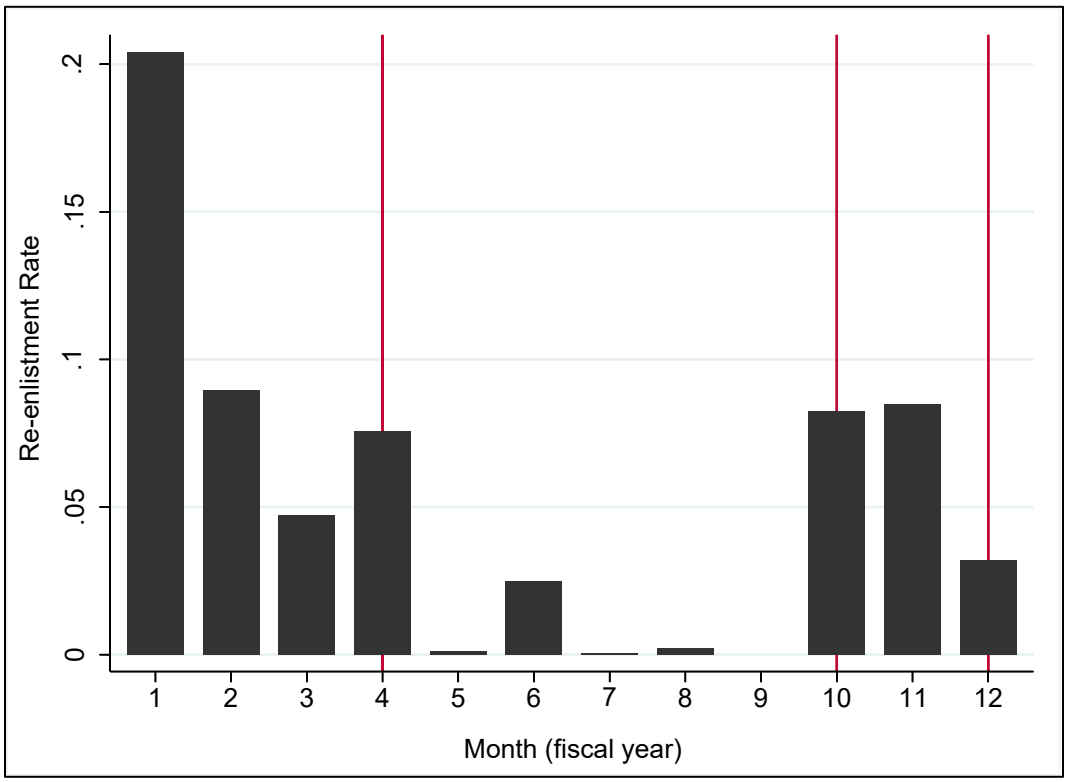

Figure 32. Zone B re-enlistment rates

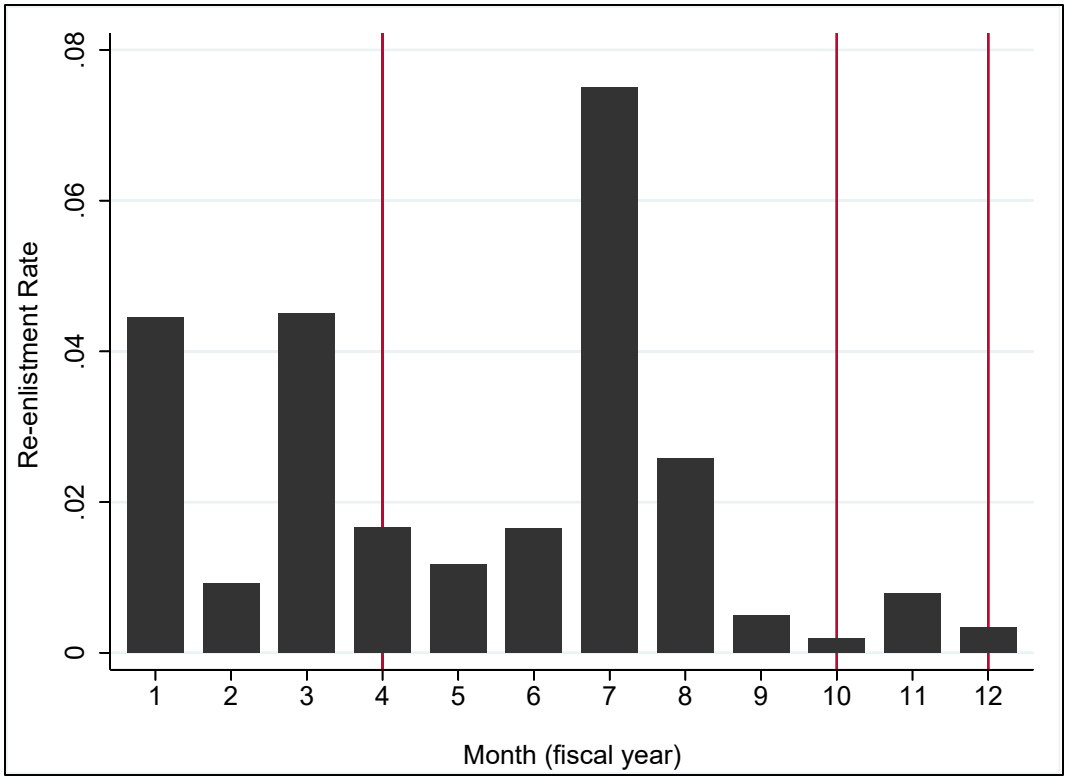

Figure 33. Zone C re-enlistment rates

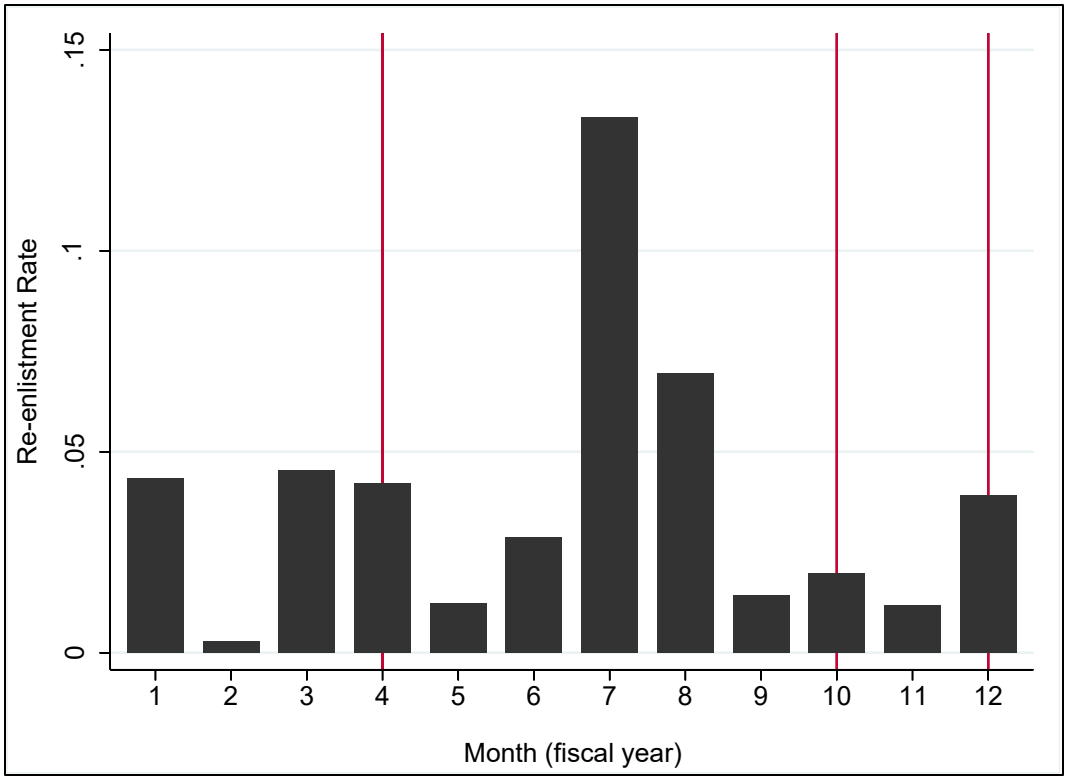

Figure 34. Zone D re-enlistment rates

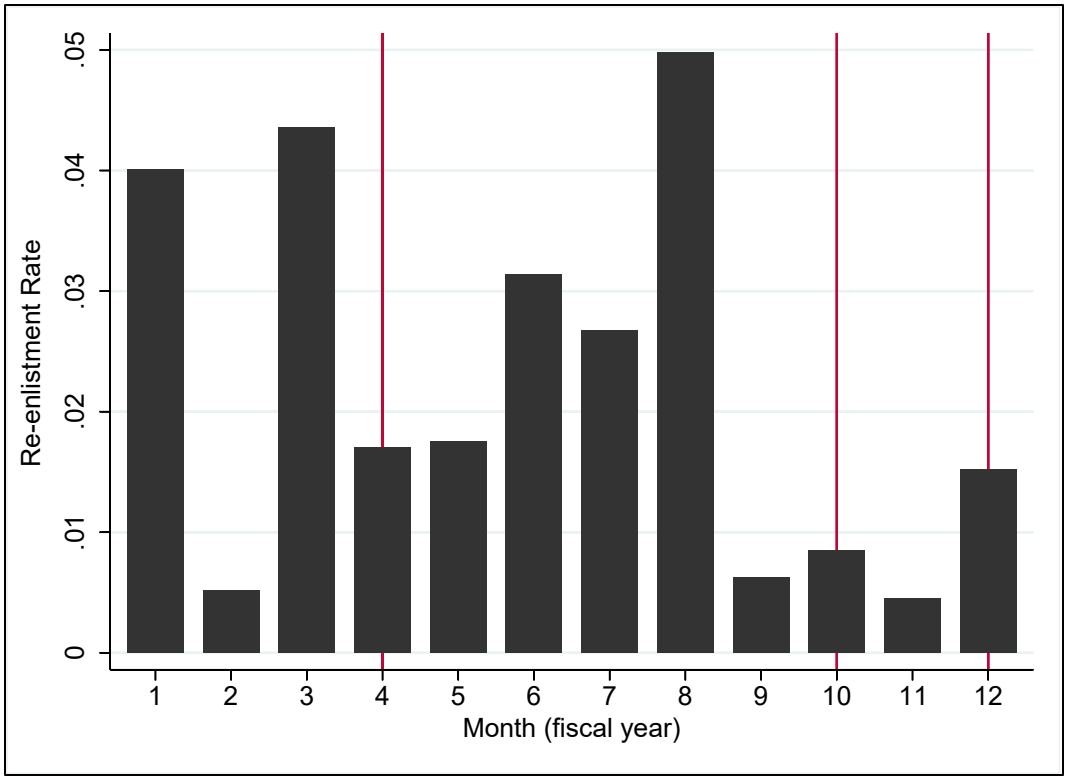

Figure 35. Zone E re-enlistment rates

H. FISCAL YEAR 2015

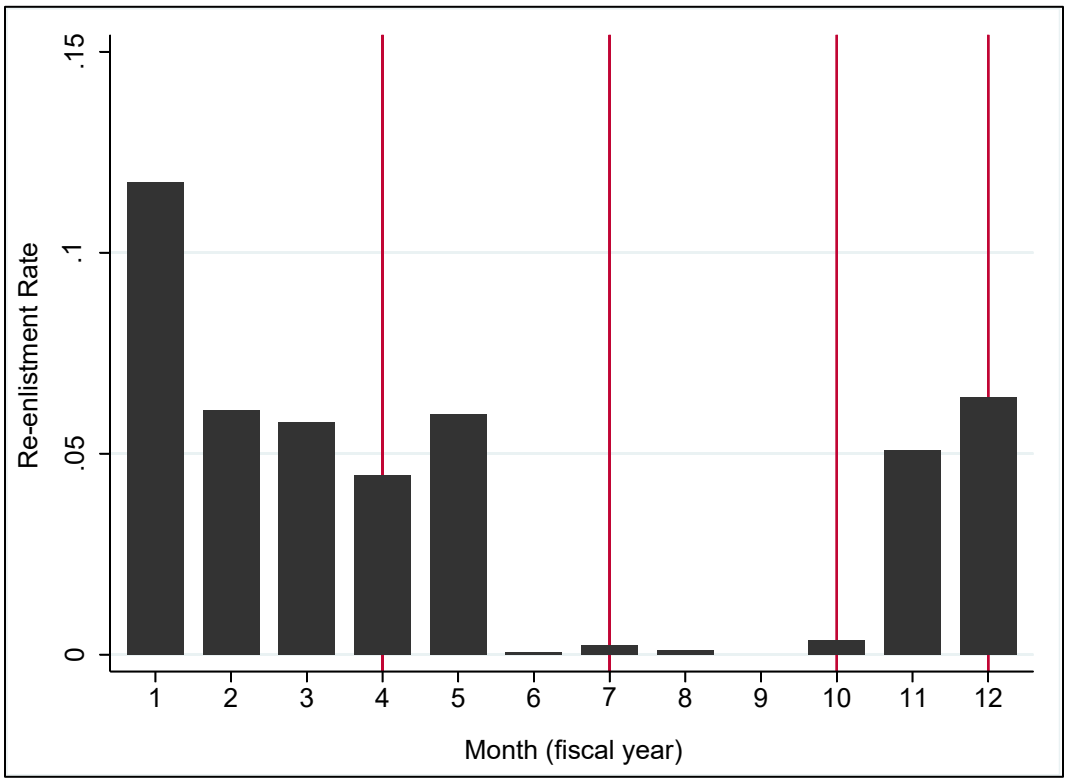

Figure 36. Zone B re-enlistment rates

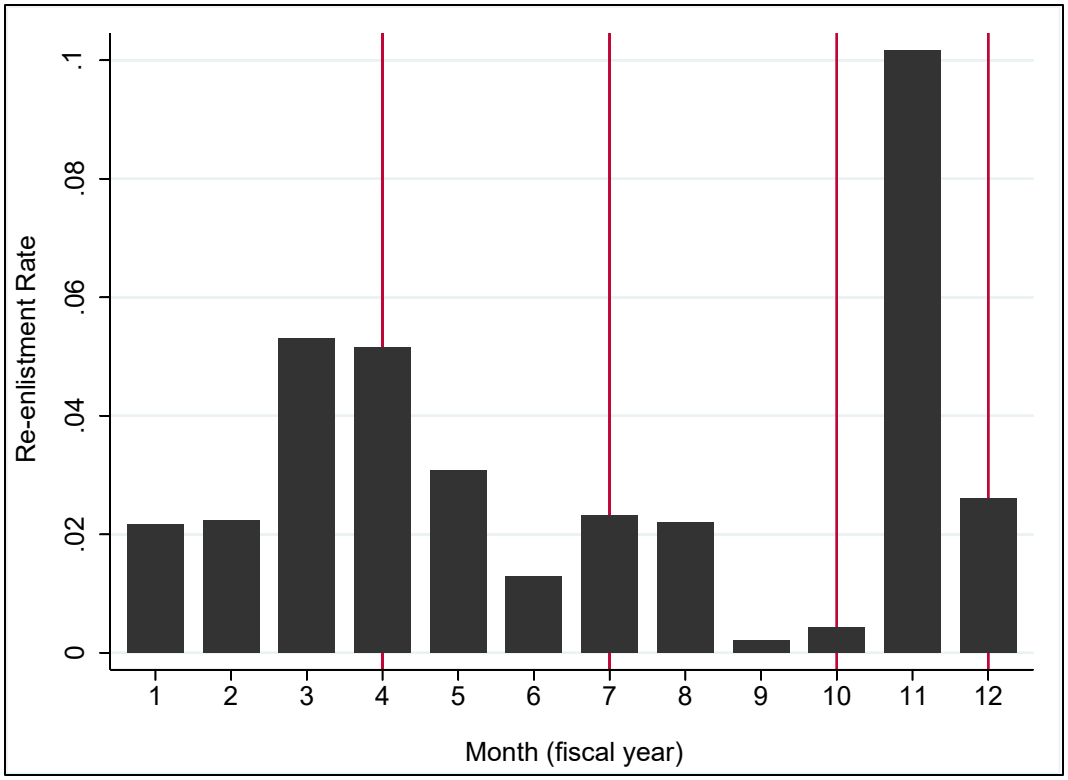

Figure 37. Zone C re-enlistment rates

