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Effects of activation on selected Marine Corps Reserve prior service enlisted continuation rates in the post-9/11 era

Price, Jonathan D.

Monterey, California. Naval Postgraduate School

NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

THESIS

EFFECTS OF ACTIVATION ON SELECTED MARINE CORPS RESERVE PRIOR SERVICE ENLISTED CONTINUATION RATES IN THE POST-9/11 ERA

by

Jonathan D. Price

March 2010

Thesis Advisor:	Stephen Mehay
Co-Advisor:	Margery Westerbeck

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Data were collected from the Total Force Data Warehouse (TFDW) for all Selected Reserve (SelRes) members who served between August 31, 2001 and October 31, 2009. Limited data to determine service history were collected from December 31, 1994 to July 31, 2001. Two probit regression models were estimated for the three tour lengths of 4-, 12- and 24-months. The models included explanatory variables for activation in support of a contingency operation, bonuses, economic conditions, ability, person-job fit, military experience, and demographics. Two additional models were estimated to isolate the effects of prior reserve experience in the active and Reserve Components (RC).

Factors having positive effects on continuation were activation frequency, bonuses, the unemployment rate, prior RC experience, tour length, and multiple tours. Negative influencers on continuation included activation length, deploying outside the continental U.S., unexcused absence from drill, being female, being married, and being older.

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Jonathan D. Price
Major, United States Marine Corps
B.S., United States Naval Academy, 1995

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requirements for the degree of

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NAVAL POSTGRADUATE SCHOOL
March 2010

Author: Jonathan D. Price

Approved by: Stephen L. Mehay
Thesis Advisor

Margery A. Westerbeck
Co-Advisor

William R. Gates
Dean, Graduate School of Business and Public Policy

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LIST OF ACRONYMS AND ABBREVIATIONS

AC	Active Component
ACOL	Annualized Cost of Leaving
ADOS	Active Duty Operational Support
AFQT	Armed Forces Qualification Test
AR	Active Reserve
ASL	Active Status List
CNA	Center for Naval Analysis
CONUS	Continental United States
DMDC	Defense Manpower Data Center
DoD	Department of Defense
FMCR	Fleet Marine Corps Reserve
FY	Fiscal Year
IADT	Initial Active Duty for Training
IDT	Inactive Duty Training
IMA	Individual Mobilization Augmentee
IRR	Individual Ready Reserve
ISL	Inactive Status List
M&RA	Manpower and Reserve Affairs
MARFORRES	Marine Forces Reserve
MCRC	Marine Corps Recruiting Command
MCTFS	Marine Corps Total Force System
MOS	Military Occupational Specialty
MSO	Military Service Obligation
NCO	Non-commissioned Officer
NPS	Non-prior Service
OCONUS	Outside the Continental United States
PMOS	Primary Military Occupational Specialty
RA	Reserve Affairs
RAP	Reserve Affairs Personnel Plans and Policy
RC	Reserve Component
RCCPDS	Reserve Component Common Personnel Data System

SELRES	Selected Reserve
SMCR	Selected Marine Corps Reserve (Units)
SNCO	Staff Non-commissioned Officer
TCPG	Training Category Pay Group
TFDW	Total Force Data Warehouse
USERRA	Uniformed Services Employment and Reemployment Rights Act

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I. INTRODUCTION

A. PURPOSE

As depicted in Figure 1, the Marine Corps failed to meet its congressionally mandated Selected Reserve (SelRes) end strength of 39,600 during fiscal years (FY) 2007 and 2008. In 2009, SelRes end strength exceeded the three percent lower limit, but fell 0.1 percentage point below this mark when calculating active duty operation support (ADOS) adjustments required by U.S. Code 10, § 115. Missing end strength may have partly resulted from the active component initiative to "Grow the Force" to 202,000 Marines, which targeted prior service Marines. However, frequent post-9/11 activations also may have impacted retention. Moreover, reserve retention has not been historically managed even though it has increased significantly over the past several years.

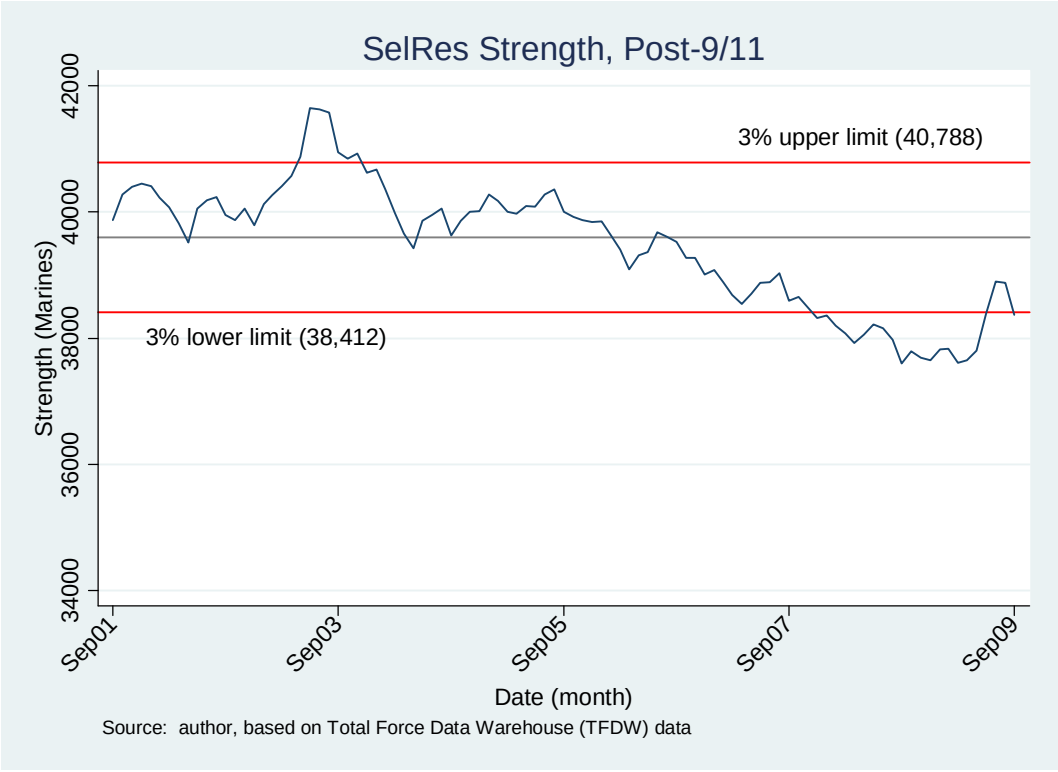

Figure 1. SelRes Monthly Strength (30 September 2001–30 September 2009)

Due to these trends, Manpower and Reserve Affairs (M&RA) for the first time assigned a retention goal for Marine Forces Reserve (MarForRes) units beginning in FY2010.

The aim of this thesis is to identify the effect of several factors on the continuation of prior service Marines serving in MarForRes units. The thesis focuses on the effect activation in support of contingency operations. Additionally, the effect of affiliation and reenlistment bonuses, and other significant predictors of attrition, are evaluated to assist M&RA in improving the SelRes end strength model used by the Reserve Affairs Personnel Plans and Policy (RAP) branch to develop the annual recruiting mission and newly developed retention goal.

B. BACKGROUND

1. End Strength

Annually, Congress mandates the SelRes end strength in § 411 of the National Defense Authorization Act (NDAA). For FY2002 and FY2003, the mandate was 39,558 Marines.[1] Beginning in FY2004, the SelRes end strength requirement has remained at 39,600 Marines.[2] In practice, Congress allows the services a three percent variance in end strength as of September 30 of each year at the discretion of the Secretary of Defense.[3] Prior to FY2008, this variance was limited to two percent. Using the current (FY2010) end strength authorization, this allows the Marine Corps flexibility of maintaining end strength between a ceiling of 40,788 Marines and a floor of 38,412 Marines. As Figure 1 illustrates, the Marine Corps failed to both meet this target during the past two fiscal years and to achieve the two percent floor (of 38,808) the year previous.

1 National Defense Authorization Act for Fiscal Year 2002, Public Law 107-107, § 411(a)(4), U.S. Statutes at Large 115 (2001).

2 National Defense Authorization Act for Fiscal Year 2004, Public Law 108-136, § 411(a)(4), U.S. Statutes at Large 117 (2003).

3 National Defense Authorization Act for Fiscal Year 2008, Public Law 110-181, § 417, U.S. Statutes at Large 122 (2008), codified at U.S. Code 10 (2010), § 115(f)(3).

2. Continuation Rates

As outlined in previous research by Kirby, et al., defining attrition for the Reserves is a complex issue and prone to measurement errors and misinterpretation.[4] Similar problems are encountered in analyses of retention. For instance, a personnel loss in the Selected Marine Corps Reserve (SMCR) units is not necessarily considered attrition for the Marine Corps as a Total Force because the personnel loss could become a gain for other components of the SelRes, such as the Active Reserve or the Individual Mobilization Augmentees.[5] Alternatively, this same individual may enlist in the active component (AC) or transfer to the Individual Ready Reserve, Retired Reserve, or Standby Reserve. To avoid this confusion, throughout this thesis continuation rates will be used to analyze the behavior of prior service personnel. In general, continuation rates take a snapshot of personnel at one point in time and then determine if these same personnel remain in the same training category pay group (TCPG) at a future point.[6]

As depicted in Table 1, overall SelRes continuation rates remained fairly steady between 2001 and 2008, varying by just over one percentage point from the mean for this period. However, Table 1 also shows that continuation rates for Reserve personnel assigned to SMCR units have varied by over two percentage points from the mean, while prior service continuation rates have varied by nearly four percentage points from the mean. Overall, the mean dropped by nearly 2.5 percentage points for prior service personnel in SMCR units (from 68.29 to 65.86 percent) when comparing the first three years to the last three years.

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[4] Sheila Nataraj Kirby, David W. Grissmer, and Priscilla M. Schlegel, "Reassessing Enlisted Reserve Attrition: A Total Force Perspective," N-3521-RA, (Santa Monica, CA: RAND, 1993), 5–6, http://www.rand.org/pubs/notes/N3521/ (accessed August 14, 2009).

[5] The terms Selected Reserve and Selected Marine Corps Reserve can be used interchangeably. However, SelRes typically signifies the entire Selected Reserve, while SMCR typically implies Selected Marine Corps Reserve units. To avoid confusion, I have designated the term SelRes to refer to the entire Selected Reserve and SMCR units to refer only to units of the SelRes.

[6] TCPG will be defined later in Chapter II, Reserve Organization and Structure for the Ready Reserve and Active Status List.

Table 1. SelRes Continuation Rates, Post-9/11[7]

Continuation Rates (all grades)			
FY	SelRes	SMCR units	Prior Service (SMCR units)
2002	80.77	86.79	70.38
2003	79.88	85.22	67.18
2004	81.27	87.83	67.32
2005	80.46	85.39	63.48
2006	79.49	84.92	64.39
2007	80.00	85.66	65.94
2008	79.95	84.72	67.24
Average	80.26	85.79	66.56

3. Importance of Retaining Prior Service Marines

Although generally accounting for only 25 percent of reserve unit end strength, prior service personnel are a critical component of readiness for several reasons. First, unlike non-prior service (NPS), prior service Marines have already completed entry-level training. Not only does this save critical training dollars, these Marines are able to make an immediate impact on SMCR units, whereas nearly 11 percent of NPS personnel are in the initial accession training pipeline. In addition, prior service Marines are normally recruited as non-commissioned officers (NCO) providing higher average levels of productivity than NPS recruits.

More importantly, prior service Marines augment SMCR units with active duty experience, often involving combat since 9/11, which greatly increases the warfighting capability of the units in which they serve. Lastly, continuation of prior service Marines is essential to the preservation of a quality staff non-commissioned officer (SNCO) corps.

[7] Based on TFDW Data.

This significant impact of prior service personnel on Reserve unit readiness "led to the passage of Title XI—The Army National Guard Combat Readiness Reform Act" of 1992 over concerns of low Army National Guard readiness during Operations Desert Shield/Desert Storm.[8] The bill specifically states,

> The Secretary of the Army shall have an objective of increasing the percentage of qualified prior active-duty personnel in the Army National Guard to 65 percent, in the case of officers, and to 50 percent, in the case of enlisted members, by September 30, 1997.[9]

However, prior service Marines create greater instability and turnover in units because they do not incur a service obligation. Since reserve enlistment contracts only obligate individuals to serve in the Ready Reserve, prior service Marines are free to leave their SMCR units without consequence, unless they are contracted to serve by other means, such as an affiliation bonus, receipt of additional training, or involuntary activation orders. As shown in Figure 2, prior service strength in SMCR units has dropped more rapidly than unit strength, and, as a share of overall unit strength, has dropped by over six percentage points since 2001.

[8] Richard Buddin and Sheila Nataraj Kirby, "Enlisted Personnel Trends in the Selected Reserve, 1986–1994," MR-681/2-OSD, (Santa Monica, CA: RAND, 1996), 3.

[9] National Defense Authorization Act for Fiscal Year 1993, Public Law 102-484, § 1111, U.S. Statutes at Large 106 (1992).