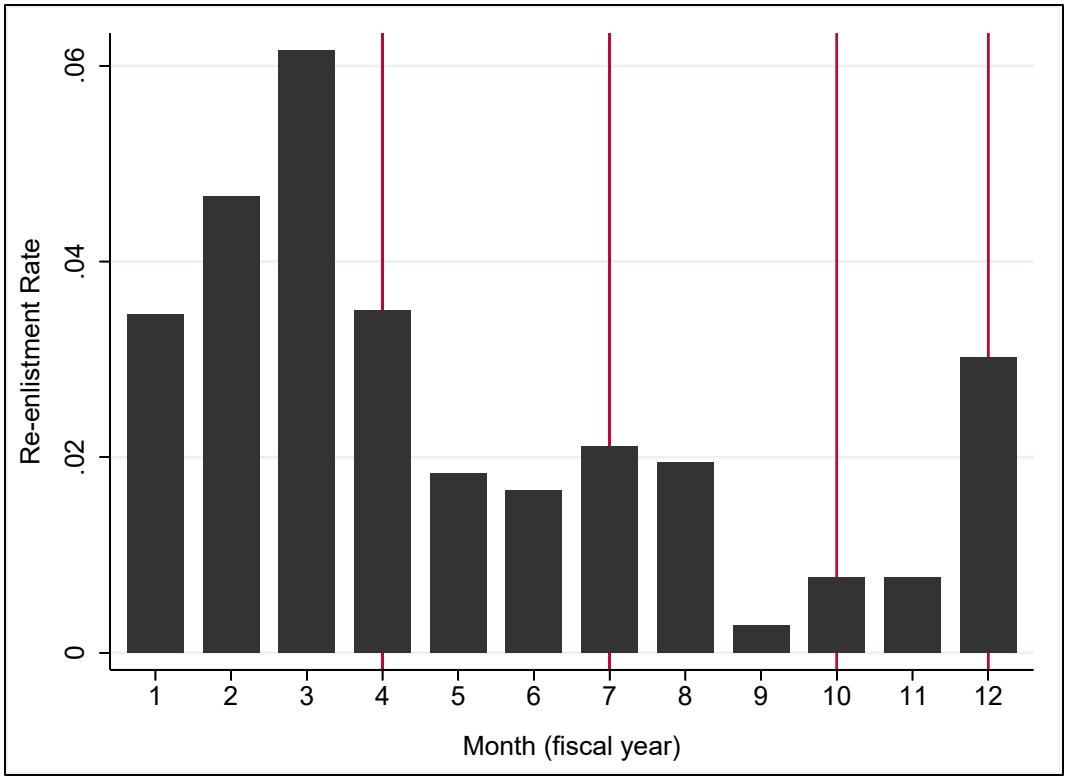

Figure 38. Zone D Re-enlistment Rates

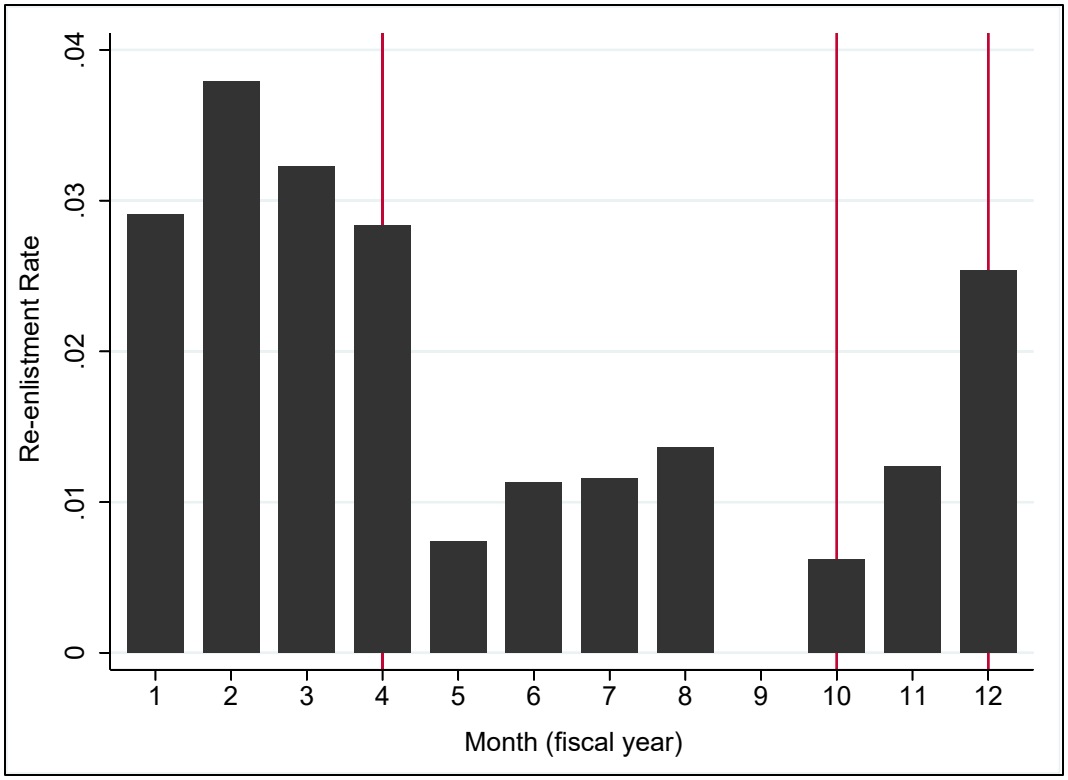

Figure 39. Zone E re-enlistment rates

I. FISCAL YEAR 2016

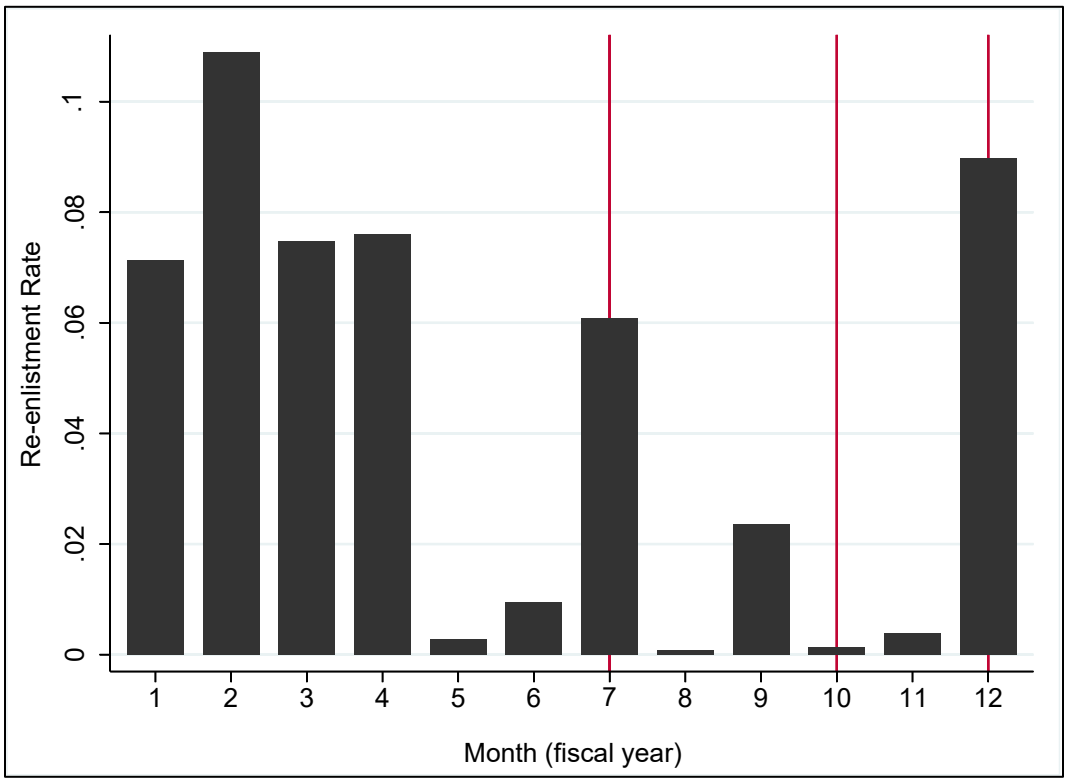

Figure 40. Zone B re-enlistment rates

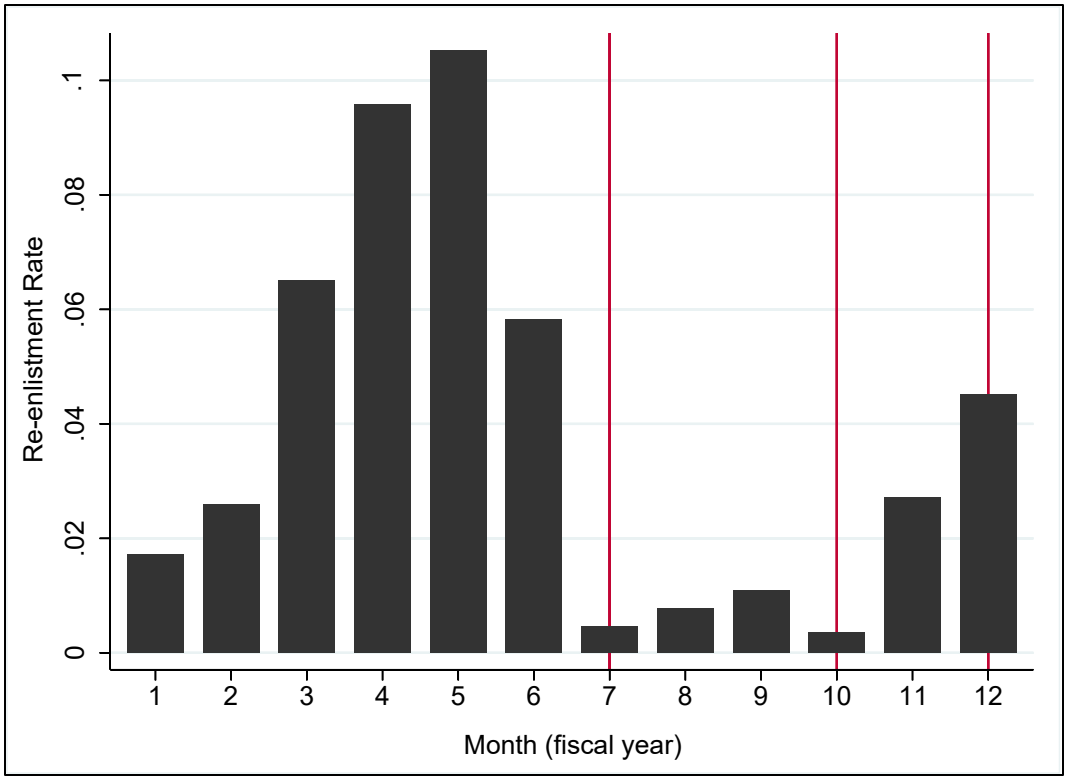

Figure 41. Zone C re-enlistment rates

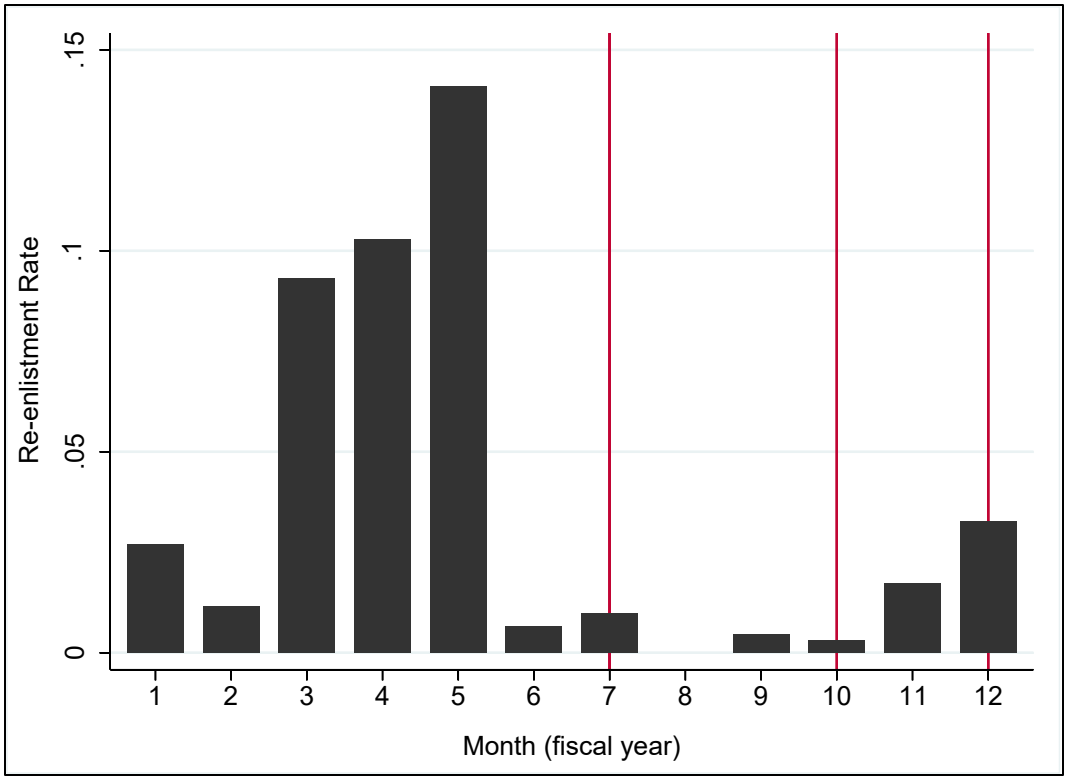

Figure 42. Zone D re-enlistment rates

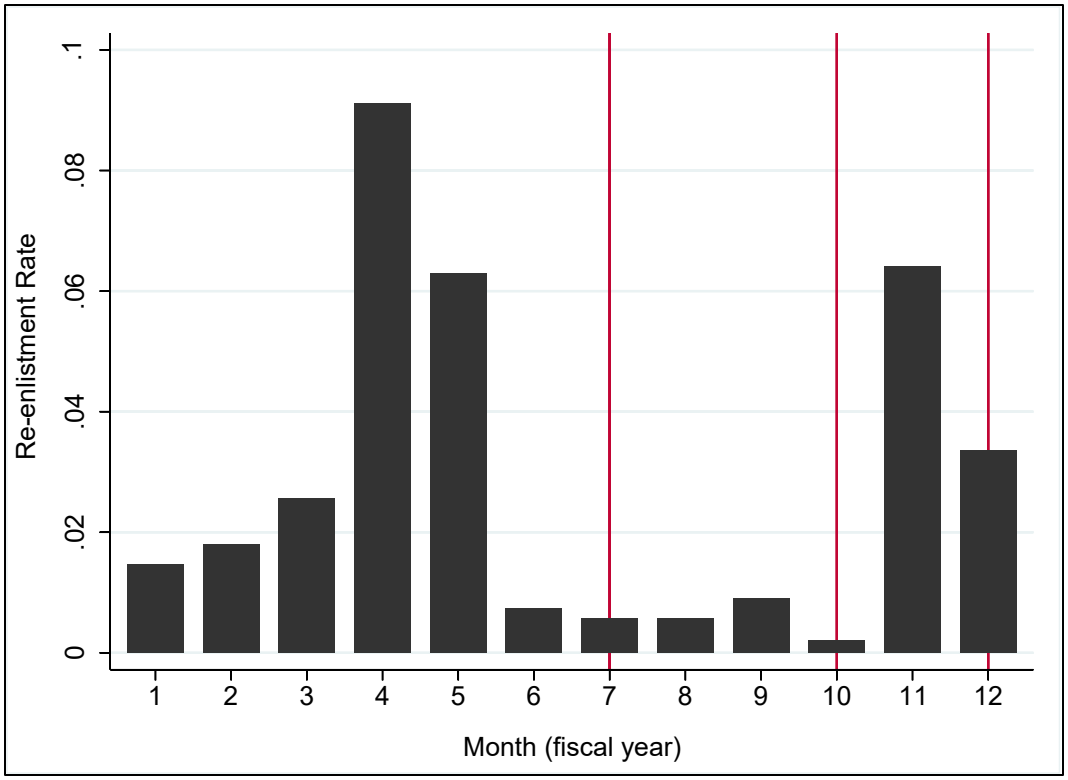

Figure 43. Zone E re-enlistment rates

J. FISCAL YEAR 2017

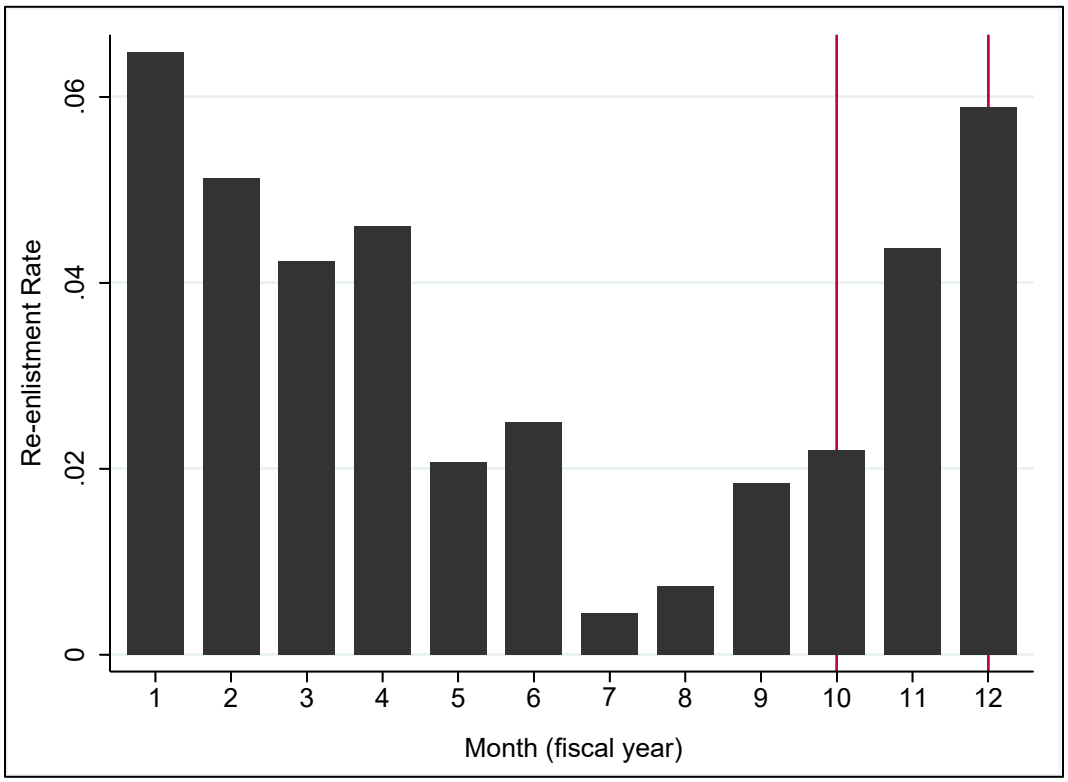

Figure 44. Zone B re-enlistment rates

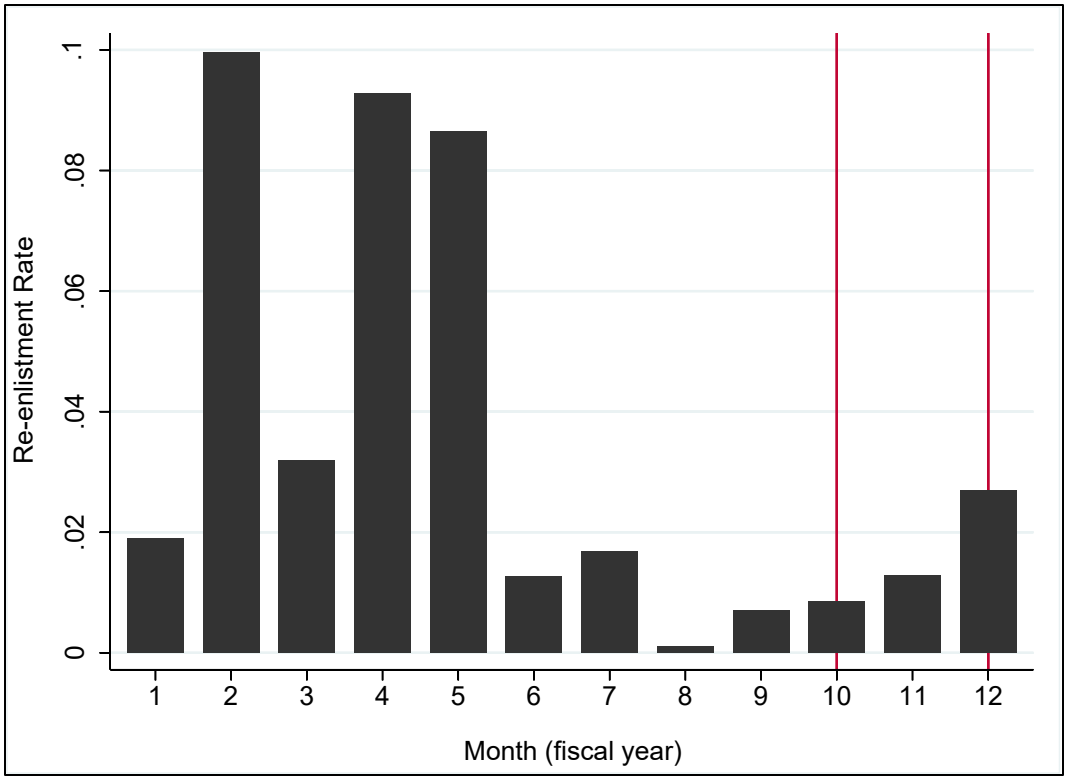

Figure 45. Zone C re-enlistment rates

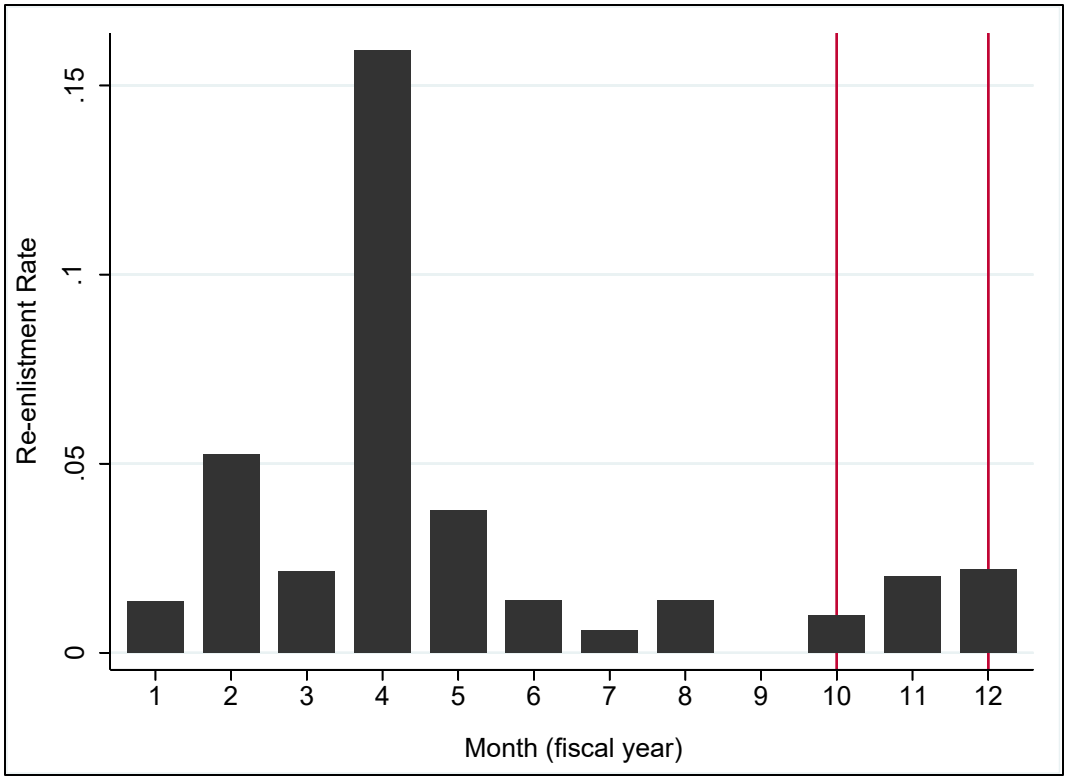

Figure 46. Zone D re-enlistment rates

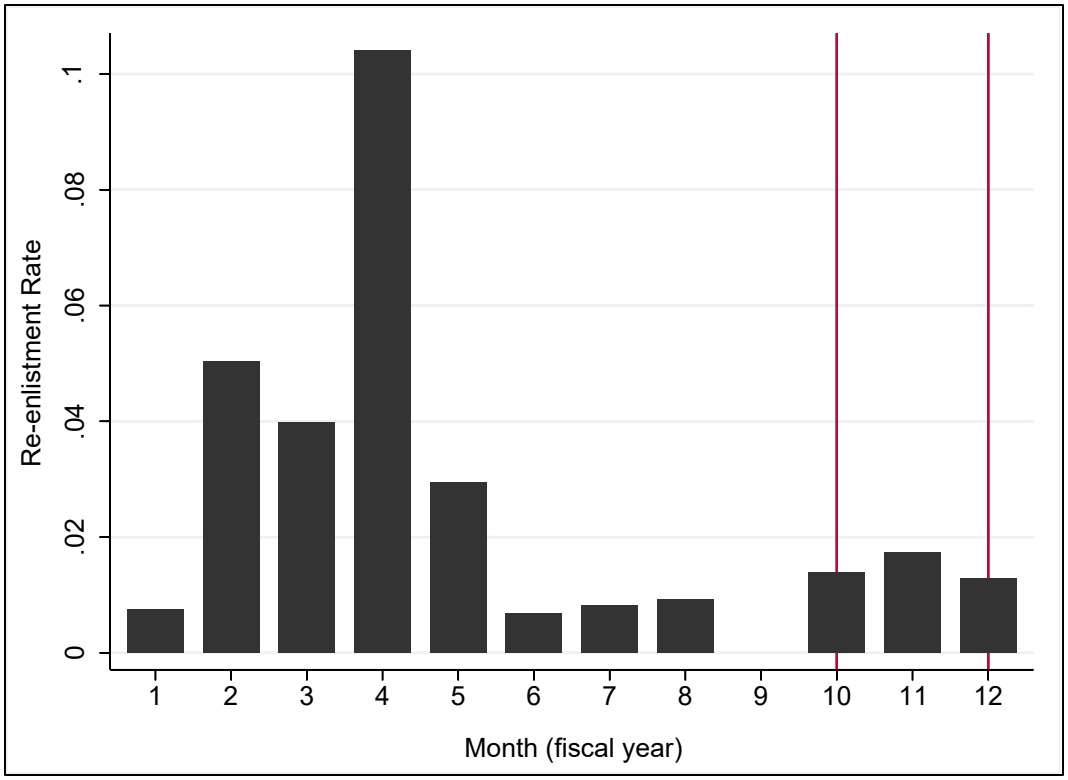

Figure 47. Zone E re-enlistment rates

K. FISCAL YEAR 2018

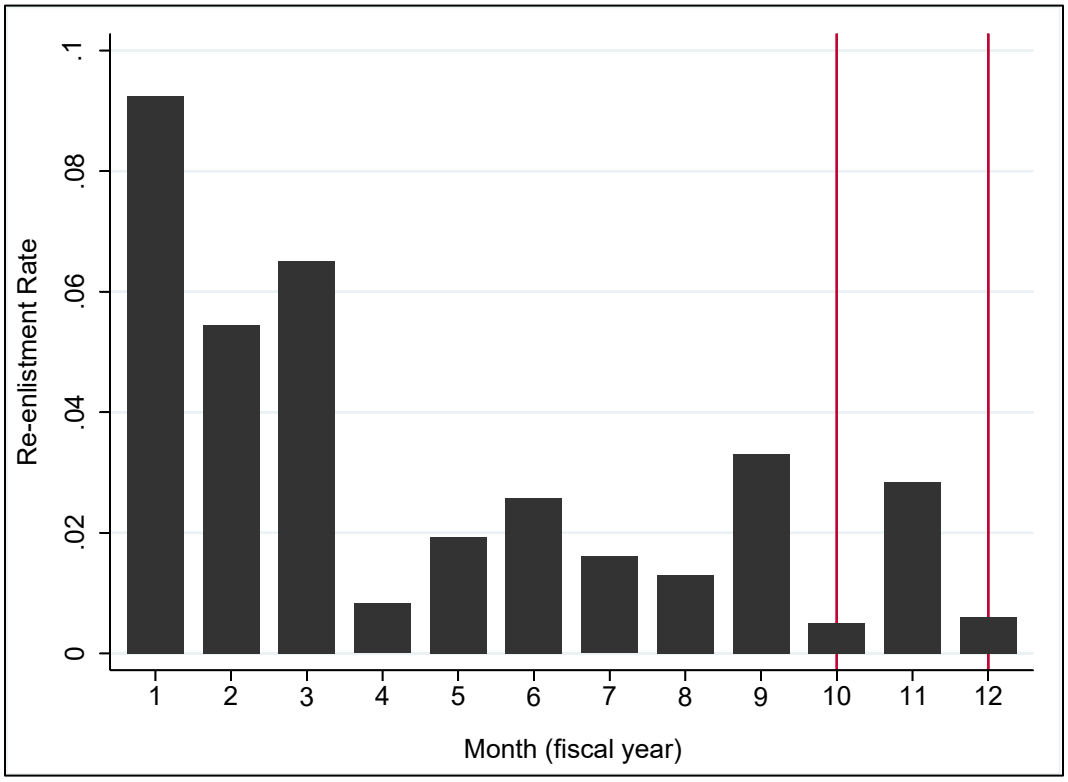

Figure 48. Zone B re-enlistment rates

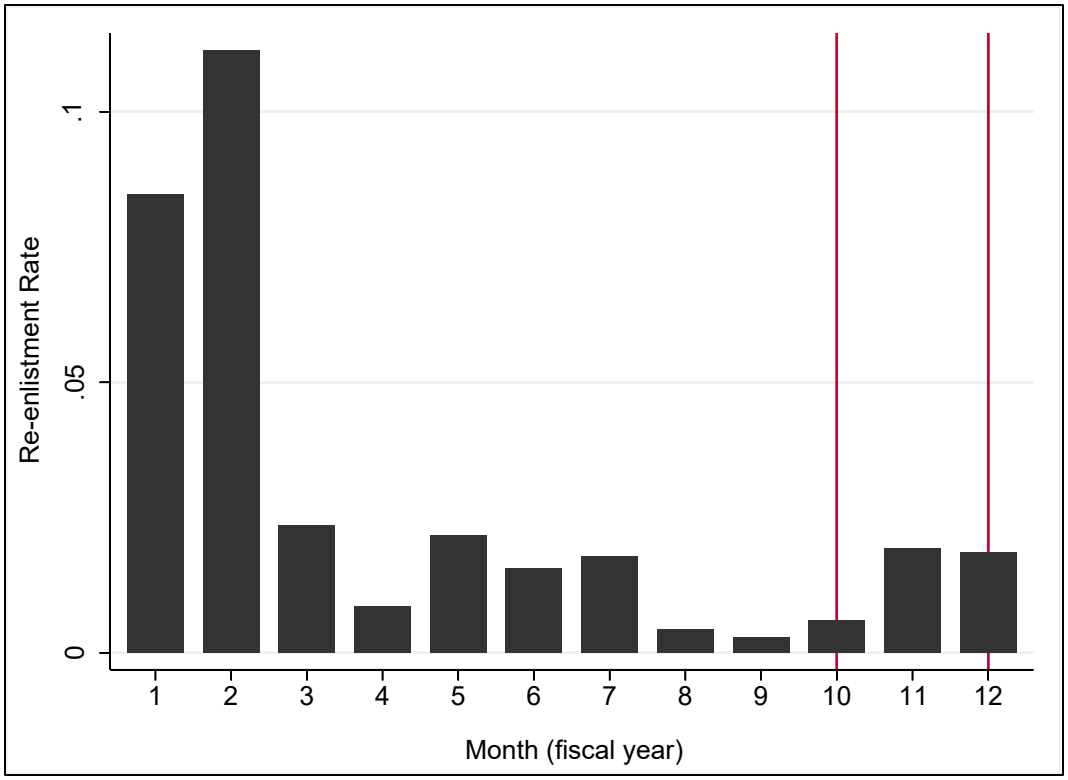