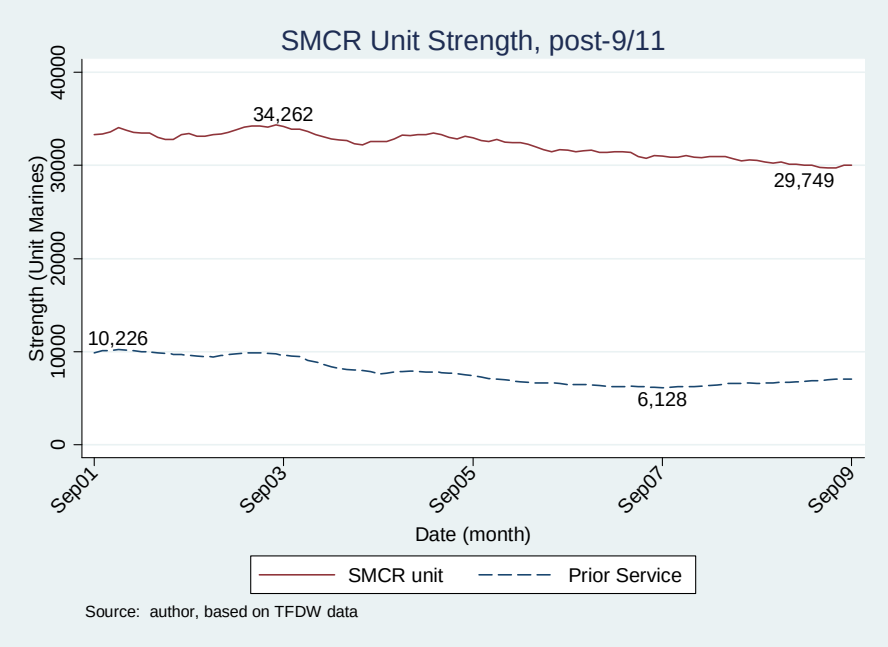

Figure 2. Comparison of Overall Unit End Strength and Prior Service Contribution

For instance, the percentage of prior service Marines in units in 2001 stood at nearly 29.7 percent, but sharply decreased to just over 20 percent by 2007 and stood at 23.6 on September 30, 2009. During this same time period, continuation of prior service personnel in the critical ranks of lance corporal through sergeant decreased from 62.6 percent to 54.8. If this trend continues, filling the ranks of SNCO with high quality personnel in the future will become increasingly difficult.

4. Increased Utilization of the Marine Corps Reserve

Since the mobilization of Reserve Forces in 1990 for Operations Desert Shield/Desert Storm, the Marine Corps Reserve has transitioned from a strategic reserve to a post-Cold War operational reserve. As Figure 3 shows, the Deputy Commandant for Plans, Policies and Operations regularly identifies Reserve battalions in the Marine Corps Force Generation Model for deployment in the Global War on Terror. On average, 6,927 SelRes Marines per month have served on activation orders since September 11, 2001, with a peak of 17,807 in April 2003 during Operation Iraqi Freedom (OIF).

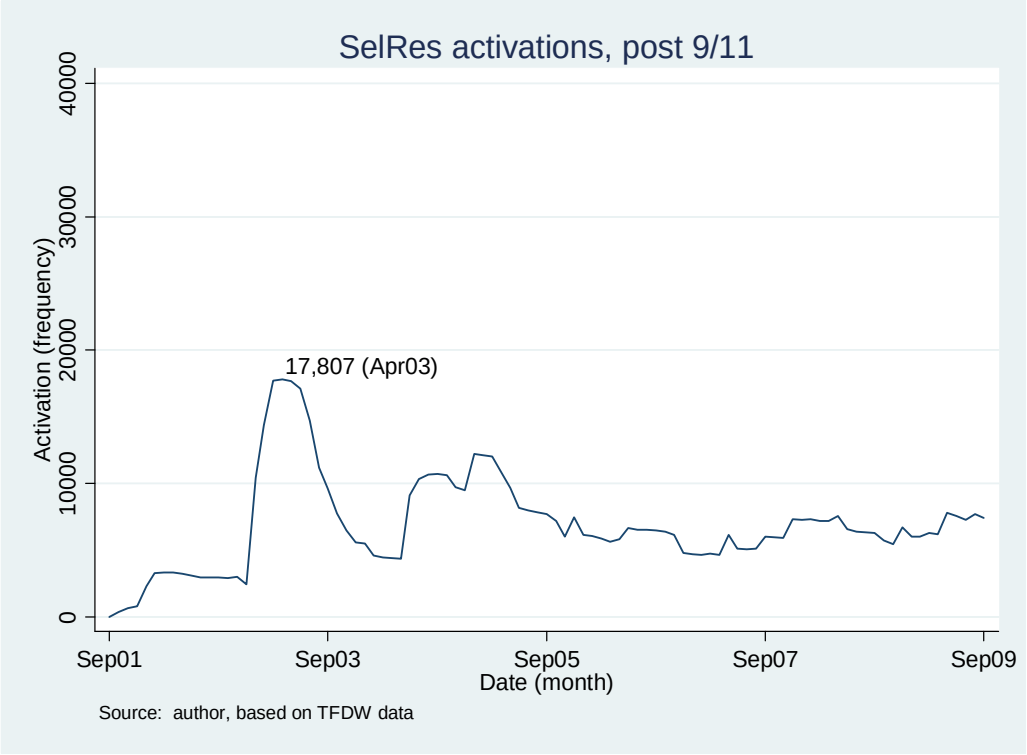

Figure 3. Frequency of SelRes Activations, Post-9/11

Previous research has indicated that activation has a positive impact on the continuation rates of Reserve Marines. However, given the expectation of continuing frequent SMCR unit activations, it is unclear if this positive trend will continue or if the activation effect on prior service Marines differs from the overall impact on the entire Reserve force.

5. Transition to Lump Sum Bonuses

Beginning in FY2006, the Marine Corps began offering lump sum reenlistment bonus payments to prior service SMCR unit Marines, as authorized in the 2005 National Defense Authorization Act. According to a 2004 study by the Center for Naval Analysis (CNA), the use of a lump sum bonus would be more cost effective given the high

personal discount rates of enlisted Marines.[10] Thereafter, a 2006 CNA study suggested revisiting this issue once enough time had passed to obtain and analyze changes to attrition behavior under this new payment plan.[11]

C. SCOPE AND METHODOLOGY

Unlike the vast majority of previous research on reserve attrition, this thesis focuses on the continuation of the prior service SMCR unit population in grades E3 to E5. For the majority of the statistical analysis, data was obtained from TFDW covering the period August 2001 to October 2009. Bonus and incentive data was provided by Manpower and Reserve Affairs, while the Center for Naval Analysis provided seasonally adjusted monthly unemployment rate data tabulated from the U.S. Bureau of Labor and Statistics. Unfortunately, incomplete bonus data during FY2006 and FY2007 limit a complete analysis of the retention effect of the transition to lump sum incentive payments.

Using 12-month continuation rates for SMCR unit prior service Marines, I employ a standard multivariate statistical model to analyze the effect of activation and bonuses on continuation rates. Additionally, this research identifies other statistically significant predictors of continuation, including marital status, gender, age, rank, unexcused absences, satisfactory years towards retirement, and prior Reserve service. It should be kept in mind that given the narrow focus on rank and the SMCR unit prior service population, caution should be given in applying these results to the continuation behavior of the entire SelRes.

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[10] Anita Hattiangadi, Deena Ackerman, Theresa Kimble, and Aline Quester, "Cost-Benefit Analysis of Lump Sum Bonuses for Zone A, Zone B, and Zone C Reenlistments: Final Report," CRM D0009652.A4/1REV, (Alexandria, VA: CNA, 2004), 56–57. The discount rate observed for active component Marines was 154.6 percent in Zone A, 18.5 percent in Zone B, and 14.3 percent in Zone C, while the government's official discount rate was 4.75 percent.

[11] Anita Hattiangadi and Ann Parcell with David Gregory and Ian MacLeod, "SelRes Attrition and the Selected Reserve Incentive Program in the Marine Corps Reserve," CRM D0013618.A2/Final, (Alexandria, VA: CNA, 2006), 94.

D. ORGANIZATION OF STUDY

Determining the effects of activation, monetary incentives, and other predictors of prior service SMCR unit continuation rates is the goal of this study. Chapter II continues the introduction and background with a review of Reserve organization and structure with an emphasis on the SelRes.

Together, Chapters III–V compose the literature review. Chapter III discusses the motivation for an individual to stay in a unit that is scheduled for activation in the near future, Chapter IV reviews theoretical models of attrition in the literature, and Chapter V provides a synopsis of historical characteristics and predictors of attrition in prior research on the SelRes.

In Chapters VI–VIII, I will present the data, methodology, analysis, results, and conclusions. Chapter VI specifies the models and describes the data and variables used in the multivariate model. Chapter VII provides the results of the analysis and presents potential applications of those results. Chapter VIII presents conclusions and recommendations for further research.

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II. RESERVE ORGANIZATION AND STRUCTURE

A. INTRODUCTION

As stated in the Marine Corps Reserve Administrative Management Manual, "The Reserve Component (RC) is an integral part of the Total Force Marine Corps and provides augmentation and reinforcement in times of war or national emergency."[12]

> The Marine Corps Reserve complements the Marine Corps operating forces structure and capabilities… [and] provides the added capability, flexibility, and depth that is the foundation for our sustainment at any level of recall or mobilization. Total Force integration is the dominant theme for all Reserve planning, training, and administration.[13]

The RC is "organized, administered, trained, and equipped under the Commandant of the Marine Corps" with the Deputy Commandant for Manpower and Reserve Affairs (DC M&RA) as the principal staff officer.

> The Director, Reserve Affairs Division (Dir RA) is the principal advisor to DC M&RA on all manpower matters pertaining to the RC. The Dir RA is responsible for the development, review, promulgation, coordination, monitoring, administration, and oversight of Reserve manpower plans, policies, and programs on readiness, training, operations, budget, and structure necessary to meet Total Force Marine Corps manpower requirements.[14]

B. COMPONENTS

As shown in Figure 4, the three major components of the Marine Corps Reserve include the Ready Reserve, Standby Reserve, and Retired Reserve.[15] As of September 30, 2009, the total Reserve force consisted of nearly 227,000 Marines to include over 132,200 retired, approximately 1,200 Marines in the Standby Reserve, and over 93,400

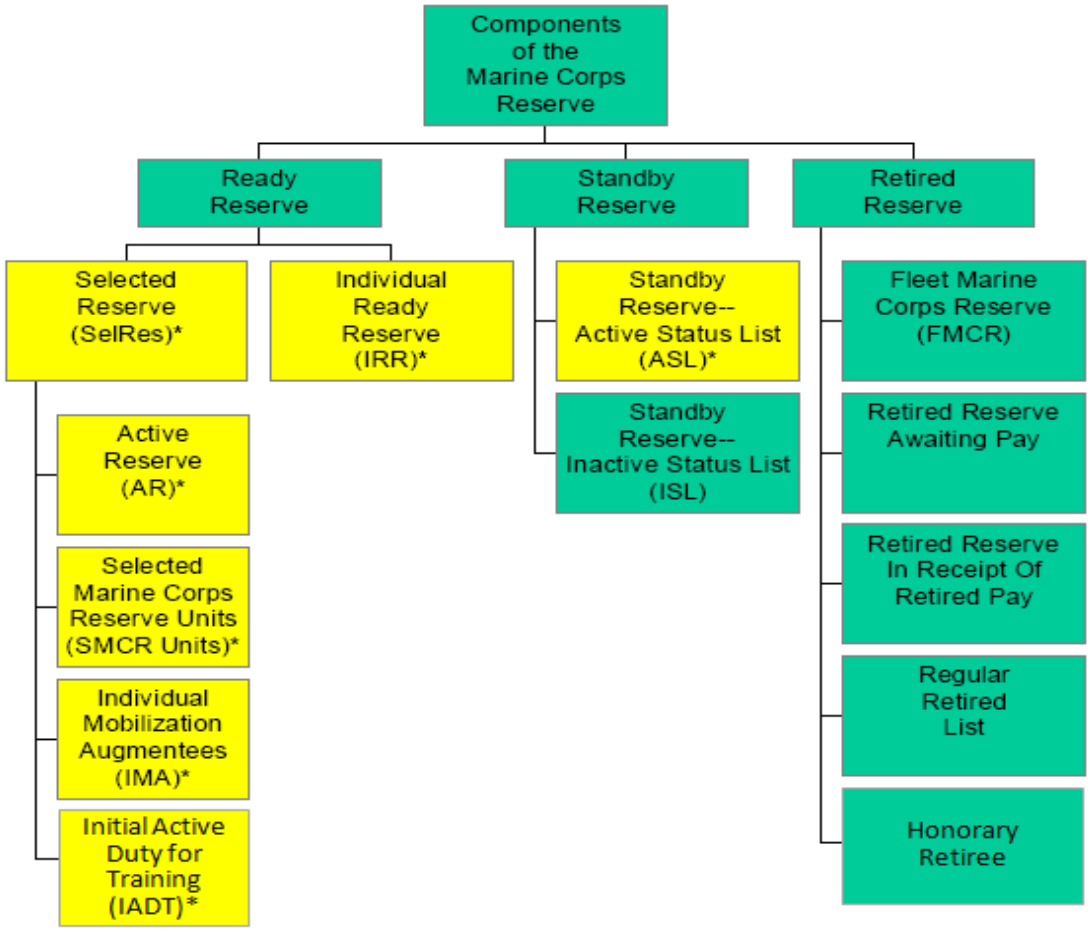
[12] "Marine Corps Reserve Administration Management Manual," MCO 1001R.1K, (Quantico: VA, U.S. Department of the Navy, 2009), 3.

[13] Ibid., 3.

[14] Ibid.

[15] The structure and organization of the Marine Corps Reserve is based on the Armed Forces Reserve Act of 1952, Public Law 82-476, U.S. Statutes at Large 66 (1952).

Marines serving in the Ready Reserve. In comparison, the Total Force, which includes both the active component (AC) and the RC, totaled just under 430,000 Marines.



Note: Components highlighted in yellow (*) are elements of the RASL.

Figure 4. Components of the Marine Corps Reserve[16]

1. Ready Reserve

The Ready Reserve is composed of both the Selected Reserve (SelRes) and the Individual Ready Reserve (IRR). Together, they comprise the bulk of Reserves ready for immediate activation in a time of War or national emergency. During the past 10 years, the Ready Reserve strength has hovered around 100,000 Marines. However, this number

[16] MCO 1001R.1K, Figure 1–1.

has dropped recently as fewer Marines departed the AC in response to the 202k "Grow the Force" initiative. Figure 5 depicts the changes in Ready Reserve end strength between 2001 and 2009 by each of its various sub-components.

a. Individual Ready Reserve

The IRR is the largest sub-component of the Ready Reserve and serves as the primary recruiting population for prior service Marines. As such, demographic changes in the IRR are of concern and directly affect the viability of sourcing the SelRes with critical prior service experience. Marines assigned to the IRR typically fall into three categories: (1) Marines who have not completed their initial military service obligation (MSO) required by U.S. Code 10, § 651, (2) Marines who voluntarily remain in the IRR after completing their MSO, and (3) Marines actively participating in orders requiring IRR affiliation.