Figure 49. Zone C re-enlistment rates

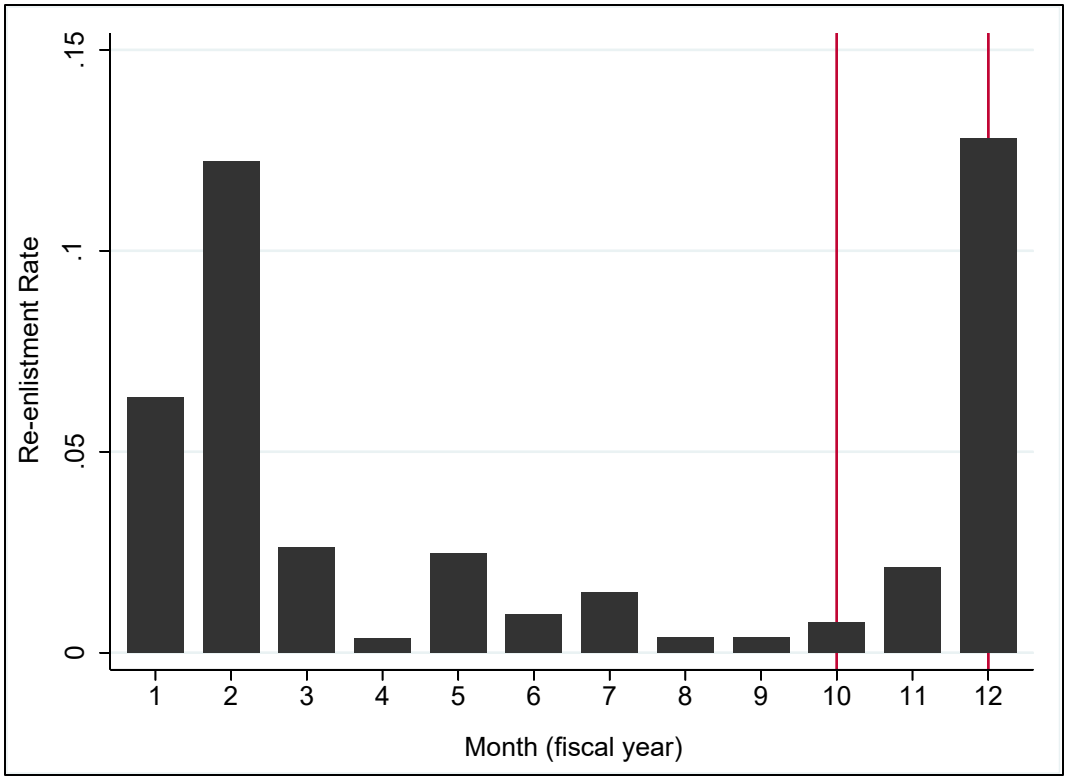

Figure 50. Zone D re-enlistment rates

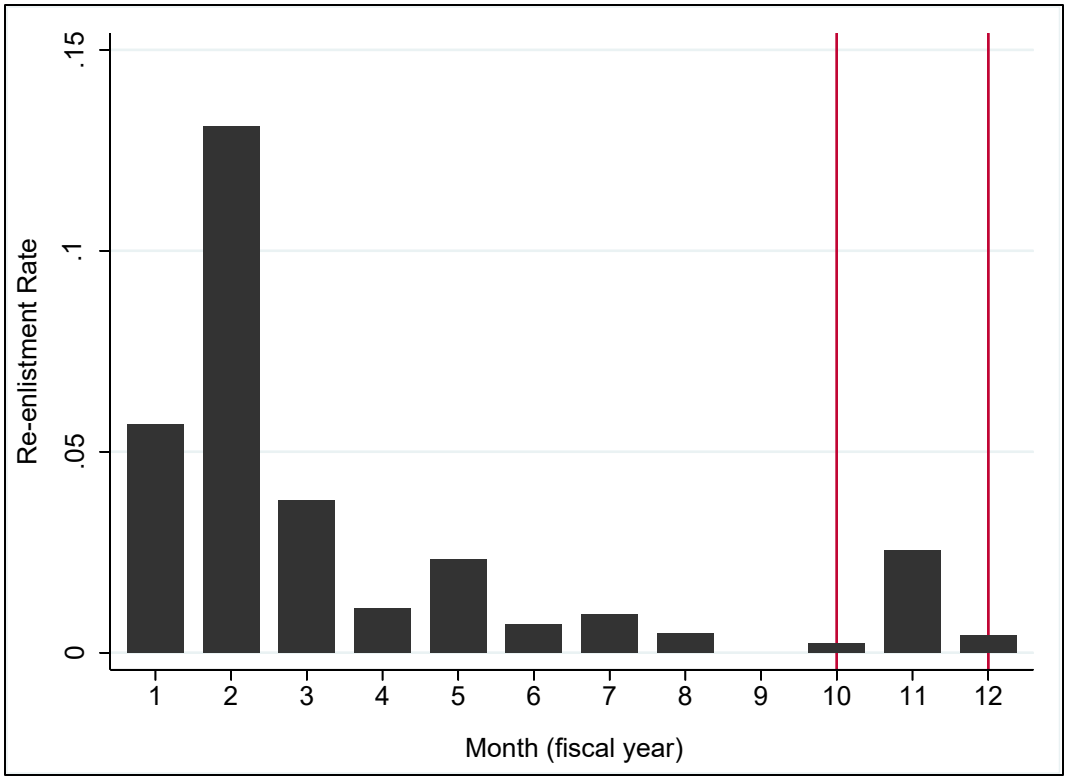

Figure 51. Zone E re-enlistment rates

APPENDIX C. MILITARY BASE PAY VS. CIVILIAN PAY

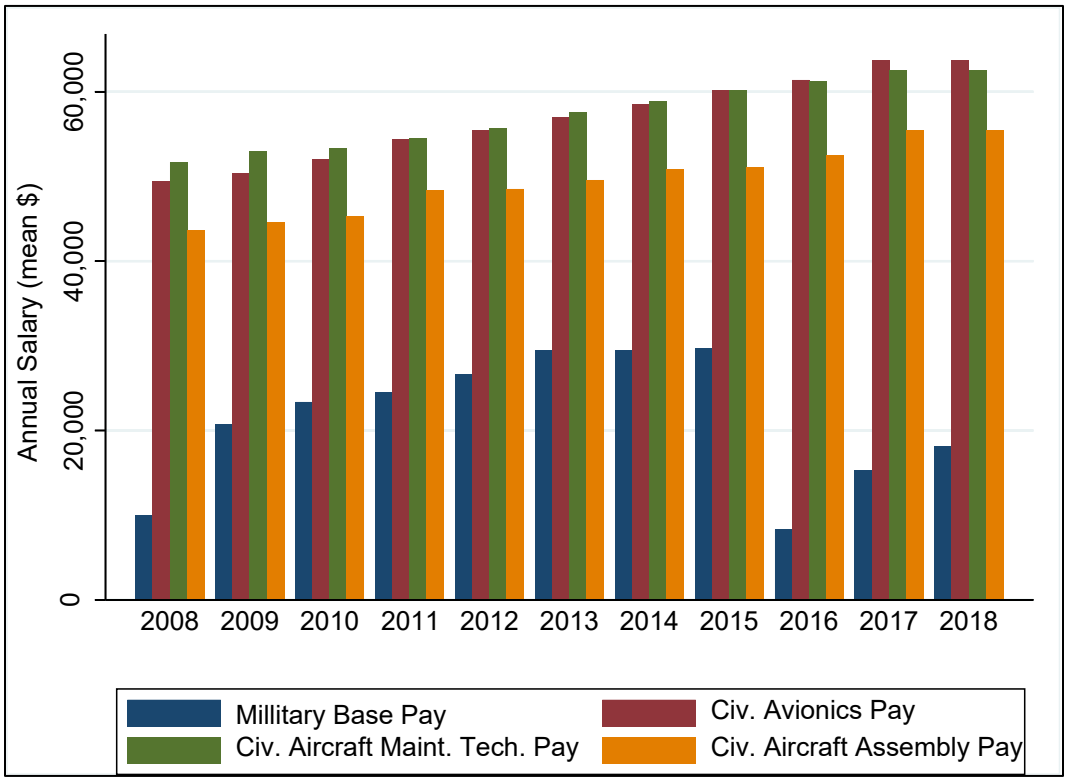

Figure 52. Zone A pays comparisons

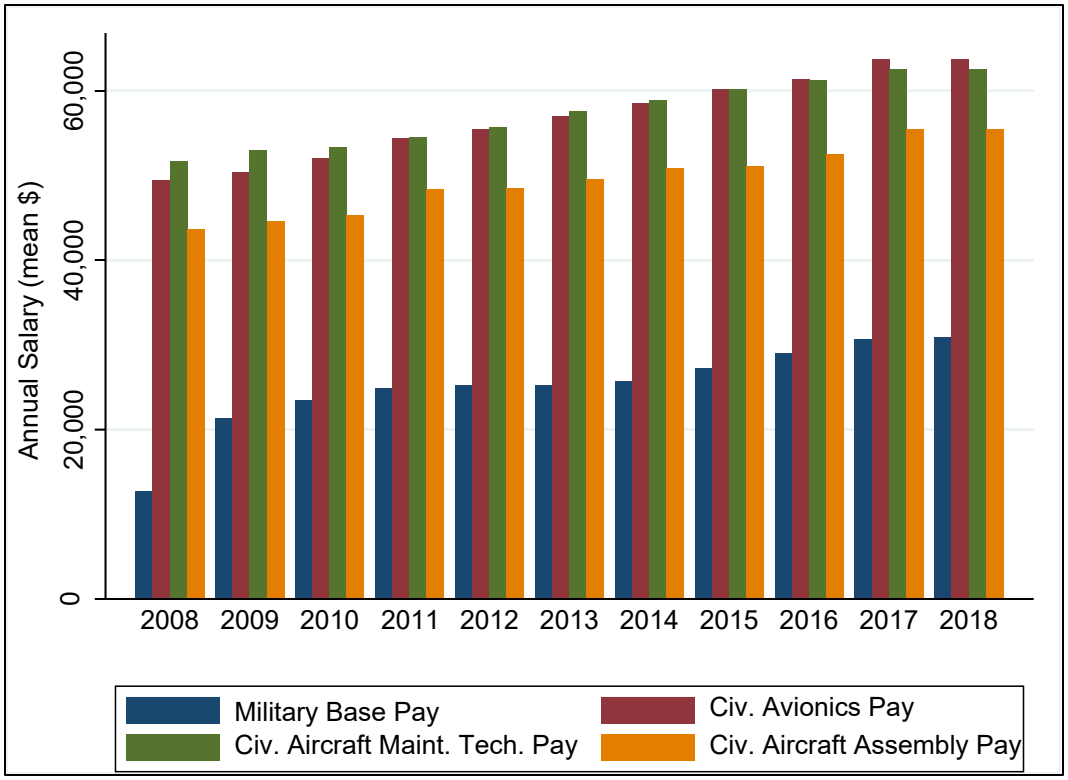

Figure 53. Zone B pays comparisons

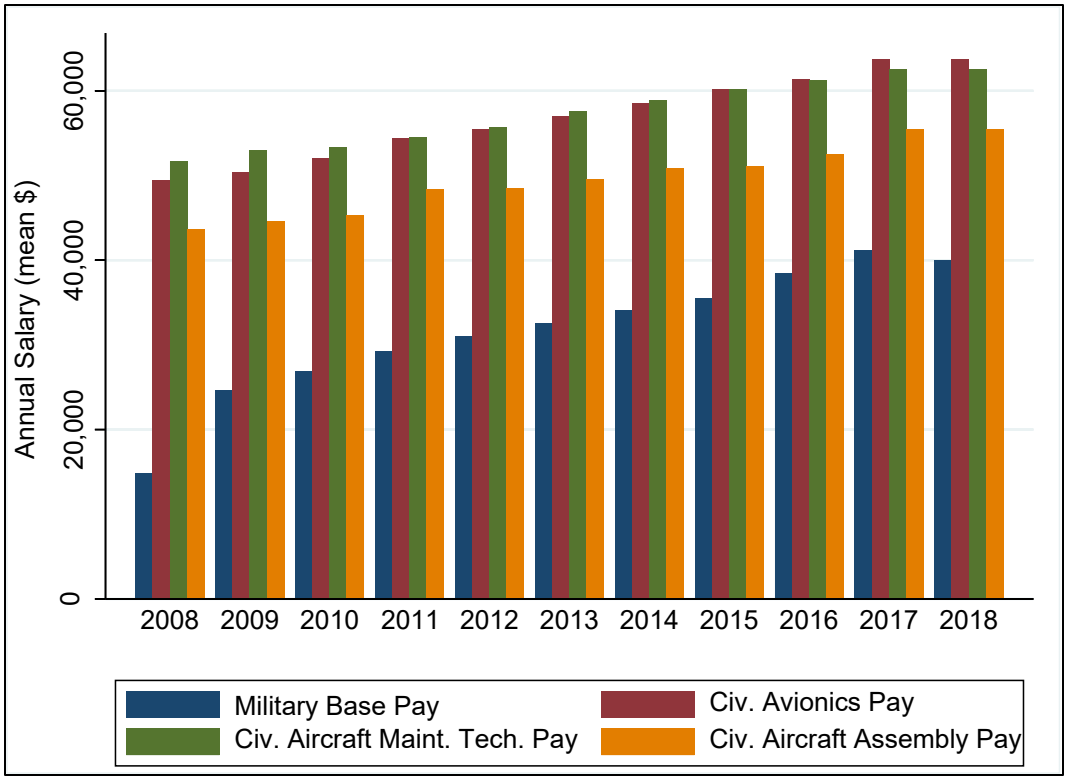

Figure 54. Zone C pays comparisons

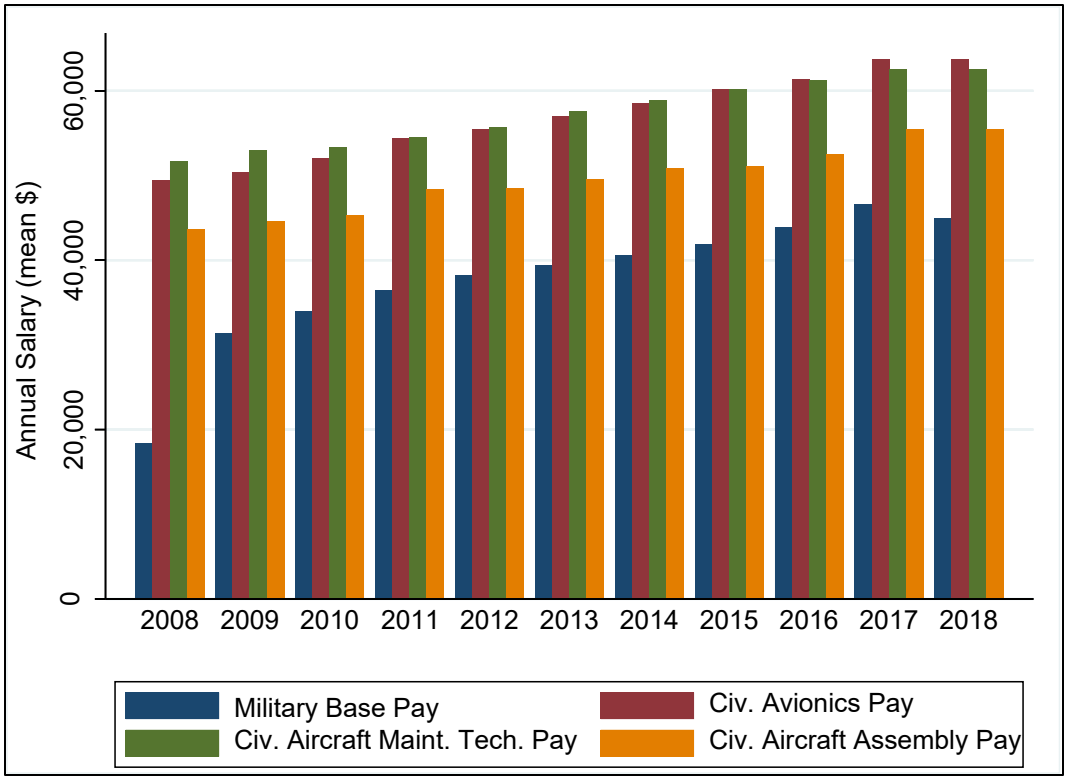

Figure 55. Zone D pays comparisons

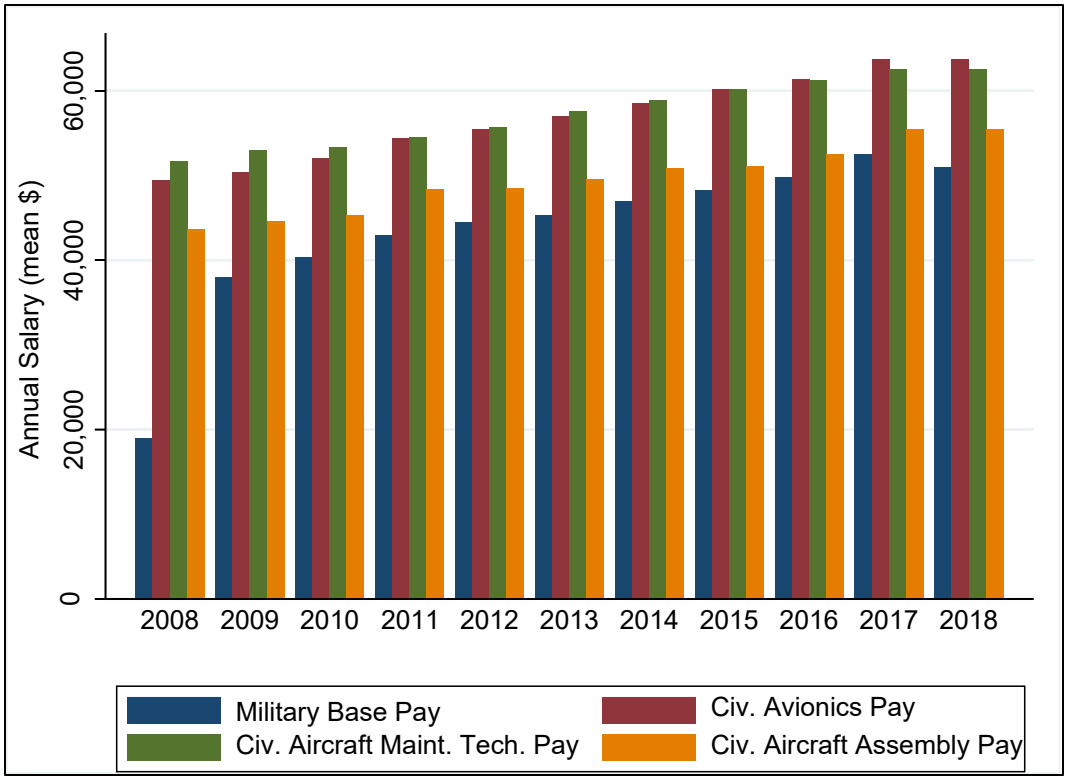

Figure 56. Zone E pays comparisons

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APPENDIX D. TOTAL MILITARY PAY VS. CIVILIAN PAY

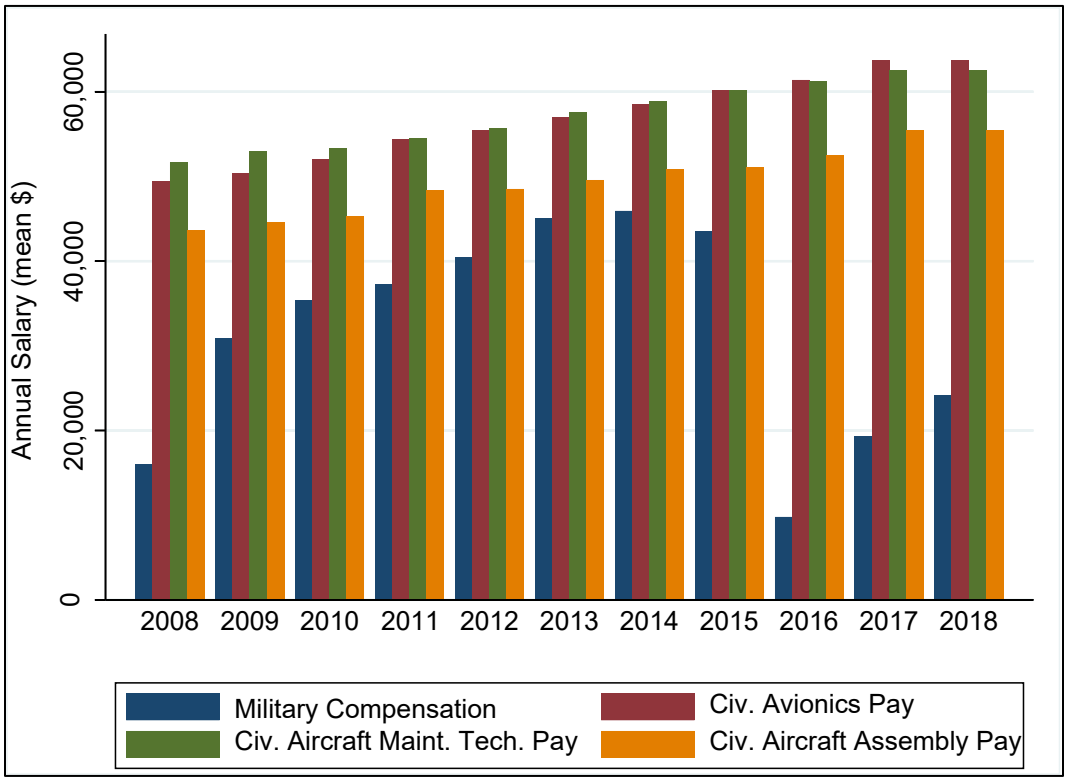

Figure 57. Zone A pays

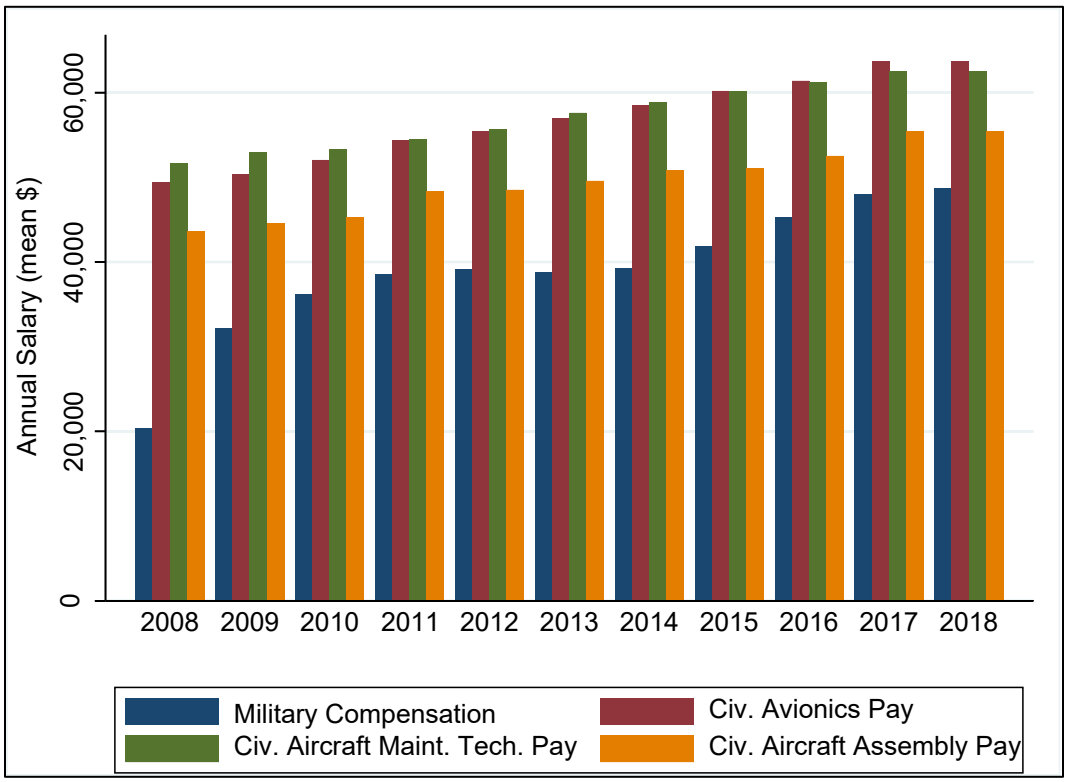

Figure 58. Zone B pays

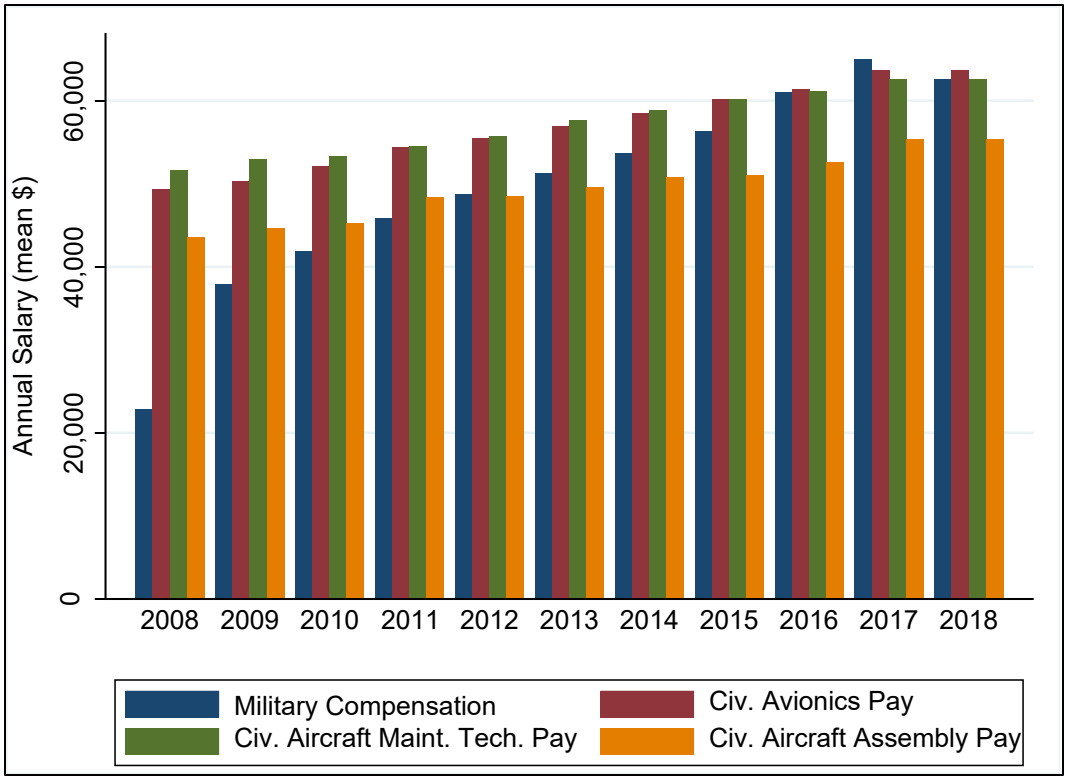

Figure 59. Zone C pays

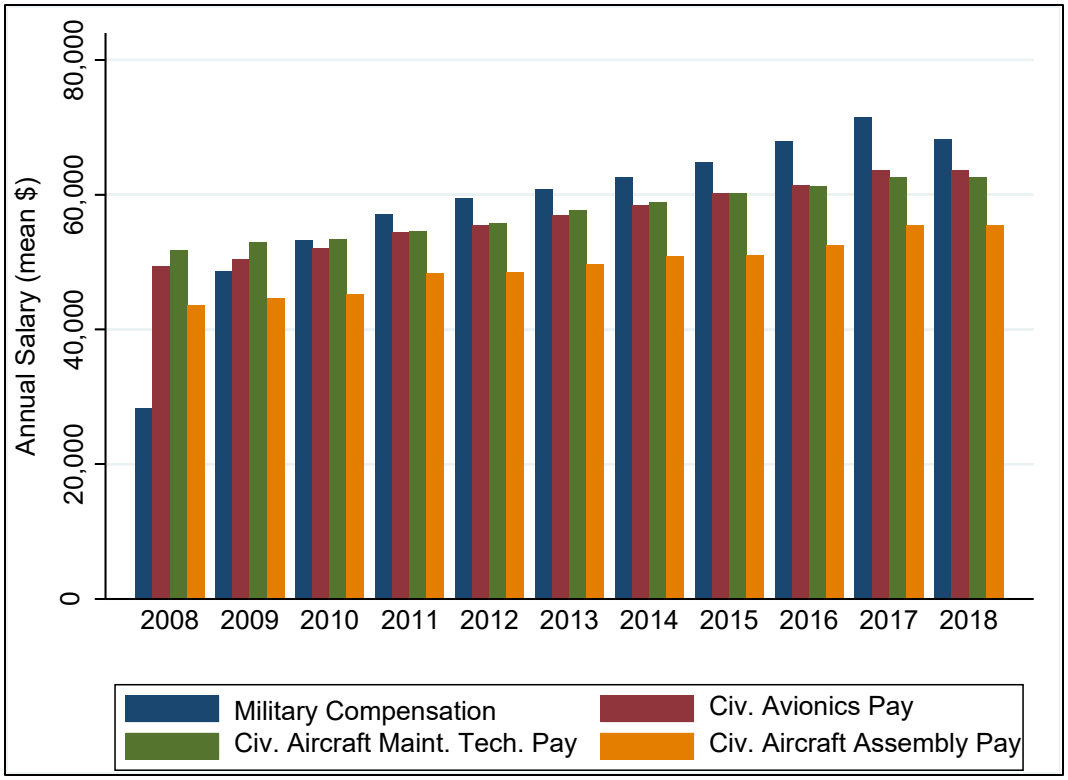

Figure 60. Zone D pays