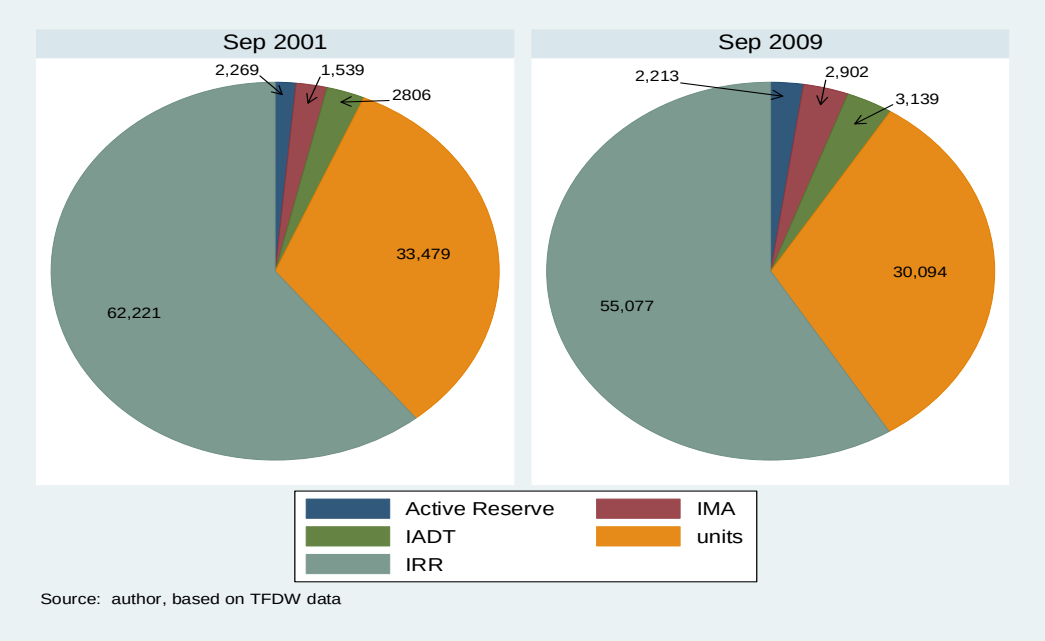


Figure 5. Comparison of Ready Reserve Strength by Sub-component (2001–2009)[17]

[17] Official SelRes end strength for 2009 as reported by Manpower and Reserve Affairs differs by 24 due to the inclusion of pending joins and drops as of September 30. (Total Force Data Warehouse [TFDW] data collection cycle runs at the end of the month. Pending and retroactive diary actions are identified on the following end of month cycle).

The IRR population is identified and approved as a manpower pool for activation by the Deputy Commandant Plans, Policies and Operations (DC PP&O) under the cognizance of the Secretary of Defense. Upon authorization by DC PP&O, IRR manpower requirements are sourced by DC M&RA. Prior to and after activation, Mobilization Command (MOBCOM) administers the IRR under the direction and guidance of DC M&RA.

b. Selected Reserve

The SelRes comprises that part of the Ready Reserve, which regularly trains in support of its wartime mission. As depicted in Figure 6, the SelRes consists of the Active Reserve (AR), IMA, SMCR units, and accessing Marines categorized as Initial Active Duty for Training (IADT). As previously mentioned, these four sub-components combine to form the total SelRes end strength authorization of 39,600; however, only the AR end strength is individually legislated by Congress.

(1) Active Reserve. The AR is a full-time active duty program whose purpose is to organize, administer, recruit, instruct, train and integrate the RC under the cognizance of DC M&RA. The AR end strength of 2,261 is prescribed annually by Congress in § 412 of the National Defense Authorization Act and is included in the total SelRes end strength.[18]

(2) Individual Mobilization Augmentees. IMAs are regularly drilling SelRes members assigned to an AC organization and who activate as individuals under DC PP&O authority. Similar to the IRR, when not on active duty, IMAs are administered to by MOBCOM under the program management of Dir RA. Per MCO 1001.62, individuals may not serve in the same IMA organization for more than three to five years before transferring to a different AC organization or Ready Reserve sub-component for a period of at least one year. As shown in Figure 5, IMA end strength has nearly doubled since 2001 as IMA structure and paid billets have increased.[19]

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[18] National Defense Authorization Act for Fiscal Year 2010, Public Law 111-84, § 412, U.S. Statutes at Large 123 (2009).

[19] Prior to Active Duty Operational Support (ADOS) end strength accounting procedures required by 10 U.S.C. §115(b)(2)(B), FY09 IMA end strength stood at 3,053 Marines.

(3) Selected Marine Corps Reserve Units. SMCR units comprise the largest portion of SelRes end strength and are organized into the 4th Marine Division (4th MarDiv), 4th Marine Logistics Group (4th MLG), and 4th Marine Aircraft Wing (4th MAW) with the exception of force level units, which are organized directly under the Commander, Marine Forces Reserve (ComMarForRes).

(4) Initial Active Duty for Training. IADT includes those SelRes individuals who have yet to complete their initial accession training and are not eligible for deployment outside the continental Unites States.

c. Volatility of the Ready Reserve

The Marine Corps actively manages the entire Ready Reserve and transitions between the IRR and SelRes are seamlessly accomplished via the Marine Corps Total Force System (MCTFS) of pay and personnel management. Although one single career path does not exist, the majority of Marines navigate multiple sub-components of the Ready Reserve during their active service. As an example, a Marine may begin his career in the AC before transferring to the IRR upon his honorable discharge from active duty. After one to two years, which is quite common,[20] he may join an SMCR unit, activate, and remain with that unit for several years. Later, he may decide to return to the IRR and continue to qualify for retirement using a litany of retirement point options.[21] Thereafter, he might drill with an AC staff or other unit as an IMA, while serving several relatively short periods of active duty using local Active Duty Operational Support (ADOS) funding, or longer orders in support of a contingency operation, before returning to an SMCR unit. These transactions may continue until he is either discharged or retires.

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[20] Anita Hattiangadi, "SelRes Attrition and the Selected Reserve Incentive Program," 71. Between 1997 and 2005, over 40 percent of AC Marines discharged to the IRR remained there for a period exceeding one year before joining the SelRes.

[21] Computation of retirement points is codified at U.S. Code 10 (2010), § 12732. In general, a Marine earns one point per day on active duty, one point per inactive duty period, one point for participating in funeral honors duty, 15 points for membership (while in an active status), and one point per period of appropriate, associate, or equivalent duty as depicted in Table 9–1 of MCO 1001R.1K. Thus, a Reserve may participate in the Reserve and qualify for retirement without joining the SelRes.

Often, this varied career path, which involves obtaining a wealth of knowledge and experience in multiple units and organizations while maintaining satisfactory participation requirements, enables a Marine's competitiveness for promotion to higher rank. However, unlike the AC, each Marine must actively manage his own career. This, combined with a need to balance civilian career opportunities and requirements increases the volatility of service in the Ready Reserve.

2. Standby Reserve

As depicted in Figure 5, the Standby Reserve includes both the Active Status List (ASL) and Inactive Status List (ISL). Together, these two sub-components comprised less than one percent of the total Marine Corps Reserve as of 30 September 2009, and included only four enlisted Marines.

a. Active Status List

Per MCO 1001R.1K, the ASL generally consists of Marines designated as key federal employees and those Marines for whom hardship or other reason renders them incapable of participating in training on a regular basis; however, they intend to return to the Ready Reserve in the future. Members of the ASL remain in an active status for promotion and retirement purposes and must maintain at least 27 points annually to remain a satisfactory participant, though they are ineligible for pay. As of September 30, 2009, the ASL end strength consisted of 18 Marines.

b. Inactive Status List

Currently, the ISL consists solely of officers who have met their service obligation and desire to retain Reserve affiliation, but failed to meet minimum participation requirements to remain in an active status. Members of the ISL are ineligible for pay, promotion, or retirement credit.[22] As of September 30, 2009, the ISL end strength consisted of 1,181 officers.

[22] National Defense Authorization Act for Fiscal Year 1995, Public Law 103-337, § 1611(a)(1), U.S. Statutes at Large 108 (1994) codified at U.S. Code 10, §10153 (2010).

3. Retired Reserve

The Retired Reserve consists of Regular Retirees, the Fleet Marine Corps Reserve (FMCR), Reserve Retirees in receipt of pay, Reserve Retirees awaiting pay (gray area), and Honorary Retirees. Figure 6 compares the relative strengths of these sub-components and depicts the growth of the Retired Reserve over the past eight years from September 2001 to September 2009.

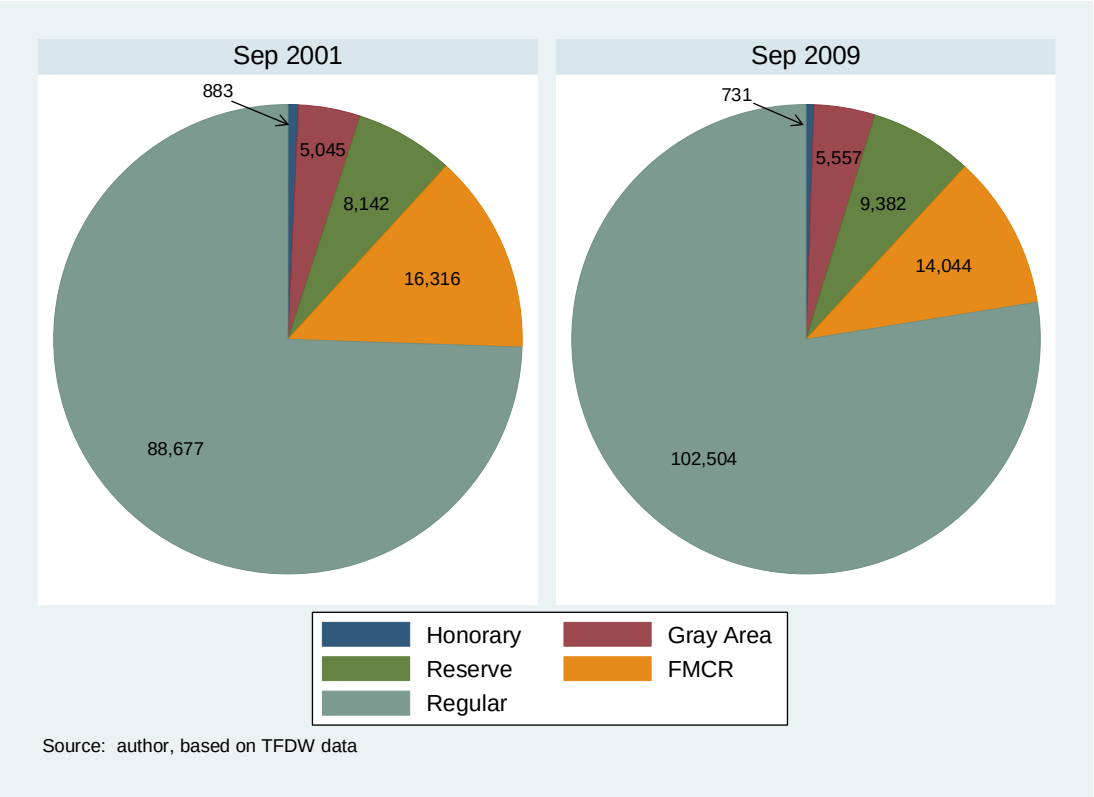

Figure 6. Comparison of Retired Reserve Strength by Sub-component (2001–2009)

a. Regular Retired

The Regular Retired List consists of all officers in receipt of retired pay who have completed 20 years of active service and those enlisted members in receipt of retired pay who have completed 30 years of combined service on active duty and in the

FMCR of which at least 20 years must have been on active duty. Note: an enlisted member of the FMCR found not physically qualified for active duty upon activation may be immediately transferred to the Regular Retired List.

b. Fleet Marine Corps Reserve

The FMCR consists of those enlisted Marines who have completed at least 20 years of active duty and are in receipt of retainer pay. The FMCR pension is called retainer pay due to the potential training requirements and higher level of readiness afforded these individuals prior to reaching 30 years of service.

c. Retired Reserve in Receipt of Retired Pay

The Retired Reserve includes those Reserve officers and enlisted in receipt of non-regular retired pay upon reaching 60 years of age. Effective January 28, 2008, this age is reduced by three months for each 90-day aggregate period served on active duty under contingency operation activation authority or ADOS orders. However, this age may not be reduced below 50 years of age.[23]

d. Retired Reserve Awaiting Pay

"Gray Area" retirees include those Reserve members who have met the requirement of 20 qualifying years of non-regular service under U.S. Code 10, § 12730 and have been approved for retirement by the Secretary of the Navy.

e. Honorary Retiree

Honorary retirees include those Reserve Marines who did not meet the requirements for retirement before reaching mandatory separation service limits and have been approved for honorary retirement by the Secretary of the Navy. Honorary retirees are not eligible for monetary compensation and are not liable for activation; however, they may keep their rank for ceremonial purposes and may obtain access to certain military base facilities.

[23] National Defense Authorization Act for Fiscal Year 2008, Public Law 110-181, § 647, U.S. Statutes at Large 122 (2008), codified at U.S. Code 10 (2010), § 12731(f).

C. PARTICIPATION REQUIREMENTS

Each member of the Marine Corps Reserve in an active status is subject to varying annual participation requirements that can range as high as a minimum 48 periods of inactive duty training (IDT)[24] and 14 days of active duty training (ADT). Table 2 summarizes participation requirements listed in MCO 1001R.1K for each of these sub-components and also identifies their associated Training Category Pay Group (TCPG) by which they are categorized in MCTFS.