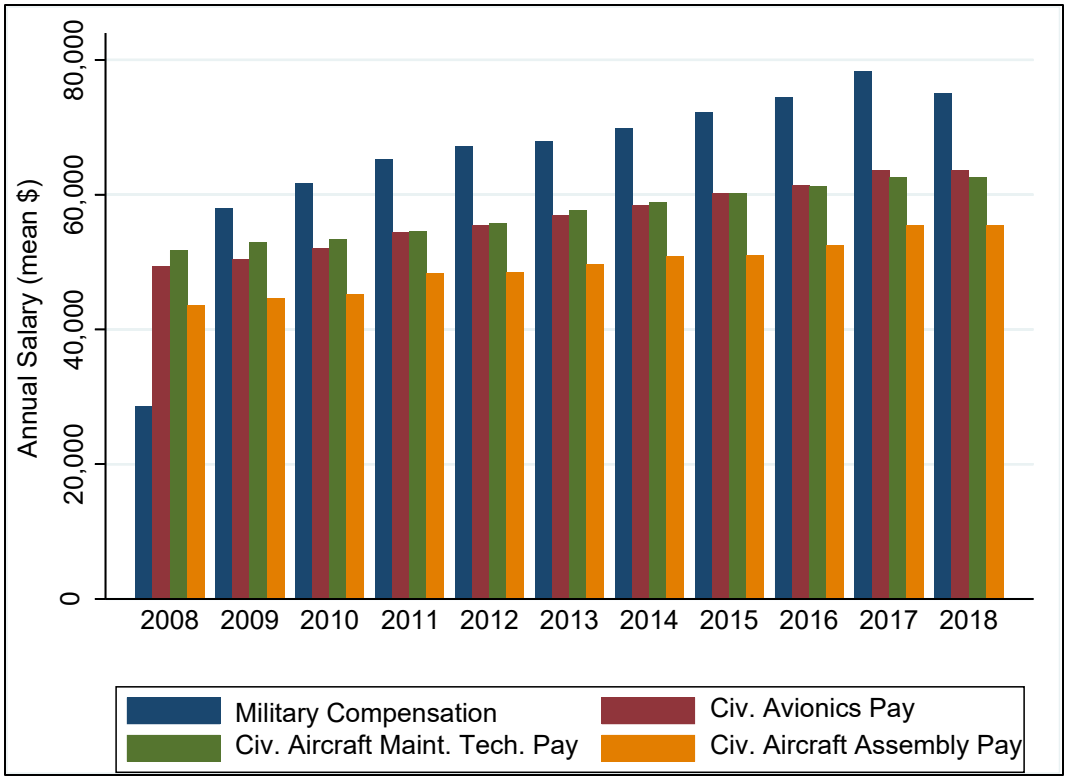

Figure 61. Zone E pays

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APPENDIX E. PAY RATIOS

A. TOTAL MILITARY COMPENSATION/ANNUAL CIVILIAN SALARY RATIOS

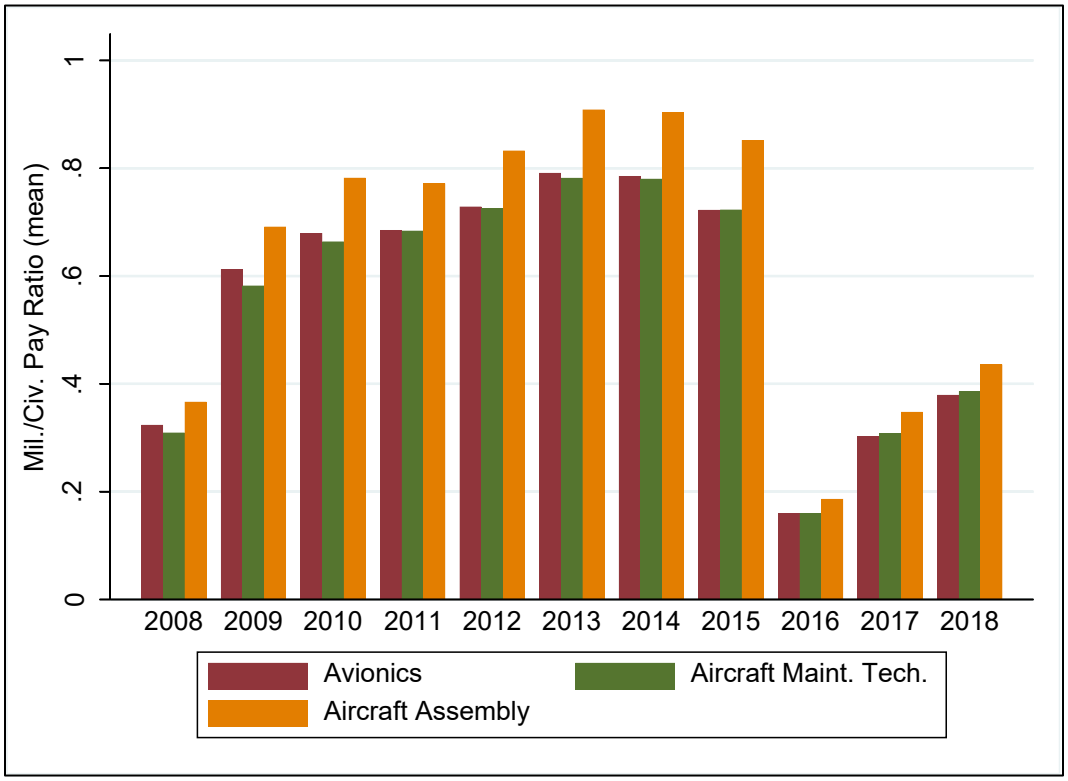

Figure 62. Zone A pay ratios

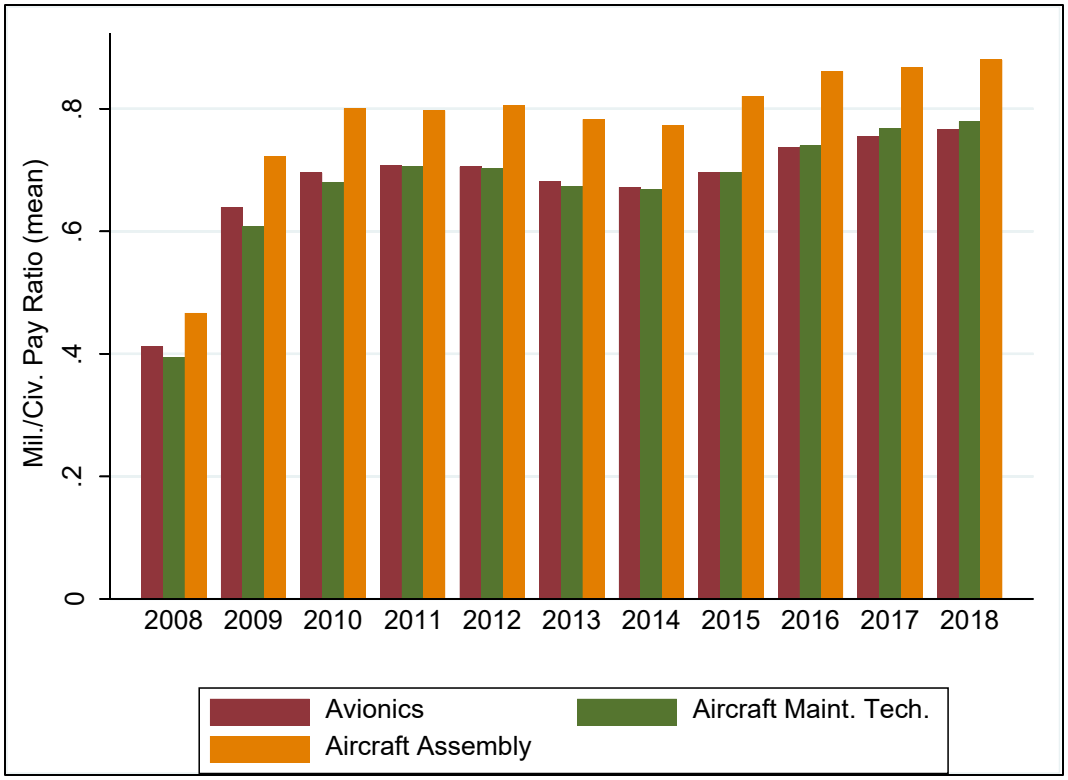

Figure 63. Zone B pay ratios

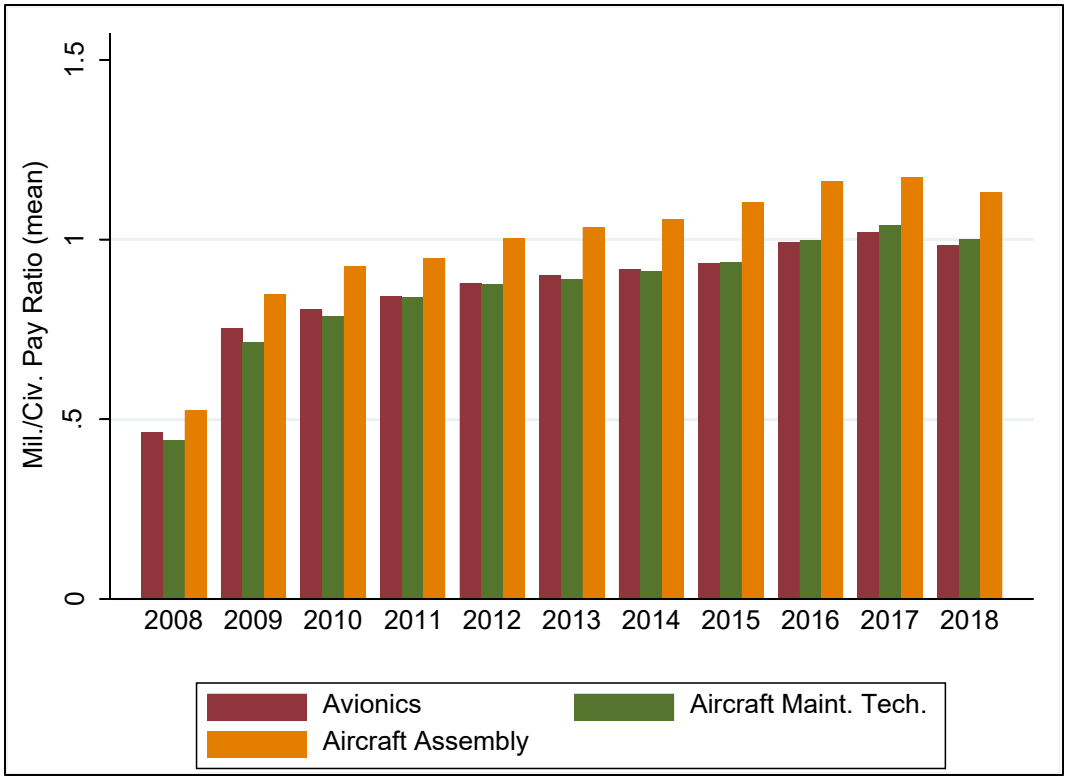

Figure 64. Zone C pay ratios

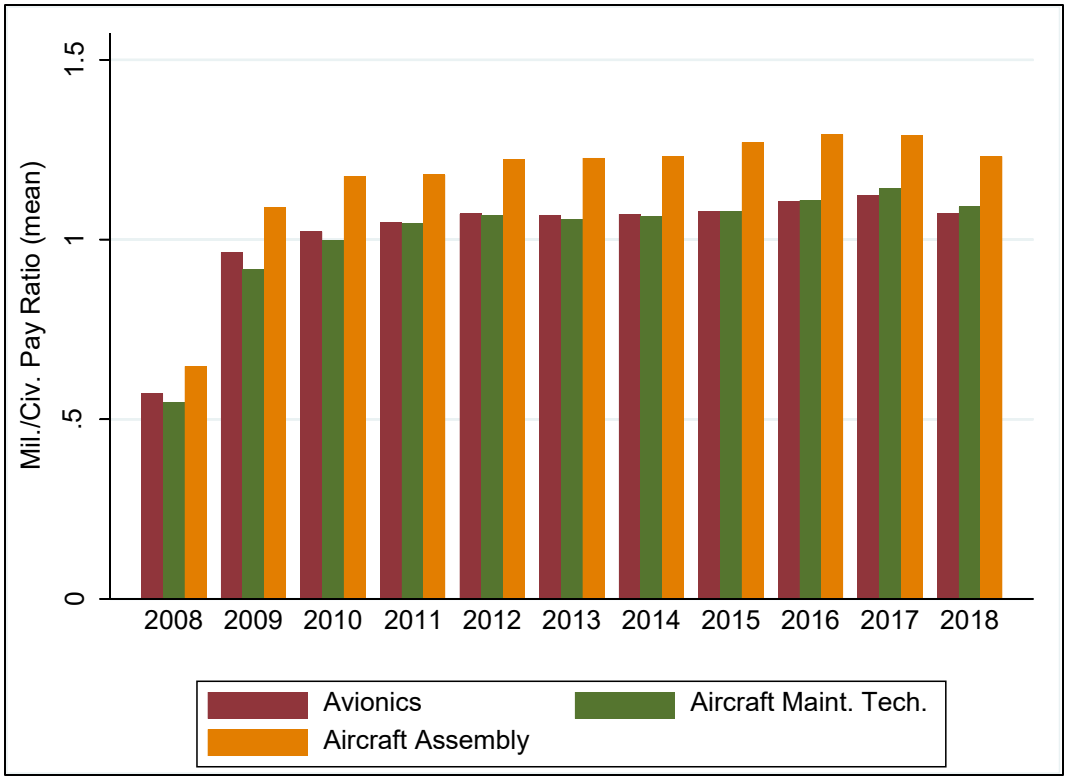

Figure 65. Zone D pay ratios

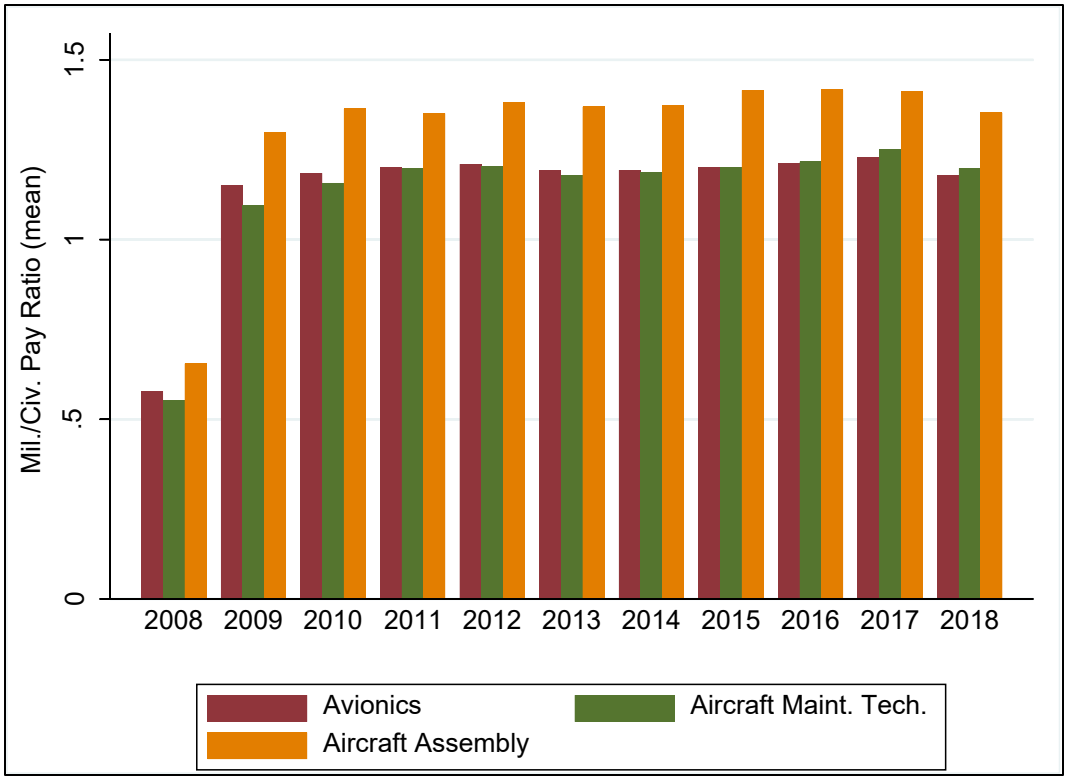

Figure 66. Zone E pay ratios

B. BONUS-TOTAL COMPENSATION/ANNUAL CIVILIAN PAY RATIOS

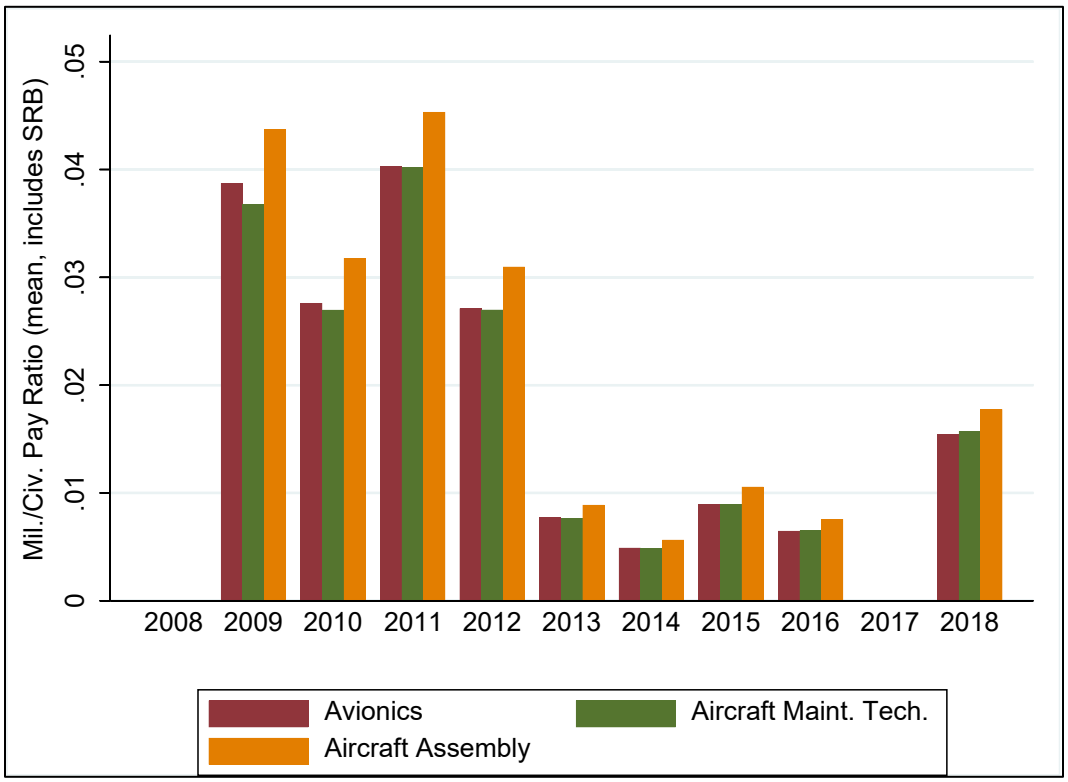

Figure 67. Zone B bonus-pay ratios

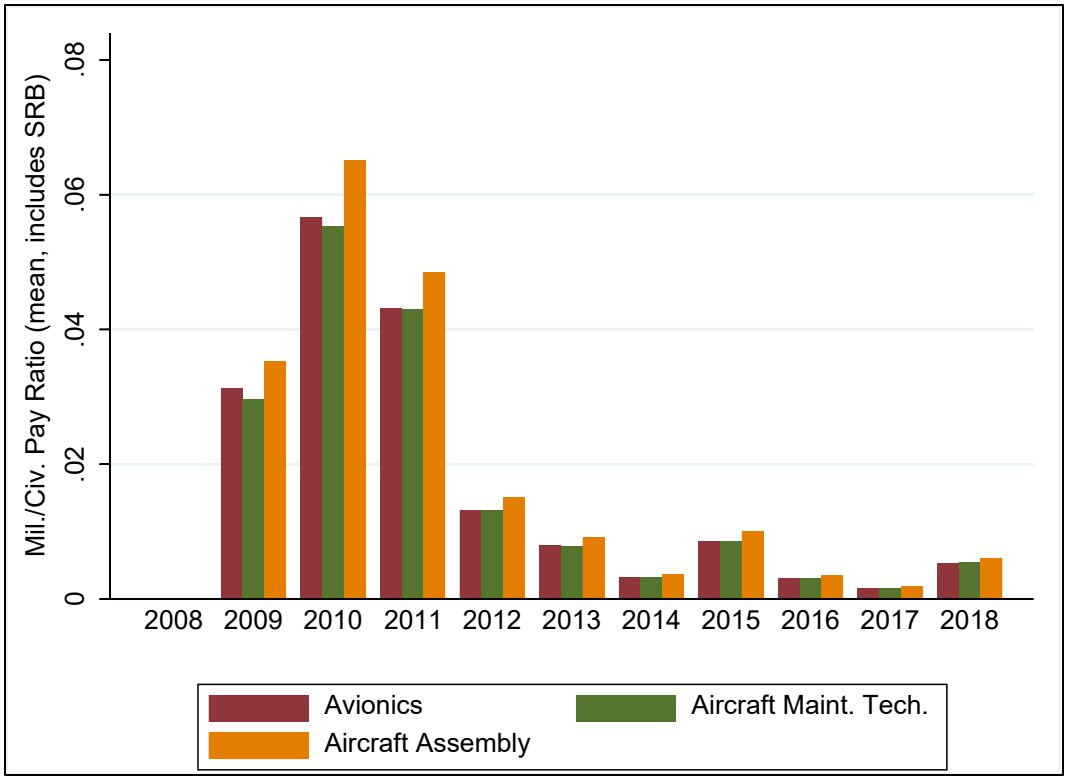

Figure 68. Zone C bonus-pay ratios

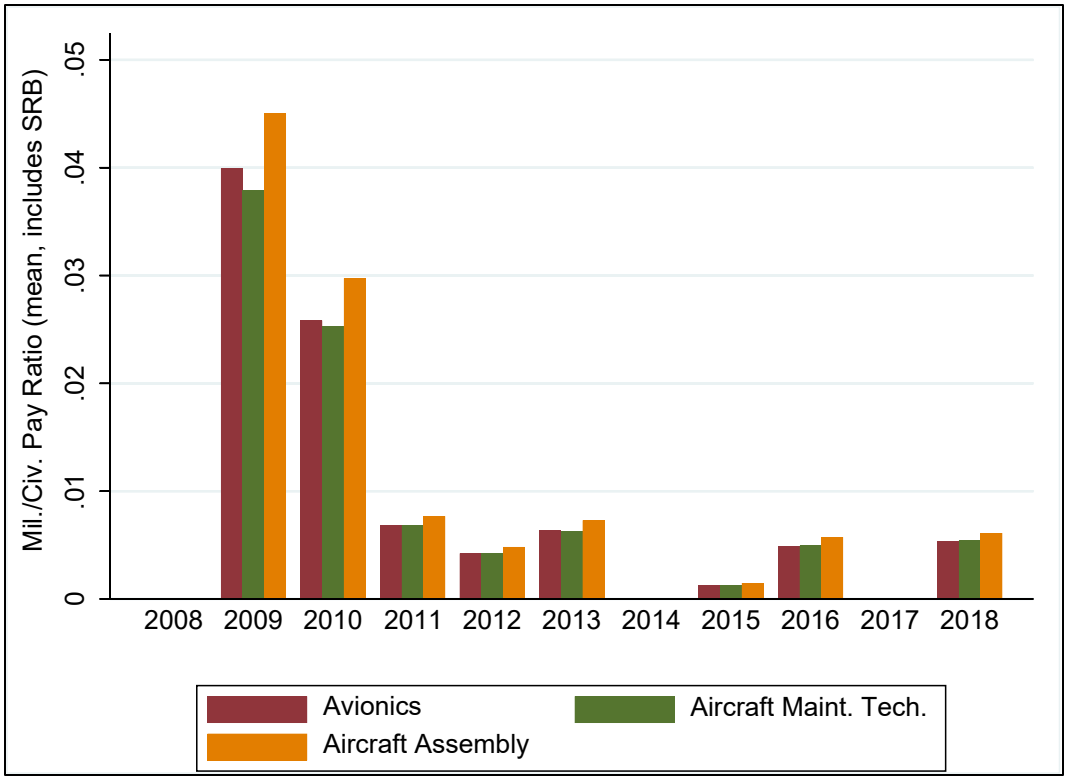

Figure 69. Zone D bonus-pay ratios

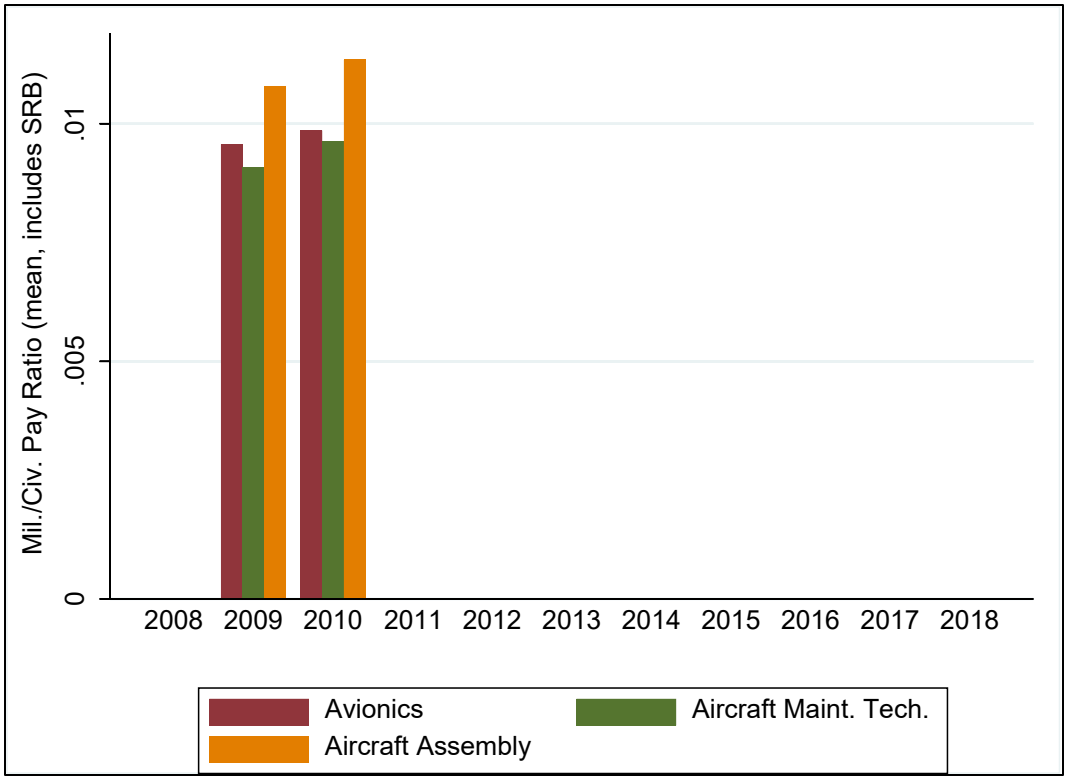

Figure 70. Zone E bonus-pay ratios

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APPENDIX F. QUALITY OF MARINES