Table 2. Summary of Participation Requirements for Reserve Marines in an Active Status

TCPG	Category	IDT	ADT[25]	Points[26]	Other
A	SMCR units	48	14	NA	
B	IMA	48	12	NA	
E, H	IRR	0	0	27	Muster Duty
F, P	IADT	NA	Varies	NA	
G, N	ASL	0	0	27	
Q	AR	NA	NA	NA	Active Duty

Failure to meet the requirements listed in Table 2 is grounds for discharge from the Marine Corps Reserve or, in the case of officers beyond their Military Service Obligation (MSO), transfer to the ISL. In addition, mandatory participants who have not completed their initial enlistment agreement to serve in the SelRes and accrue at least nine unexcused absences from IDT in a 12-month period will have their contractual period of participation extended.

[24] According to Table 9-1 of MCO 1001R.1K, the minimum time period to complete a drill (IDT) is four hours and no more than two drills can be completed in a single calendar day.

[25] Exclusive of travel. Commanders may waive this requirement based on execution of ADOS orders.

[26] Minimum participation points applies only to officers beyond their MSO. Officers who are retirement eligible must obtain 50 points annually, regardless of TCPG.

D. ACTIVATION[27]

With the exception of Honorary Retirees and IADT[28], all members of the Marine Corps Reserve may be ordered to active duty under the Title 10 authorities listed in Table 3. All SelRes activations for duty other than training are considered involuntary notwithstanding the individual's consent to that activation given the limits of statutory authority.

Table 3. Activation Authorities for the Marine Corps Reserve[29]

Authority[30]	Categories	Personnel Limits	Duration	Notes
§ 12301(a)	Entire RC	None	Duration plus 6 months	Involuntary
§ 12301(d)	SelRes, IRR	None	Unlimited	Voluntary
§ 12302	SelRes, IRR	1,000,000	24 consecutive months	Involuntary
§ 12304	SelRes, IRR	200,000	365 days	Involuntary
§ 12308	Gray Area	None	Unlimited	Voluntary
§ 688[31]	Retired Reserve	25 during peacetime	12 in 24 months during peacetime	Involuntary
§ 688a	Retired Reserve	1,000	Unlimited, expires December 2010	Voluntary

[27] Activation includes voluntary and involuntary order to active duty with and without the member's consent. The term mobilization refers specifically to an order under involuntary authority with or without the member's consent. These differences cannot be inferred from the data; thus, the term activation is used to avoid incorrect use of the term mobilization.

[28] IADT members may be ordered to active duty, but cannot deploy outside the U.S. prior to completing initial accession training.

[29] MCO 1001R.1K.

[30] § 12301(a) requires declaration of war by Congress. §§ 12302, 12304, and 688 (other than peacetime) require a Presidential Executive Order declaring a National Emergency.

[31] The personnel limits and duration are unlimited during war or National Emergency. During peacetime, officers retired early or notified of early retirement under § 638 are not eligible.

E. ACCESSIONS

During June of each year, participants from M&RA, MarForRes, and the Marine Corps Recruiting Command (MCRC) meet to finalize the subsequent FY non-prior service (NPS) and prior service recruiting missions at the annual Reserve Mission Planning Conference.

1. SelRes Recruiting Missions

In general, manpower analysts from RA develop SelRes accession and new prior service affiliation requirements based on historical trends and projected losses for the following fiscal year. Figure 7 depicts the historical recruiting missions, post-9/11. In order for recruiters to receive credit, NPS accessions must complete recruit training and prior service joins must stay with the unit for at least three months before leaving. In addition, MCRC cannot receive credit twice for recruiting the same prior service Marine to two different units in the same FY.

Until recently, the overall recruiting mission had decreased since 9/11, stabilizing after Operation Iraqi Freedom (OIF) in FY03. Over the past several years, the NPS/prior service split has been approximately 60/40 with the exception of FY08 when adjustments were made to facilitate AC growth to 202,000.

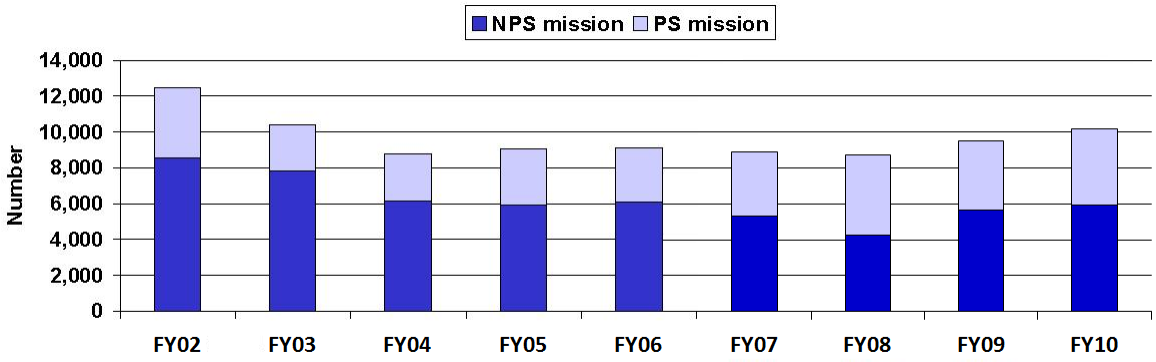

Figure 7. SelRes recruiting mission, FY2002–present[32],[33]

[32] CRM D0013618.A2, 8.

[33] Anita Hattiangadi, "SelRes Attrition and the Selected Reserve Incentive Program," 8. FY2007 through FY2010 data provided by Reserve Affairs (RA).

At the annual mission planning conference in June, the missions are further specified via quota serial numbers (QSN), which link an individual manpower requirement to a reserve reporting unit code (RRUC), grade, and MOS placeholder. In order to increase flexibility, some of these QSNs are left "open" and a RRUC is not specified. Altogether, the QSNs are combined into a single requirements document commonly referred to as "Memo 01."

2. Reserve Optional Enlistment Programs

All NPS enlisted accessions are contracted to serve in the Ready Reserve of the Marine Corps for an initial eight-year MSO. The majority of these NPS accessions do so via six years of mandatory SMCR unit participation followed by a two-year Ready Reserve requirement, also known as 6x2 contracts. This six-year obligation is required in order to qualify for the Selective Reserve Educational Assistance program.[34]

As shown in Table 4, a small number of Marines each year join the Reserve under a shorter mandatory participation contract. In doing so, the Marine Corps potentially loses these Marines in the latter, more productive period of their contracts. However, some of these Marines may later extend their mandatory participation dates in order to qualify for educational benefits.

Table 4. Reserve Optional Enlistment Program Distribution (2001 and 2009)

Contract	30 Sep 2001	30 Sep 2009
3x5	36	21
4x4	449	599
5x3	29	8
6x2	25,840	25,431
Total	26,354	26,059

[34] National Defense Authorization Act for Fiscal Year 2008, Public Law 110-181, § 647, U.S. Statutes at Large 122 (2008), codified at U.S. Code 10 (2010), § 12731(f). Reserve educational benefits are more commonly referred to as Chapter 1606 or MGIB-SR.

F. MONETARY INCENTIVES

On an annual basis, Headquarters Marine Corps, Reserve Affairs Personnel Plans and Policy (RAP) releases Marine Corps Bulletin (MCBul) 7220 announcing policies and procedures for monetary incentives available during the upcoming FY. In general, these incentives are further divided into the two broad categories of enlistment bonuses for NPS accessions, and reenlistment, extension, or affiliation bonuses for prior service Marines. Table 5 summarizes each of the bonuses offered from FY2002 through FY2010.

1. Non-Prior Service

According to MCO 1001R.1K, NPS accessions may be eligible for an enlistment bonus if they meet the following criteria:

- Assigned and agree to serve satisfactorily in a designated military occupational specialty (MOS) or unit for six years (6x2 contract)
- Are a graduate of a secondary school with a category I, II, or III Armed Forces Qualification Test Score (AFQT)
- Do not have prior military service in any armed force
- Agree to serve in a billet requiring a critical skill as defined by RA

2. Prior Service

Prior service Marines may qualify for a reenlistment bonus provided they have not previously received a six-year reenlistment, extension, or affiliation bonus and serve or agree to serve in a designated MOS or unit in the rank of corporal through staff sergeant. In cases where the prior service Marine is not qualified in the required MOS, the Prior Service MOS Retraining Program (PSMRP), formerly known as the Prior Service Training Assignment Program (PSTA), may be available to obtain the necessary skill set.

Table 5. Summary of Enlisted Monetary Incentives Available from FY 2002–Present

Incentive[1]	FY02–05	FY06	FY07	FY08	FY09	FY10
Affiliation[2]	$50/mo[3]	$50/mo	$5,000–3 yrs	$15,000–3 yrs	$15,000–3 yrs	$5,000–3 yrs
Reenlistment/ Extension	$5,000–6 yrs $2,500–3 yrs[4]	$15,000–6 yrs[5] $7,500–3 yrs[6]	$5,000–3 yrs	$15,000–3 yrs[7]	$15,000–3yrs	$5,000–3 yrs
Enlistment	$8,000[8]	$10,000	$10,000	$20,000	$20,000	$5,000
Payment Schedule	Installments	Installments[9]	Lump	Lump	Lump	Lump

Notes:
[1] Concurrent receipt of monetary incentives and $350 MGIB-kicker authorized, except for affiliation bonuses after FY06.
[2] From FY07–11 June 2009, this bonus was restricted to prior service active component who had not previously served in the SelRes.
[3] Maximum $1200 in FY02-04, increased to $2400 in FY05.
[4] Second 3-yr bonus reduced to $2,000.
[5] Tiered bonuses of $15,000, $10,000, & $5,000 based on unit.
[6] First 3-yr bonus tiers were $7,500, $5,000, & $2,500. Second 3-yr tiers were $6,000, $4,000, and $2,000.
[7] Incentive was $7,500 first 3-yr bonus, $6,000 second 3-yr bonus prior to 15 March 2008.
[8] Originally $5,000 in FY02, retroactively increased to $8,000 on 7 May 2002.
[9] Reenlistment/Extension bonus was paid as a lump sum

G. CHAPTER SUMMARY

While not all-encompassing, the purpose of this chapter has been to provide a quick overview of the RC structure and organization, simultaneously developing a deeper appreciation for the non-linear nature and volatility of service in the Marine Corps Reserve. Although on the surface the RC may at first appear burdensome, or overwhelming at the very least, this same complex structure provides a functional flexibility and adaptability, which supports the needs of the Total Force while integrating two systematically diverse manpower pools.

The focus for the remainder of this thesis will quickly narrow to determining the impact of mobilization, incentives, and other significant factors on the continuation rates of prior service SMCR unit Marines. However, it is important to keep in mind the surrounding mechanisms and volatility described in this chapter inherent to the RC.

III. SOCIAL AND PSYCHOLOGICAL FACTORS OF ACTIVATION AND DEPLOYMENT

A. INTRODUCTION

Activation can disrupt the lives of reserves and their families. However, activation often results in deployment outside the continental U.S. (OCONUS). Figure 8 shows that nearly 80 percent of Marine Corps Selected Reserve (SelRes) activations and over 93 percent of reactivations are OCONUS. Disruptions due to OCONUS deployment can create tremendous turmoil for everyone involved. Service members miss birthdays, special holidays, and other significant family-life occurrences during their absence. Deploying to a combat zone or other hostile fire location (which represent 97 percent of Marine Corps SelRes OCONUS deployments) further intensifies this emotional distance.

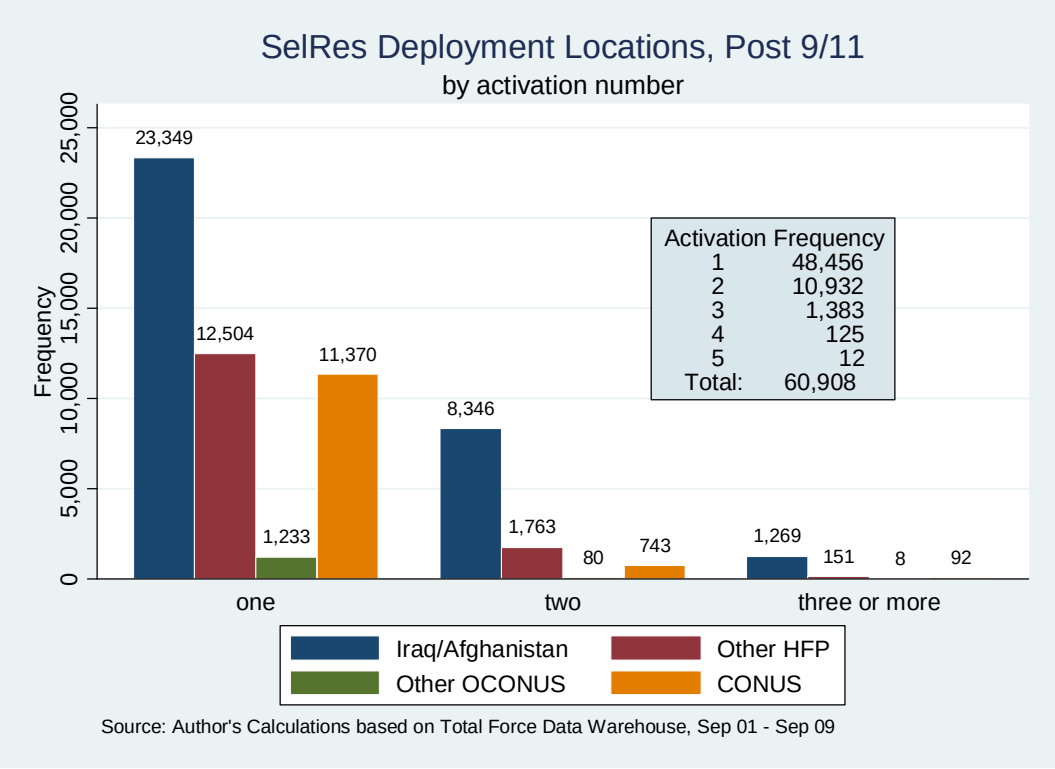

Figure 8. Frequency and Location of SelRes Activations, Post-9/11

Not surprisingly, DoD closely monitors divorce and suicide rates of service members as indicators of stress in the force.[35] However, a much more obvious metric in the SelRes, and the subject of this thesis, is a potential decrease in continuation rates of prior service personnel. Since prior service personnel are not obligated to affiliate with a drilling unit, we would expect their reaction to an increase in activation and deployment to be more elastic than that of non-prior service (NPS) obligors.