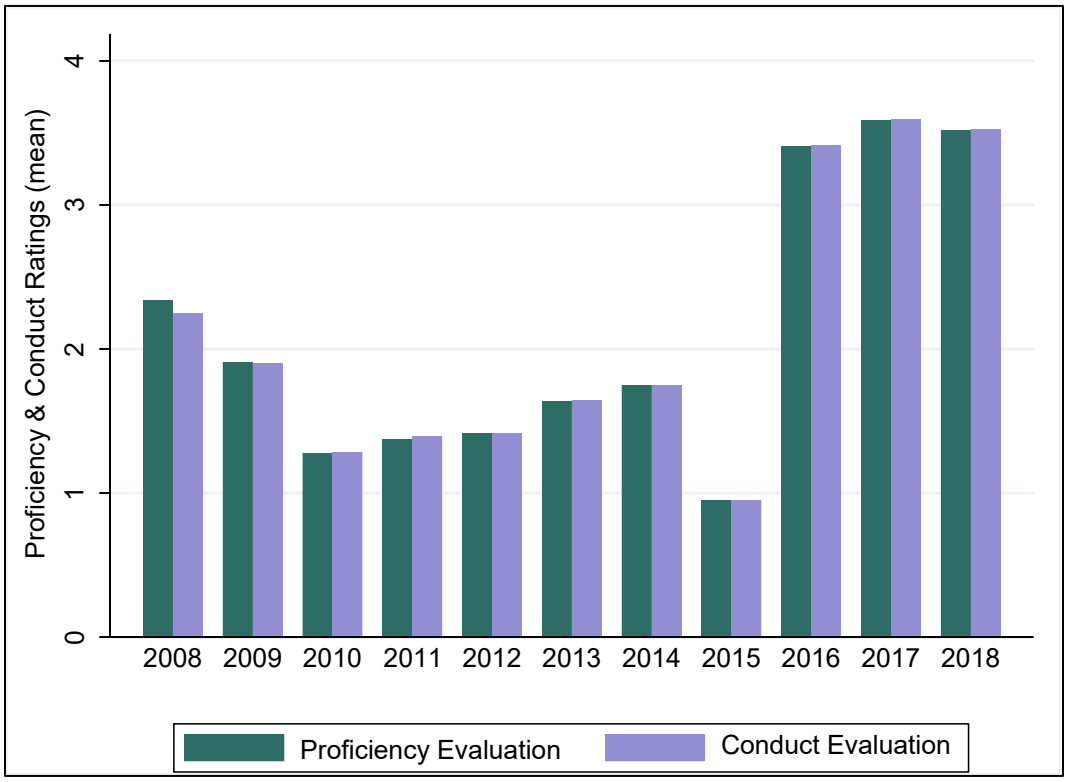

Figure 71. Zone A proficiency and conduct evaluations, from 2008–2018

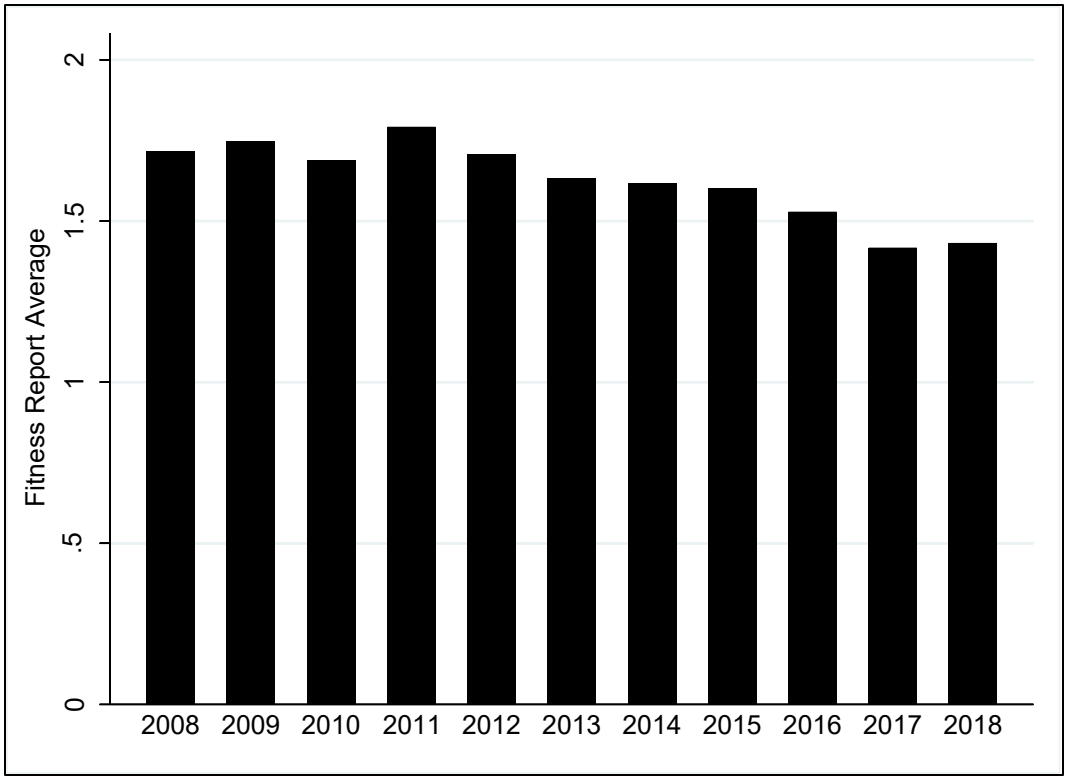

Figure 72. Sgt fitness report averages

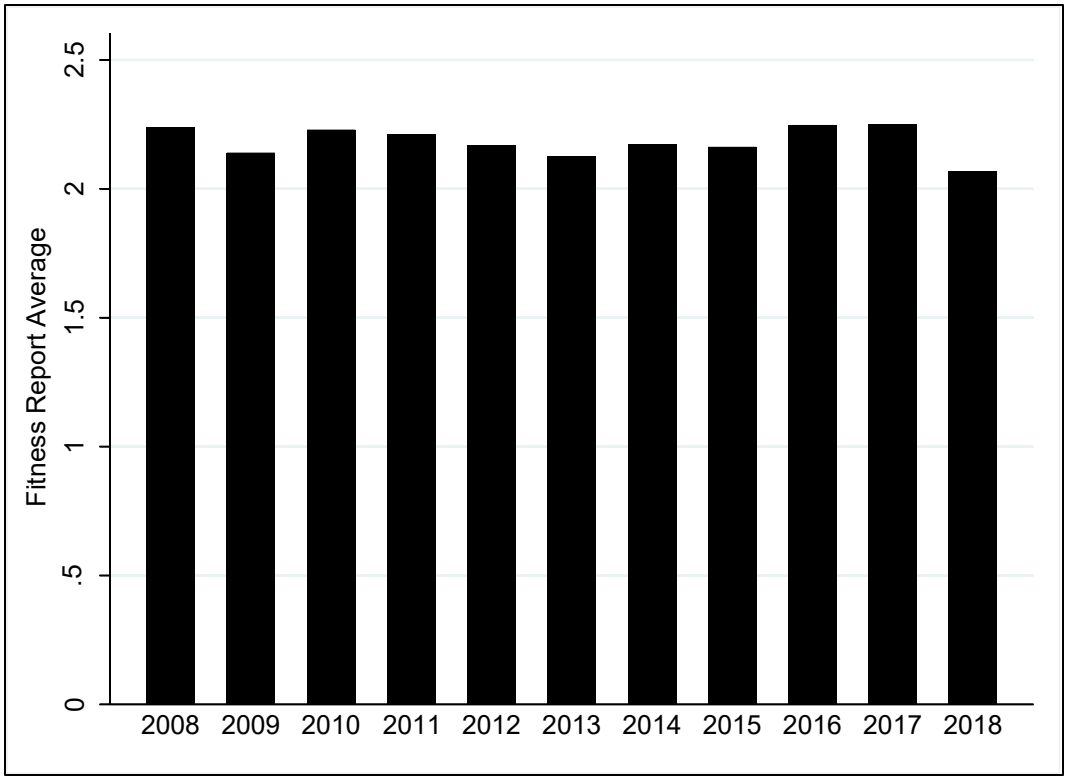

Figure 73. SSgt fitness report averages

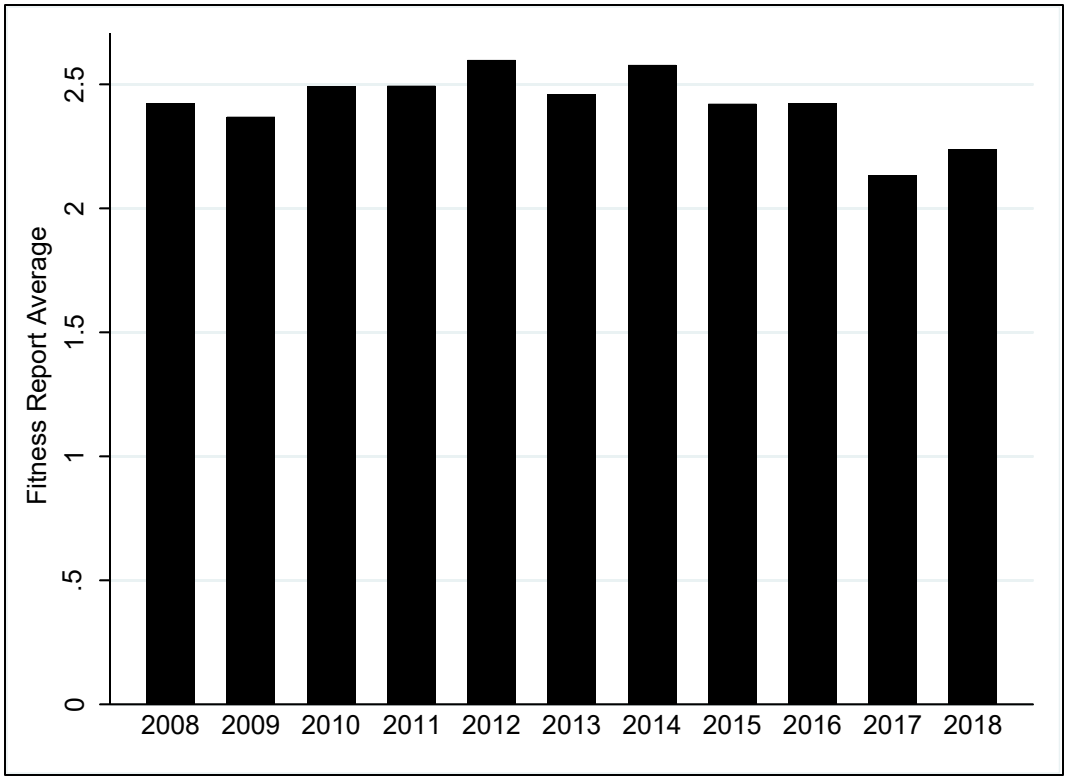

Figure 74. GySgt fitness report averages

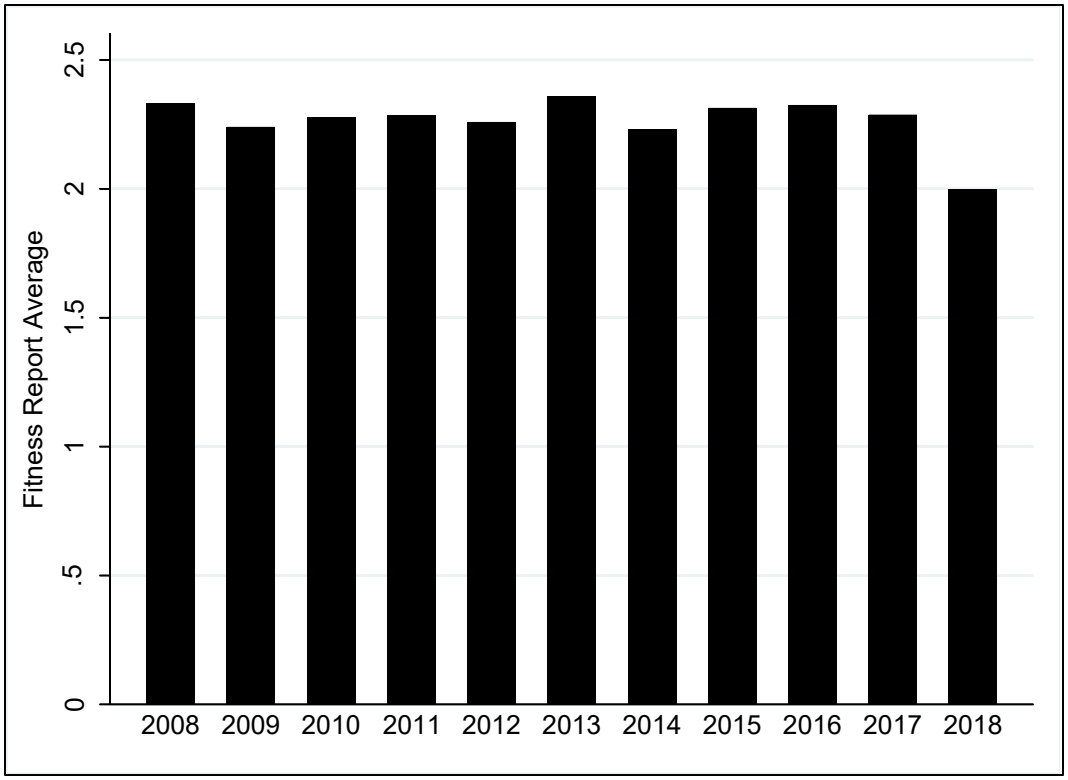

Figure 75. MSgt fitness report averages

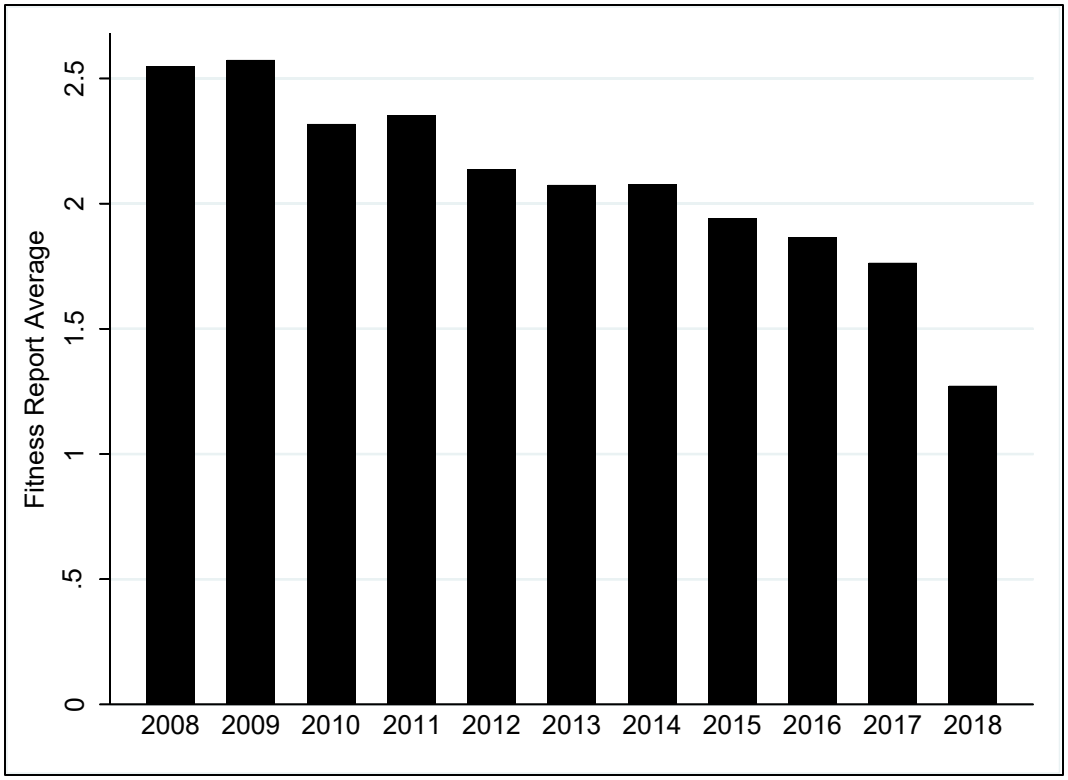

Figure 76. MGySgt fitness report averages

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