Although protected by statute, prolonged absence can negatively affect civilian careers and opportunities. According to Status of Forces Reserve Component (SOFRC) survey data obtained in 2000 and 2004, 41 to 49 percent of activated reserves experienced an income loss while on active duty.[36] According to recent estimates by the SAG Corp., small business, which employs approximately 72 percent of all reserve service members, experienced a three percentage point drop in sales when reserve employees were activated for 180 days or more.[37] Given these negative impacts and the expectation of continued activations for the foreseeable future, why would a reserve service member continue to serve in the SelRes upon the completion of his service obligation?

In this chapter, I will identify those factors that can potentially support or detract from continued reserve service despite these issues. We will begin by reviewing the role of the Reserve and its relevance to the Global War on Terror. Next, we will discuss extrinsic and intrinsic motivators using Herzberg's two-factor theory as a basis for job satisfaction. SelRes that have a high satisfaction should remain in the SelRes longer than those who are unhappy with their career choice. In summary, we will identify a

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[35] Recent evidence indicates that suicide rates are increasing (see Barbara Starr, "Army to Report Record Number of Suicides," CNN.com/US, January 30, 2009, http://www.cnn.com/2009/US/01/29/army.suicides (accessed February 4, 2010).) Research on divorce rates does not support an increasing trend due to the Global War on Terror (see Benjamin Karney and John Crown, "Families under Stress: an Assessment of Data, Theory, and Research on Marriage and Divorce in the Military," MG-599-OSD, (Santa Monica, CA: RAND, 2007).)

[36] David Loughran, Jacob Klerman, and Craig Martin, "Activation and the Earnings of Reservists," MG-474-OSD, (Santa Monica, CA: RAND, 2006), 6–7.

[37] John Hope, Douglas Christman, and Patrick Mackin, "An Analysis of the Effect of Reserve Activation on Small Business," SBAHQ-07-F-0306, (Annandale, VA: SAG, 2009), 16, 26. Small business is defined as having 100 or fewer employees. In comparison to large businesses, the effect on sales was 15 times greater.

multitude of factors that affect the decision to stay in the SelRes to include hygienic issues, such as monetary compensation and protection of civilian employment, and intrinsic motivators to include societal acceptance, career aspirations, honor, recognition, and guilt.

B. TRANSITION TO AN OPERATIONAL RESERVE

Prior to the 1990s, the Department of Defense (DoD) managed and utilized the Reserve Component (RC) as little more than a strategic reserve–a force to mobilize in case of all-out war. However, this paradigm began shifting after the end of the Cold War. Previously, the Reserve lay dormant following the Korean conflict with only a relatively few minor exceptions. However, Operations Desert Shield and Desert Storm resulted in the involuntary call-up of 238,729 reserves service members in 1990-91. Thereafter and for the remainder of the 1990s, the Reserve was increasingly relied upon for operations in Southwest Asia, Somalia, Haiti, and the Balkans.[38]

The events of September 11, 2001 eliminated any remaining image of a strategic reserve. Out of necessity, partly due to the downsizing of the AC and an increased Reserve share of the total force (amounting to 37 percent in 2008),[39] the RC has consistently engaged in combat missions and operational support duty over the past eight years. As previously discussed in Chapter I (Figure 3), the Marine Corps SelRes has reached a sustained level of activation, averaging 6,927 Marines per month during this period and can expect this operational requirement to remain stable for the foreseeable future.[40]

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38 "Final Report to Congress and the Secretary of Defense: Transforming the National Guard and Reserves into a 21st Century Operational Force," Commission on the National Guard and Reserve, (Arlington, VA: CNGR, 2008), 52–53. http://www.cngr.gov/Final%20Report/CNGR_final%20report%20with%20cover.pdf (accessed February 28, 2010).

39 Ibid., 53.

40 Total excludes the individual ready reserve and retired reserve. Total Marine Corps Reserve contribution, omitting active reserve, extended active duty for recruiting, and active duty for training, is 8,891 as of September 2009.

C. VOLUNTEERING FOR DUTY

Critics often point out that reserve service members are not volunteers and that they have no choice but to deploy. They argue that reserve service members enlist to protect the Homeland, while not anticipating activation in conflicts, such as the current operations in Iraq and Afghanistan. Ironically, it was not so long ago in our nation's history that the best way to avoid the draft was to either go to college or join the Reserve.[41] During the initial phases of the last two major activations, it was not uncommon to read about a service member declaring, "I joined the Army National Guard to pay for college."

However, as previously discussed in Chapters I and II, it is difficult to ignore the significant proportion of SelRes who are prior service and who may leave the SelRes almost at whim. In the Marine Corps, which traditionally retains the fewest first-term enlistees, prior service accounts for 30.8 percent of SelRes units and individual mobilization augmentees (IMA) (23.6 percent in SMCR units). As a whole, the DoD RCs obtain over half of their annual enlisted accessions from prior service sources.[42] Even the remaining NPS population can extricate themselves from a drilling obligation by relocating to a residence over 100 miles from the nearest Reserve unit. Consequently, reserve service members, particularly prior service Marines, are "semi-volunteers" for activation and deployment. Thus, it is important to understand what factors lead to job satisfaction, or conversely, dissatisfaction.

D. EXTRINSIC MOTIVATION

According to Frederick Herzberg's two-factor theory, the two elements necessary for employee satisfaction are motivators and hygiene. Hygiene factors are extrinsic in nature and include pay and compensation, as well as job security in the advent of activation. Although neither of these factors are typically identified as the primary motivation for activation, this is in keeping with the role constituted by hygiene factors.

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[41] CNGR, 324.

[42] According to DoD's FY2007 report on "Population Representation in the Military Services," http://prhome.defense.gov/PopRep2007/download/download.html (February 24, 2010). Fifty-eight percent (81,386/145,860) of DoD reserve accessions in FY07 were prior service.

According to Herzberg's theory, it is critical that extrinsic needs be first met in order to avoid job dissatisfaction and enable other intrinsic rewards to provide the primary motivation for continued employment.[43] I will present several hygiene issues first followed by a discussion of intrinsic motivators.

1. Compensation and Benefits

Reserve service members are paid 1/30th of the active duty monthly base pay and eligible hazardous duty pays for each drill period. During the typical month, reserve service members complete four drills in one weekend, thus receiving approximately 13 percent of active duty base pay per month. In addition, reserve service members typically serve 14 days annual training, paid similar to active duty with the main exception being a lower basic allowance for housing (BAH) rate.[44] For those who are self-employed or who are otherwise unable to access affordable healthcare, participation in the SelRes also qualifies for Tricare Reserve Select (TRS) healthcare coverage at significantly lower premiums than typically offered by private insurance companies.[45] Additionally, reserve service members may qualify for a retirement pension upon reaching 60 years of age (or younger age as discussed later in this chapter). Lastly, reenlistment bonuses and other affiliation pays may be available for assignment to a critical unit or in an under-manned military occupational specialty (MOS). Thus, there is some motivation to "moonlight" in the SelRes to augment one's income, future retirement, or healthcare needs.

Upon activation for any length of time for a contingency operation, or for a period greater than 30 days otherwise, reserve service members receive all components of active duty military compensation to include basic pay, BAH, basic allowance for subsistence (BAS), family separation allowance, and all eligible special pays to include hazardous

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[43] "Herzberg's Motivation-Hygiene Theory," NetMBA, http://www.netmba.com/mgmt/ob/motivation/herzberg/ (accessed March 4, 2010).

[44] Complete pay tables to include drill pay and BAH-RC, see http://www.dfas.mil/militarypay/militarypaytables/2010WebPayTable34.pdf.

[45] Monthly TRS rates for 2010 were $49.62 for an individual or $197.65 for family coverage and do not exclude pre-existing conditions. See http://www.triwest.com/document_library/pdf_docs/FS_2010 for the TRSRates.pdf for official rates and plan information.

duty and aviation continuation incentive pay. In general, allowances are tax exempt and leave accrues at the normal rate of 2.5 days per month. Additionally, activated service members and their family receive the same health care benefits provided to the AC.

Upon assignment to a hostile fire designated location, service members also receive imminent danger pay/hostile fire pay and tax exempt status for their entire base pay up to the E-9 monthly salary. Reenlistment bonuses and reserve affiliation pays received while in a hostile fire location are also eligible for the combat tax exclusion.

Despite the above compensation and benefits, the before-mentioned SOFRC surveys indicated that 41 to 49 percent of activated reserve service members experience an income loss while activated. Thus, some argue that causing reserves to take a pay cut to fight for their country is not equitable. More importantly, if this monetary loss causes significant dissatisfaction, loss rates will dramatically increase; however, survey data can be misleading and recent studies by RAND conclude that this number is overstated.

In contrast to the SOFRC surveys, Loughran, Klerman, and Martin (2006) empirically estimated that only 17 percent of activated reserve service members lost income when compared to their civilian earnings reported by the Social Security Administration (SSA) in 2002 and 2003. Of those that did lose income, only six percent exceeded $10,000. In contrast, average earnings increased by $11,165 more than if these individuals had not been activated. Additionally, over 40 percent of reserve personnel not activated during this same period experienced a lower income than the previous year in their civilian careers.[46] Thus, not only does the average income of activated reserves exceed their civilian earnings, it can temporarily improve financial stability.

Regardless, concern that involuntary activation should not result in loss of net income prompted passage of income replacement legislation, which will be discussed further in Chapter IV. Additional benefits and compensation recently authorized include a decrease in the retirement age for activation and qualification for the Post-Deployment Mobilization Respite Absence (PDMRA) program, which will also be discussed in Chapter IV.

[46] Loughran, Klerman, and Martin, xvii–xviii.

In summary, active duty military pay and benefits should not dissuade the majority of RC service members from serving on activation orders. In the majority of cases, active duty pay exceeds civilian earnings and could quite possibly motivate some service members to stay or affiliate with a Reserve unit scheduled for activation.

2. Uniform Services Employment and Reemployment Rights Act

Though financially stable during activation, concern that reserve service members may face problems with their civilian employers upon return from deployment is a significant concern. In 1994, Congress passed the Uniform Services Employment and Reemployment Rights Act (USERRA) to protect reserve service members faced with discrimination due to their reserve affiliation or absence due to activation. To assist service members, the DoD-sponsored Employer Support of the Guard and Reserves (ESGR) organization provides information briefings and mediation services upon request. Figure 9 summarizes the reemployment portion of this act. The maximum cumulative period of absence due to military orders is five years. However, this limitation is waived for orders in support of a contingency operation.

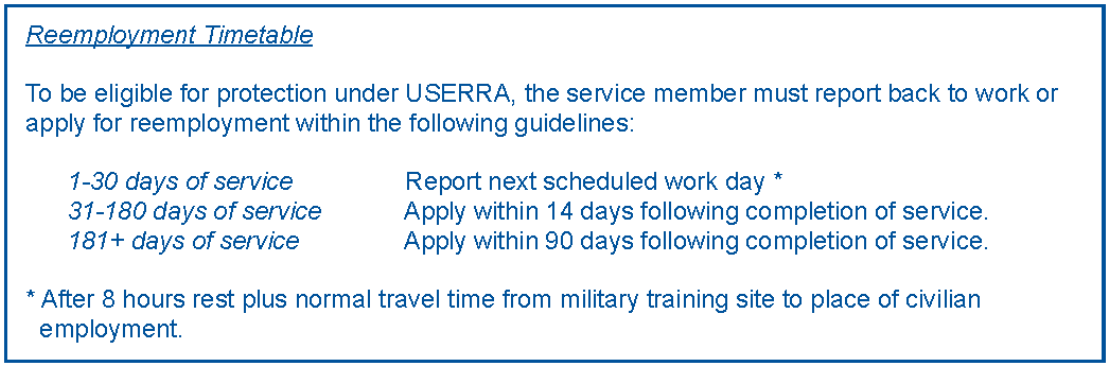

Figure 9. USERRA Reemployment Time Table[47]

Additional provisions of USERRA include the right to all pay raises and promotions that would have occurred during the service member's absence and protection from termination of employment, except for cause, within 180 days if the

[47] "USERRA Fact Sheet," Employer Support of the Guard and Reserve, http://www.esgr.org/files/factsheet/USERRA.pdf (accessed March 4, 2010).

employee's service related absence was greater than 30 days and one year if the absence was greater than 180 days.[48] Although these protections mentioned under USERRA are not useful for self-employed reserve service members, anecdotal evidence suggests that they have been helpful for employees of large firms.

In one case, an individual reemployed after returning from one-year activation orders was terminated nine months later. After reminding his employer of his USERRA rights, he negotiated one additional year of pay and benefits as compensation for the loss of his job. In other cases, pilots have avoided furlough by accepting activation orders when the airline industry downturn occurred in the early- to mid-2000s.

Unfortunately, it is impossible to eliminate all forms of employer discrimination through legislation for reserve members. However, USERRA has provided tremendous support for the Guard and Reserve in dealing with this issue. Although activation may not endear all employees to their civilian employers, potential activation has decreased as a significant point of dissatisfaction from an employee point of view since Operations Desert Shield and Desert Storm. Nevertheless, this issue undoubtedly results in the temporary and sometimes permanent loss of some SelRes whose civilian career path is incongruent with the activation expectations of an operational reserve.

3. Summary of Hygiene Factors

In this section, we have reviewed compensation, benefits, and reemployment rights of veterans. None of these are strong motivators for activation since a reserve service member would have enlisted or reenlisted in the AC or active reserve (AR) program if full-time active duty was his objective. However, using Herzberg's two-factor theory, we can see that these factors provide the preventative medicine necessary in the area of financial stability to avoid attrition; thus, laying the groundwork for intrinsic motivation factors.

[48] Uniformed Services Employment and Reemployment Rights Act of 1994, Public Law 103-353, § 2(a), U.S. Statutes at Large 108 (1994), codified at U.S. Code 38 (2010), § 4316(c).

E. INTRINSIC MOTIVATION

Suggesting that young men and women serve in the military mainly for compensation, or because they lack sufficient alternatives elsewhere, is insulting to many service members, particularly those in the Reserve whose drill pay is a fraction of active duty pay. As an example, a botched joke by Senator John Kerry (2006) in which he stated, "Education—if you make the most of it and you study hard and you do your homework, and you make an effort to be smart, you can do well. If you don't, you get stuck in Iraq,"[49] resulted in a firestorm of criticism. In response, Senator John McCain declared, "Senator Kerry owes an apology to the many thousands of Americans serving in Iraq, who answered their country's call because they are patriots and not because of any deficiencies in their education."[50] Politics aside, it is necessary to look beyond compensation and benefits to explain why the reserve continuation rate is not even lower given the current deployment tempo. In particular, we will review social and psychological needs to include acceptance, expectations, career aspirations, personal pride and honor, recognition, and the guilt of remaining behind.

1. Acceptance into Adulthood

According to Grossman (2009), "in development psychology there is a general understanding that an individual must master the twin areas of sexuality and aggression in order to have truly achieved adulthood."[51] The U.S. Center for Disease Control reports that over 64 percent of high school seniors have engaged in sexual intercourse.[52] This leaves aggression as the last barrier to adulthood for the majority of high school seniors.

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[49]Rick Klein, "Kerry's 'stuck in Iraq' remark ignites firefight with Bush, GOP," *The Boston Globe*, November 1, 2006, online edition, http://www.boston.com/news/nation/washington/articles/2006/11/01/kerrys_stuck_in_iraq_remark_ignites_firefight_with_bush_gop/ (accessed August 16, 2009).

[50] Ibid., para. 18.

[51] Dave Grossman, *On Killing: The Psychological Cost of Learning to Kill in War and Society* (New York: Back Bay Books, 2009), xxiv.

[52] "United States 2007: Percentage of students who have ever had sexual intercourse," U.S. Center for Disease Control, http://apps.nccd.cdc.gov/yrbss/QuestYearTable.asp?cat=4&Quest=Q58& Loc=XX&Year=2007&compval=&Graphval=yes&path=byHT&loc2=&colval=2007&rowval1=Sex&rowval2=Grade&ByVar=CI&Submit2=GO (accessed March 5, 2010).

Many of today's youth see joining the military as a way in which to "test one's courage," to prove that they have reached the maturity and independence of adulthood. In particular, the Marine Corps targets this population through their advertising campaign "We're looking for a few good men." As a result, the Marine Corps attracts those individuals desiring both a physical challenge and to prove themselves worthy.

Staff platoon commanders at The Basic School in Quantico, Virginia often refer to war as the "Super Bowl" event of the Marine Corps. As such, it is not enough for Marines to serve; they must deploy to combat as well. Consequently, the next logical step after completion of training is to use their newfound skills on the field of battle and Marines pursue this opportunity when presented.

2. Expectations

Marines are constantly "sizing up" fellow Marines by the medals they wear on their chest. A Marine who does not hold a campaign ribbon from Southwest Asia may lose some credibility in the eyes of his comrades. He will be an "outsider looking in" on every conversation about Iraq, Afghanistan, and combat and left to question, good or bad, how he would have performed. Even service members that have only deployed to Bahrain or Qatar are held in lower esteem.

The expectation that Marines must deploy and fight is best echoed by the Commandant of the Marine Corps in his famous All Marine message, "Every Marine into the Fight."

> The Marine Corps remains actively engaged in combat operation in the Central Command area of responsibility. Marines, by their performance in Iraq and Afghanistan, have added notably to the legacy of our colors. Frequent deployments and short dwell periods have been the norm, yet our Marines have responded magnificently with unwavering determination and commitment to win the Long War from the very outset. When they

> join our Corps, Marines expect to train, deploy, and fight. That's who we are; that's what we do; and we must allow every Marine that opportunity.[53]

Incidentally, the Commandant's message was directed more toward Congress than Marines. The expectation to "train, deploy, and fight" is engrained in every Marine starting on the first day of boot camp and officer candidate school. Anecdotally, a Marine reserve lieutenant colonel serving in Bagram, Afghanistan on his third deployment in four years was asked why he volunteered to deploy to again. His response was simple, "I've already been to Iraq and Camp Lemonnier (Djibouti). I just wanted to be able to say that I've been to all three."

3. Career Aspirations

Given the high expectations placed upon Marines, it's not surprising that participation in combat operations is an unstated requirement for promotion to senior rank. In 2007, Lieutenant General Coleman, former Deputy Commandant for Manpower and Reserve Affairs (DC M&RA) advised, "I guarantee you…if you have a six- to seven-year war and you don't get to the war zone, you needn't wonder what's going to happen when it's time for promotion."[54] This sentiment is reflected throughout the Marine Corps and combat experience is a significant briefing item for promotion boards.

4. Honor and Pride

There are also several deep-seated personal reasons why some Reserve Marines may feel obligated to activate and deploy in support of combat operations. Since September 11, 2001, one of the most common questions asked of service members by complete strangers is "Have you been to Iraq?" For the minority of prior service ground forces that have not deployed, it may be with great embarrassment and feeling of

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[53] "ALMAR 002/07 Every Marine Into the Fight–Commandant's Intent," U.S. Marine Corps, January 19, 2007, http://www.marines.mil/news/messages/Pages/2007/EVERY%20MARINE%20INTO%20THE%20FIGHT-COMMANDANTand%2039;S%20INTENT.aspx (accessed March 5, 2010).

[54] Trista Talton, "General: Deploy or Risk Promotion Chances," *The Marine Corps Times*, August 17, 2007, http://www.marinecorpstimes.com/news/2007/08/marine_coleman_070815/ (accessed March 5, 2010).

dejection that they answer "no" considering the many opportunities provided during the previous eight years of war. This internal consternation is often sufficient motivation for Marine reserve service member to activate and deploy when called. For this reason amongst many others, almost every single officer I served with in my last assignment voluntarily requested orders to Southwest Asia.

General Patton best articulated this sentiment in his speech to the Third Army on June 5, 1944:

> There is one great thing that you men will all be able to say after this war is over and you are home once again. You may be thankful that twenty years from now when you are sitting by the fireplace with your grandson on your knee and he asks you what you did in the great World War II, you won't have to cough, shift him to the other knee and say, 'Well, your Granddaddy shoveled (explicative) in Louisiana.' No, Sir, you can look him straight in the eye and say, 'Son, your Granddaddy rode with the Great Third Army and a Son-of-a-(explicative)-(explicative) named Georgie Patton!'[55]

General Patton understood his men's intrinsic motivators well and had honed his oratory skills to a form of art.

5. Status and Recognition

Serving in the military is an honorable profession, recognized and respected by a vast majority of the American people. In a 2009 Gallup Poll, 82 percent of those queried had high confidence in the military, marking the twelfth straight year atop the ratings for U.S. institutions.[56] Status as a veteran can qualify an individual for discounts at stores like The Home Depot on major holidays, free entry into amusement parks and other venues on special occasions, and even educational benefits in certain states, such as California.

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[55] "Address to the Troops (The Famous Speech–Unexpurgated)," *The Patton Society*, http://www.pattonhq.com/speech.html (accessed March 4, 2010).

[56] Lydia Saad, "American's Confidence in Military Up, Banks Down," *Gallup.com*, June 24, 2009, http://www.gallup.com/ poll/121214/Americans-Confidence-Military-Banks-Down.aspx (accessed March 4, 2010).

Veterans have two holidays recognizing their sacrifices. Memorial Day honors those who have given their life in our nation's service[57] and Veteran's Day is "a celebration to honor America's veterans for their patriotism, love of country, and willingness to serve and sacrifice for the common good."[58] These holidays take on more meaning for veterans after having served in a hostile fire location away from friends and family.

6. Guilt

One of the most compelling reasons for a Reserve Marine to activate and deploy is guilt. In the film *Taking Chance,* Marine Lieutenant Colonel (LtCol) Michael Strobl awoke every night to review the list of Marines killed in action, obsessed with the fear that one of his friend's names would be next and that he had done nothing to save them.[59] Although a veteran of Operations Desert Shield and Desert Storm and awarded the combat action ribbon for satisfactory performance under enemy fire, LtCol Strobl was haunted with the guilt of staying behind and manning a desk while his friends and comrades fought in Iraq.

In his book *On Killing*, Gross discusses this guilt as one of the main motivations for participating in combat:

> Men in combat are usually motivated to fight *not* by ideology or hate or fear, but by group pressures and processes involving (1) regard for their comrades, (2) respect for their leaders, (3) concern for their own reputation with both, and (4) an urge to contribute to the success of the group…
>
> This bonding is so intense that it is a fear of failing these comrades that preoccupies most combatants…The guilt and trauma associated with failing to fully support men who are bonded with friendship and camaraderie on this magnitude is profoundly intense.[60]

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[57] "Memorial Day History," *The Memorial Day Site*, April 4, 2009, http://www.usmemorialday.org/backgrnd.html (accessed March 4, 2010).

[58] "History of Veterans Day," U.S. Department of Veterans Affairs, http://www1.va.gov/opa/vetsday/vetdayhistory.asp (March 4, 2010).

[59] Ross Katz and Michael Strobl, *Taking Chance*, directed by Ross Katz (New York: HBO, 2009).

[60] Grossman, *On Killing*, 88–9.

Gross' analysis places LtCol Strobl's fixation with guilt over consciously extending in a staff position in Quantico, VA into perspective. Although it had been over 12 years since he had served with his comrades in the first Gulf War, this bond forged under fire had not diminished.

F. CHAPTER SUMMARY

Although U.S. involvement in Iraq appears to be winding down, participation in Afghanistan is steadily increasing and shows no sign of relief in the near future. In order to sustain regular Selected Marine Corps Reserve (SMCR) unit activations, the Marine Corps must retain the appropriate mix of combat veterans necessary to lead young Marines in battle.

Policy makers must intuitively understand the extrinsic and intrinsic motivators that support these operations oriented manpower requirements. Simultaneously, manpower analysts must be able to accurately predict the effect of activation on prior service SMCR unit Marines to ensure recruiting and retention efforts are focused in the right direction.

In this chapter, we have more closely analyzed the social and psychological aspects of activation and deployment in addition to a cursory review of compensation and benefits. The latter are categorized as hygiene factors that must be met to allow a Marine to continue affiliating with the SMCR units, while developing intrinsic motivators foster a Marine's desire to stay serving in the SMCR units. During the next chapter, I will review the ACOL and Expected Utility of Deployment models, which theoretically predict the effect of compensation, activation, and other factors on the behavior of the Marine Corps Reserve, specifically members of SMCR units and the Ready Reserve.

IV. REVIEW OF THEORETICAL MODELS OF RETENTION

A. INTRODUCTION

In this chapter, I will review the Annualized Cost of Leaving (ACOL) and expected utility of deployment models of retention. The ACOL model compares the opportunity cost of military and civilian life and individual preferences between each. The expected utility of deployment model redefines utility as a trade-off between income, home, and deployed time. The goal of this chapter is to explore these models as the basis for specifying the multivariate retention models to be estimated in Chapter VII. In Chapter V, I will review previous empirical research in the areas of retention, attrition, and continuation prior to introducing the multivariate model used for this thesis and analyzing those results in Chapters VI and VII.

B. ANNUALIZED COST OF LEAVING

The ACOL model of reenlistment shown in equation 1 is based on the assumption that if an individual's cost of leaving the military exceeds his net preference for civilian life in any future time horizon, then that individual will make the decision to stay in the military. In this case, the cost of leaving is calculated by determining the monetary value of leaving immediately and subtracting that value from the net present value of staying over any future period. One advantage of this approach is that it accounts for both changes in the military-civilian wage differential resulting from additional years of military service and loss of experience in the civilian labor market, as well as the increased military retirement pension based on years of service. Warner and Asch use the following equation to summarize the ACOL model.[61]

[61] John Warner and Beth Asch, "The Economics of Military Manpower," in *Handbook of Defense Economics, Volume I*, ed. Keith Hartley and Todd Sandler (Amsterdam, Netherlands: Elsevier Science B.V., 1995), 360–1.

$$\tau^c - \tau^m < \frac{\sum_{j=t+1}^{n} \frac{W_j^M - W_{j,t}^C}{(1+\rho)^{j-t}} + \left(\frac{R_n}{(1+\rho)^{j-t}} - R_t \right) - \sum_{j=n+1}^{\infty} \frac{W_{j,t}^C - W_{j,n}^C}{(1+\rho)^{j-t}}}{\sum_{j=t+1}^{n} \frac{1}{(1+\rho)^{j-t}}} \quad (1)$$

Given the following for an individual at year t:

(1) $\tau^c - \tau^m$ is the net preference for civilian life,

(2) W_j^M is expected military pay in each future year j,

(3) $W_{j,t}^C$ is civilian earnings in future year j if the individual leaves at t,

(4) $W_{j,n}^C$ is civilian earnings in future year j if the individual separates after future year n,

(5) R_n is the expected value at future year n of retired pay and other separation benefits if the individual separates after year n,

(6) R_t is the present value at year t of retired pay and other separation benefits if the person leaves now,

(7) ρ is the individual's subjective discount rate on future income

Several relationships can be anticipated by applying the ACOL model to continuation in the Marine Corps Reserve. The most obvious principle is that an increase in the military-civilian pay ratio or an increase in monetary incentives should positively impact continuation. While activated, individuals who experience a loss in civilian income might leave the Reserve after release from active duty. By contrast, an individual who experienced an unexpected increase in income might be more likely to remain in the Reserve. Similarly, a rise in the unemployment rate would also increase continuation. Additionally, an increase in Armed Forces Qualification Test (AFQT) scores may signify higher civilian earnings potential, while not having a proportionately equal impact on military pay via an increased probability of promotion.

One example that incorporates the ACOL model is a 2006 law supplementing the income of reserve service members experiencing a minimum $50 monthly loss of civilian income while involuntarily activated.[62] It would appear that such a program would positively impact continuation. However, given the stringent qualification criteria, the program is unlikely to generate a statistically significant impact on the Marine Corps Reserve.

Another recent legislative change, which might also have limited impact on continuation is the recent reduction in the retirement age based on active duty service after January 28, 2008. As previously discussed in Chapter II, this new law reduces the age by three months for every 90 days of qualifying duty. However, as seen in the ACOL model, adjusting future income does not have the same effect as income in the present. For instance, a 26-year-old Marine with an expectation of two additional years of activation prior to retirement as a Master Sergeant (E8) would be just as likely to stay in his SMCR unit if he was given a $279.32 bonus instead.[63] Alternatively, a 30 year-old Marine with the same expectation would need $1430.98 for an equivalent impact on his decision to stay, thus, illustrating both the significance of time, preferences, and personal discount rates.[64]

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[62] National Defense Authorization Act for Fiscal Year 2006, Public Law 109-163, § 614, U.S. Statutes at Large 119 (2006), codified at U.S. Code 37 (2010), § 910. The Reserve Income Replacement Program (RIRP) has a termination clause that requires an extension annually. As written, RIRP requires 18 months continuous activation, greater than 24 months cumulative, or back-to-back orders (less than 180 days) all under involuntary authority. Maximum reimbursement is $3,000 per month. During the first two years of the program, only two Marines qualified for this program.

[63] Computation of NPV based on a personal discount rate of 18.5 percent, an 8-year base quarter ECI of 3.37 percent, 8 years of service, and retirement at age 58 with 2984 retirement points (equivalent to 8.29 years of active duty). Average retirement points based on Beth Asch, James Hosek, Michael Mattock, and Christina Panis, "Assessing Compensation Reform: Research in Support of the 10th Quadrennial Review of Military Compensation," MG-764-OSD (Santa Monica, CA: RAND, 2008), 93. Personal discount rate based on Anita Hattiangadi, "Cost-Benefit Analysis of Lump Sum Bonuses."

[64] Computation of NPV based on a personal discount rate of 14.3 percent, an 8-year base quarter ECI of 3.37 percent, 12 years of service, and retirement at age 58 with 2984 retirement points. Average retirement points based on Beth Asch, "Assessing Compensation Reform," 93. Personal discount rate based Anita Hattiangadi, "Cost-Benefit Analysis of Lump Sum Bonuses."

C. EXPECTED UTILITY OF DEPLOYMENT

Another important model in predicting continuation rates given the recent sustained level of operation tempo previously illustrated in Figure 3 (Chapter I) is the Expected Utility of Deployment.[65] In this model, the individual's utility is a function of his income, length of deployments, and length of dwell between deployments as shown in equation 2. Expected utility is the cumulative total of the utility from time spent at home, shown in the first term of the equation, combined with the utility of deployment in the second term, assuming a uniformly distributed deployment time, which varies in length from d_1 to d_2. Although an individual's probability of deployment *p* might range from $0 \le p \le 1$, it is assumed that the desired probability of deployment is not *0* since a member serving in the All-Volunteer Force would likely have chosen a different profession if this were the case.[66]

$$EU = (1-p)U(m,1,0) + p\int_{\mu-\delta}^{\mu+\delta} \frac{1}{2\delta} U(m+\omega d, 1-d, d)\, dd \qquad (2)$$

Given the following:

(1) *p* is the probability of deployment, *m* is the base pay. Thus, expected utility at home is $-p)U(m,1,0)$

(2) *d* is the fraction of the time deployed, ω is the deployed pay. Thus, ωd is the pay for the fraction of time deployed and $U(m+wd,1-d,d)$ is the expected utility while deployed

(3) $\delta = (d_1 - d_2)/2$. Thus mean deployment time μ is $d_1 + \delta$.

(4) expected utility deployed is the average at each deployment length times the likelihood at that length with a probability density of $1/(2\delta)$

[65] Beth Asch and James Hosek, "New Economics of Manpower in the Post-Cold War Era," in *Handbook of Defense Economics, Volume 2: Defense in a Globalized World*, ed. Todd Sandler and Keith Hartley (Oxford, United Kingdom: Elsevier Science B.V., 2007) 1097–9.

[66] Asch, "New Economics of Manpower," 1099.

Asch and Hosek demonstrate that the optimum mean deployment time $\mu*$ is at a maximum when the derivative of *EU* with respect to μ equals *0*, given that the optimum probability of deployment $p*$ is not *0* and that $0 < \mu^* < 1$. Thus, expected utility is concave in nature. Under this condition, the preferred variance is also zero $\left(\delta^* = 0\right)$.[67]

Figure 10 illustrates two potential possibilities for this relationship, EU_1 and EU_2. However, marginal utility will vary individually and the characterization shown is not necessarily indicative of priori empirical results. Thus, some individuals would prefer to always deploy rather than never at all, while others would opt to never deploy if their other choice was always deployed. Independent of operational concerns, the optimum value for the service μ^*_s will be $\mu^*_1 < \mu^*_s < \mu^*_2$.

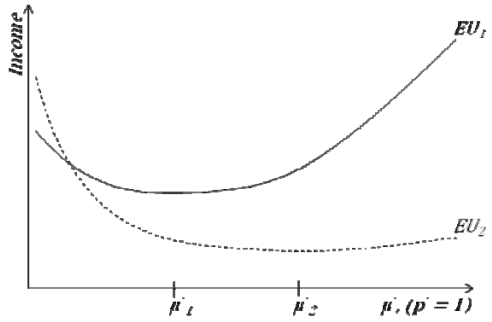

Figure 10. Graphical Representation of the Expected Utility of Deployment

The Expected Utility of Deployment model is of particular relevance to prior service Marines in SMCR units. Since these individuals are not obligated to serve for any length of time, unless compelled by acceptance of a monetary incentive, they are free to transfer to another unit or training category pay group (TCPG) while continuing to qualify for retirement (as discussed previously in Chapter II). Although units are stabilized from voluntary loss once an alert message is received from the Deputy Commandant for Plans, Policies, and Operations (DC PP&O), identification of units in the Force Generation Model has reduced information asymmetry and substantiated the probability and length of deployment well in advance of the alert message.

[67] Asch, "New Economics of Manpower," 1098–9.

Thus, individuals whose expectations of deployment are exceeded are likely to leave the SelRes or identify a service opportunity with a lower deployment expectation. Likewise, individuals who deploy less frequently than they desire may transfer within the Ready Reserve to billets and/or units that can meet their expectation. While transfers to avoid deployment might reflect poorly on performance evaluations and later negatively impact service member career aspirations, transfers to deploying units might have the opposite result, rewarding those individuals later in their Marine Corps careers, thus shaping the force accordingly.

Contextually, this discussion also explains why an SMCR unit member might join the IMA or IRR. In particular, these two TCPGs might increase the possibility of identifying a billet that meets his expectation of deployment length and probability. Likewise, individuals in this scenario are more empowered to control their own destiny, and mirror an individually dynamic $u*$, which could vary with changes in job and marital status, family concerns, childbirth, and civilian career opportunities.

An interesting application of the Expected Utility of Deployment model is observed in current defense policies. First is the Secretary of Defense Memorandum of January 19, 2007, which limited the involuntary mobilization of Reserve Forces,

> First, from this point forward, involuntary mobilization for members of the Reserve Forces will be for a maximum one year at any time…
>
> Second, mobilization of ground combat, combat support, and combat service support will be managed on a unit basis. This will allow greater cohesion and predictability in how these Reserve units train and deploy…
>
> Third, the planning objective for involuntary mobilization of Guard/Reserve units will remain a one year mobilized to five years demobilized ratio...
>
> Fourth, I am directing the establishment of a new program to compensate or incentivize individuals in both the active and Reserve components who are required to mobilize or deploy early or often, or to extend beyond the established rotation policy goals.[68]

[68] "Utilization of the Total Force," U.S. Department of Defense, 1–2, http://ra.defense.gov/documents/quickwins/Utilization%20of%20Total%20Force%2019Jan07.pdf (accessed February 25, 2010).

In implementing this new policy, the Secretary of Defense attempted to obtain a workable compromise between operational requirements and manpower constraints. Specifically, Secretary Gates set the probability of deployment $p = 1$ for any member of the SelRes participating continuously for six years, while setting the expected values of $\mu = 0.17$ and $\delta = 0$. Not surprisingly, this mirrors the contractual obligation of over 97 percent of SMCR non-prior service (NPS) personnel, as previously depicted in Table 4 (Chapter II).

Shortly thereafter, the Marine Corps released a policy to compensate individuals with non-chargeable leave known as Post-Deployment Mobilization Respite Absence (PDMRA) if their period of promised dwell (2:1 AC, 5:1 RC) was broken by deployment or activation. Per MarAdmin 448/07, Marines were eligible for up to 23 days of PDMRA per deployment or activation and in the case of the RC, could instead opt for $3,000 of assignment incentive pay if they were assigned to a government job that did not allow simultaneous payment by two government entities.[69]

D. CHAPTER SUMMARY

During this chapter, the ACOL and Expected Utility of Deployment models were discussed to theoretically predict the effect of compensation, activation, and other factors on the behavior of the Marine Corps Reserve, specifically members of SMCR units and the Ready Reserve. During the next chapter, I will review previous research in this area and present the empirical evidence they provide in the subject area of this thesis. In this regard, a greater emphasis will be placed on the Marine Corps and the Marine Corps Reserve.

[69] "MARADMIN 448/07: Post-Deployment Mobilization Respite Absence (PDMRA)," U.S. Marine Corps, July 27, 2007, http://www.marines.mil/news/messages/Pages/2007/Messagesfinal43.aspx (accessed February 25, 2010).

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V. HISTORICAL CHARACTERISTICS AND PREDICTORS OF ATTRITION AND RETENTION

Maintaining the strength and readiness of the All-Volunteer Force has been the focal point of numerous studies and research. At the center of this research are the federally funded research and development centers. In particular, the National Defense Research Institute (RAND Corporation) and Center for Naval Analysis (CNA) have a wealth of institutional knowledge and have produced a multitude of analyses, which are readily accessible to the public.

A. INTRODUCTION

With the exception of enlistment supply, the majority of manpower studies can be categorized as dealing with either retention or attrition. Although these terms are often used synonymously by those not indoctrinated in military manpower, it is important to note the distinction between the two terms that often leads to systematic differences in behavior.

1. Attrition

Attrition refers to the premature loss of personnel prior to the expiration of a contractual service obligation also known as non-EAS attrition for the active component. First term attrition, the loss rate of personnel prior to completing their initial period of required service, is commonly the focus of these studies. However, attrition can also refer to losses during specific training events, such as boot camp and follow-on military occupational specialty (MOS) schools or subsequent enlistment terms. Due to the difficulty of accurately measuring 48-month attrition, 36-month loss rates are commonly used as the measure of first term attrition in the naval services.

Defining attrition in the Marine Corps Reserve is much more challenging than in the active component (AC). As previously discussed in Table 4 (Chapter II), initial contractual drilling obligations in the Selected Marine Corps Reserve (SMCR) units range from three to six years, while reenlistment contracts only obligate Marines to serve in the Ready Reserve vice in SMCR units or in the SelRes. In addition, not all enlistees

complete their initial basic military and technical skills training in one summer.[70] Moreover, an individual loss in the SMCR units does not necessarily translate into a Marine Corps Reserve loss. Thus, how one defines both the population and loss are important factors to consider when comparing different analyses of attrition.

2. Retention

Retention differs from attrition in that it measures the stay rate for individuals not contractually obligated to serve or who have successfully completed their obligation. For active component enlisted Marines, this rate is based on the percentage of Marines reenlisting at the end of an enlistment term. In this regard, the Marine Corps sets goals or objectives called alignment plans for both the first and subsequent terms, referred to as first-term alignment plan (FTAP) and subsequent term alignment plan (STAP). Complicating this measure is Marines who extend, but do not ultimately reenlist. Officers, on the other hand, are not contractually obligated past their initial service obligation and their stay rates are normally measured as continuation or retention past various years of service or during a certain time interval based on survival up to that point.

As with attrition, measuring retention for the Marine Corps Reserve is not straightforward and depends on a number of factors, which includes the volatility of the Ready Reserve as previously discussed in Chapter II. Additionally, years of service often do not coincide with qualifying years towards retirement. Furthermore, SelRes members who have successfully completed their initial drilling obligation are no longer contractually obligated to continue drilling and may request transfer to the Individual Mobilization Augmentees (IMA), Active Reserve (AR), Individual Ready Reserve (IRR) or Active-Status List (ASL) at any time. Even accepting a monetary incentive does not

[70] Under the Incremental IADT (IIADT) program, enlisted accessions are allowed to complete recruit training and MOS school in two separate periods. In the majority of IIADT accessions, this concession is allowed in order to recruit college students or individuals with long follow-on schools who otherwise would be unable to attend both recruit training and MOS school.

legally obligate an individual to continue drilling with an SMCR unit; although, failure to comply with the terms of the contract results in pro-rated recoupment of the incentive based on the unfulfilled portion of the contract.

3. Organization of the Literature Review

The remainder of this chapter will focus on prior studies on the historical characteristics and predictors of attrition and retention. Considering the enormous library of research in this area, the scope of this review cannot be comprehensive, but rather will focus on studies involving the Reserve and/or the Marine Corps, where possible. As such, the remainder of this chapter will be divided into the two areas of attrition and retention studies.

B. ATTRITION STUDIES

In general, attrition studies attempt to identify the factors and characteristics that impact the probability that an individual will decide to leave the service prior to fulfillment of his obligatory contract. However, in many studies, the definition of attrition includes retention losses. For the purposes of this chapter, studies where the definitions of attrition and retention are fully intertwined will be categorized under the broad area of attrition. The following studies highlight the factors significant in the attrition decision.

Doering and Grissmer (1985) identified the changing composition of the armed forces during the first 10 years of the All-Volunteer Force (AVF) as context for further research. Specifically, they identified substantial increases in the percentage of females, blacks, and high school graduates combined with a decline in AFQT Category I and II scores. The Reserve followed similar patterns with the primary difference being a decline in educational achievement. Additionally, Doering and Grissmer identified

increased longevity and experience levels as an issue that would require further research to identify more efficient compensation and benefits combinations considering the changing demographics caused by aging of the force.[71]

Doering and Grissmer also performed a selected review of research in the area of attrition. For the active component, they found that attrition varied inversely with educational achievement and higher aptitude scores (AFQT). Women had higher attrition than men; whites had higher attrition than non-whites; 18–19 year old enlistees had lower attrition than 17-year-olds and enlistees over 20; married enlistees had lower attrition than single enlistees; and longer terms of service were associated with increased attrition. Additionally, individuals unemployed prior to enlisting, and those with frequent job changes, appeared to have higher levels of attrition. One concern discussed was that it appeared the services' institutional policies seemed to be creating a standard level of attrition regardless of the quality of new recruits by "creaming" each cohort.[72]

Although Doering and Grissmer acknowledged that scant research had been completed on the SelRes, they did identify systematic differences between the AC and SelRes based on the nature of reserve participation and enlistment influencers.

Since 93 percent of the SelRes surveyed held another full-time job, changing employer attitudes is an important factor in attrition. Additionally, Doering and Grissmer identified changes in marital status, migration, and the birth of a child as significant indicators of attrition. Although they were unable to test their hypothesis, Doering and Grissmer predicted that enlistees who were married prior to accession would have lower attrition since they had already experienced this life-changing event. Doering and Grissmer also predicted that older enlistees, between the ages of 24–28, would have higher attrition since this was the age at which the probability of migration, marriage, and employer change was highest.[73]

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[71] Zahava Doering and David Grissmer, "Active and Reserve Force Attrition and Retention: A Selected Review of Research and Methods," P-7007, (Santa Monica: RAND, 1985), 4–8.

[72] Ibid., 13–14.

[73] Ibid., 18–20.

Grissmer and Kirby (1985) hypothesized that the following three factors contribute to a high rate of Reserve attrition: "the quality and demographic composition of the enlistment cohort, transfers to the active forces or to reserve component, and for moonlighting reservists, the turbulence of normal civilian life." Using a logit model for the 1980 National Guard and Reserve enlisted cohort, they determined that non-high school diploma graduates (NHSDG) separated at a rate 12 to 13 percentage points higher than high school diploma graduates (HSDG) during their first two years of service, while Armed Forces Qualification Test (AFQT) category I enlistees had a 7 to 11 percentage point lower attrition versus category IV enlistees. Lastly, everything else equal, they determined that the female attrition rate was approximately twice that of males, potentially due to increased difficulty of adjusting to some MOSs, earlier marriage, and the difficulties of childbirth.[74]

Using cross-tabulation, Grissmer and Kirby identified that 28 percent of Army Reserve and 17 percent of Guard attrition during the first two years was to the active forces, another RC, or returned to the SelRes. However, they were only able to indirectly support their third hypothesis that the turbulence of civilian life was a large factor in attrition. Specifically, they identified correlations with the demographic factors (gender, age, and race) that experience the highest number of migration, marriage, and job changes across the U.S. and a higher level of attrition.[75]

Grissmer and Kirby (1988) followed up their previous study from 1985 by including multiple Army Reserve and Guard cohorts from 1980–1982 and using a similar logit regression model. In extending their previous study, Grissmer and Kirby were able to analyze the consistency of attrition factors over time. They found that the estimated relationships remained stable; however, the magnitude of each effect changed over time. Additionally, they determined that certain factors, such as age, marriage, and childbirth, were gender- and race-specific. For instance, males were not affected by changes in

[74] David Grissmer and Sheila Kirby, "Attrition of Nonprior-Service Reservists in the Army National Guard and Army Reserve," R-3267-RA, (Santa Monica, CA: RAND, 1985), 44–46.

[75] Ibid., 46.

status, while females experienced a strong negative impact. Likewise, increasing enlistment age raised attrition for males, whereas black females experienced lower attrition.[76]

Grissmer and Kirby also attempted to analyze the impact of the unemployment rate on attrition. Grissmer and Kirby believed that higher unemployment might attract recruits who have a weaker taste for the military and are more risk-averse in their full-time job. Other factors that lower attrition are lower migration and higher stability for individuals in their full-time jobs. Thus, the effect of unemployment was theoretically indeterminate and would require empirical determination. However, changes in Army institutional policies, which were strongly linked to higher attrition, made this attempt inconclusive. Specifically, a shift towards a more lenient discharge policy was confounded with a period of higher unemployment resulting in nonrandom attrition.[77]

In one of only a few studies on reserve prior service attrition, Marquis and Kirby (1989) used a Cox proportional hazard function to estimate the effect of unemployment, civilian wage rates, changes to drill pay, incentives, and prior RC service. Of particular interest is how they defined both attrition and reserve prior service. In their research, they took the total force approach and examined only attrition to civilian life. However, a temporary separation that occurred between the Reserve member's anniversary dates was not considered a loss.[78] As such, a transfer from the Army Reserve to the active Navy is not considered attrition, whereas a loss upon successful completion of an individual's service obligation is considered attrition by this broad definition.[79]

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[76] David Grissmer and Sheila Kirby, "Changing Patterns of Nonprior Service Attrition in the Army National Guard and Army Reserve," R-3626-RA, (Santa Monica, CA: RAND, 1988), 53–59.

[77] Ibid., vi–vii, 17.

[78] Anniversary dates are based on the first day a member enters into an active status and are used to determine satisfactory years towards retirement. As previously discussed in Chapter II, an individual must obtain 50 points each anniversary year to qualify as a satisfactory year towards retirement. Using this definition, an individual could temporarily separate for up to a year, and not be counted as a loss, as long as the member was assigned to the reserves on the subsequent anniversary date.

[79] Susan Marquis and Sheila Kirby, "Economic Factors in Reserve Attrition: Prior Service Individuals in the Army National Guard and Army Reserve," R-3686-1-RA (Santa Monica: RAND, 1989), vi–vii, 17–18.

Of additional interest is their definition of prior service. In this case, they included all individuals with prior military training and experience to include prior recruits and prior active and reserve forces. This population included all prior service enlisted members serving in the Army Reserve or Army National Guard from 1980–82 regardless of rank or years of service with loss data monitored up until 1985. As such, their techniques accounted for right-censored data.[80]

As previously mentioned, the primary purpose of Marquis and Kirby's research was to estimate the effect of compensation factors. In this regard, they calculated a military pay elasticity of 0.45 for the Guard and 0.95 for the Army Reserve. A 10 percent increase in unemployment was estimated to decrease attrition by 1.3 and 1.7 percent for the Guard and Reserve, respectively. On the other hand, a 10 percent increase in civilian pay would increase attrition by 1.5 percent for the Guard and 3.0 percent for the Army Reserve. As with other studies at this time, the impact of receiving a bonus was not statistically significant, though negative in this case. The authors believe that systematic differences existed in the population eligible to receive a bonus. For instance, the bonuses are targeted at individuals in MOSs with high attrition. Additionally, they believe that the coefficients are negatively biased due to self-selection on the part of individuals who accept a bonus.[81]

Lastly, Marquis and Kirby identified a 10.1 percent higher attrition probability for reserves whose prior service is on active duty.[82]

> This may be partly due to differences in information and expectations: those with prior reserve service are more likely to know what the reserve job involves than those who had previously served only on active duty.[83]

A 1991 United States General Accounting Office (GAO) report on SelRes attrition identified a multitude of factors affecting reserve attrition (defined to include retention) in addition to those already discussed. This research used Reserve Component

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[80] Susan Marquis, "Economic Factors in Reserve Attrition," 2, 17.

[81] Ibid., vi, 35–9.

[82] Ibid., 31, 40.

[83] Ibid., vii.

Common Personnel Data System (RCCPDS) files provided by the Defense Manpower Data Center (DMDC) from 1986–88 in addition to the 1986 Reserve Component Survey. The analysis included both cross-tabulations of data, as well as the estimation of a logit model for SelRes attrition by service, prior active service, non-prior service (NPS), prior reserve service, and DoD overall.

Given the extensive nature of this report and importance of the findings, only those most relevant to this thesis are summarized below.

- Aggregate attrition data can mask trends that occur at lower levels. For instance the overall Marine Corps Reserve SelRes attrition rate was 28 percent, while E-4 to E-5 attrition was 45 percent.[84]
- An indirect relationship exists between high NPS to prior service ratios and high loss rates.[85] Specifically, they believed that the Air Force's low loss rates were correlated with a lower percentage of NPS, while the Marine Corps high loss rates were indicative of a high percentage of NPS in units
- MOS mismatches, defined as a prior service assigned to a billet prior to obtaining the requisite MOS designator, are strongly related to attrition. For the Marine Corps Reserve, this factor increased attrition by 9.7 percentage points[86]
- Smaller units proportionally have higher loss rates[87]

Lastly, when comparing demographic factors across all six RCs, to include the Army and Air National Guards, the magnitude and in some cases the relative relationship of demographic factors varied tremendously. Similarly, combining dissimilar populations, such as NPS and prior service together generated greater ambiguity due to the systematic differences between these two populations.[88]

In a follow-up to the 1991 GAO report, Kirby and Grissmer (1993) reassessed losses from a total force perspective. Specifically, their hypothesis is that from a DoD

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[84] "Reserve Components: Factors Related to Personnel Attrition in the Selected Reserve," NSIAD-91-135, (Washington, D.C.: U.S. Government Accounting Office, 1991), 4, 21.

[85] Ibid., 19.

[86] Ibid., 31, 85.

[87] Ibid., 60.

[88] Ibid., 79–85.

return on investment perspective, "it is losses to civilian life that constitute a real loss–individuals who leave and do not return to military service provide no return on the money spent training them."[89]

Using longitudinal data for cohorts (FY82–88) in all services, Kirby and Grissmer used a Kaplan-Meier estimator to conduct survival analysis to identify factors that might have caused a drop in two-year attrition between FY82 and FY86. Controlling for quality and other demographics, they were unable to identify the cause for the significant drop in retention. Their theory is that some other factors, the most important being the implementation of the reserve G.I. Bill and increased resources for equipment and training resulted in the decrease in attrition.[90]

Using "Recruit's Education and Background" survey results, Wenger and Hodari (2004) identified non-cognitive factors as influencers of attrition rates for AC personnel in all services. Specifically, heavy smokers were predicted to have higher attrition by 13.5 percentage points and being expelled from school increased attrition by 6.0 percentage points. They hypothesize that these indicators potentially reveal a deviant behavioral pattern. Likewise, individuals who did not complete 12 years of schooling have higher attrition than HSDGs and certificate holders. They suggest that educational credentials are measuring a non-cognitive factor, such as persistence or determination.[91]

Dolfini-Reed, Parcell, Gregory, and Horne (2005) used six-month loss rates to estimate the impact of activation on SelRes attrition. Like several previous studies, the definitions of attrition and retention are intertwined and the population included all enlisted grades, excluding the active reserve (AR). Specifically, they used post-9/11 RCCPDS data up until January 2005 and calculated SelRes six-month loss rates for those members who completed their activation by April 2004 and then compared those rates to

[89] Sheila Kirby, "Reassessing Enlisted Reserve Attrition," v.

[90] Ibid., 31.

[91] Jennie Wenger and Apriel Hodari, "Predictors of Attrition: Attitudes, Behaviors, and Educational Characteristics," CRM D0010146.A2/Final (Alexandria, VA: CAN, 2004), 71.

FY00. They also noted that it was important to use only individuals who had completed their activations since activated individuals "are not eligible to leave and their inclusion will artificially lower the loss rate."[92]

Their major findings include that enlisted six-month weighted average loss rates increased by 4.4 to 4.6 percentage points from FY00 for Marine Corps Reserve SelRes enlisted regardless if they were activated or not, loss rates increased with the length of activation and loss rates were lower for those who deployed outside the continental United States (OCONUS). Self-selection bias limited comparing loss rates of activated individuals to those never activated since those who remained in the model (never activated) were likely systematically different from those who separated. Additionally, activated individual loss rates were based on six months from their last activation, whereas it is unclear which six-month period should be used as comparison for individuals never activated. Lastly, they recommended future research that would define and model transition between states using a multinomial logit model of transition between states and a Cox regression model of time spent in each state. Combined, these models would create a semi-Markov process.[93]

In a follow-on study, Dolfini-Reed, Parcell, and Horne (2005) identified that the previous relationships estimated for enlisted SelRes, also existed SelRes officers, though their magnitude differed greatly. Marine Corps Reserve SelRes officers who were activated had a 7.9 percentage point increase in six-month loss rates. However, officers who were not activated experienced only a 1.9 percentage point increase in six-month loss rates and officers who deployed OCONUS had loss rates 6.2 percentage points lower than those officers activated and not deploying OCONUS. Lastly, the authors noted a decrease in six-month loss rates for officers with multiple activations.[94]

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[92] Michelle Dolfini-Reed, Ann Parcell, Dave Gregory, and Benjamin Horne, "Determining Patterns of Reserve Attrition Since September 11, 2001," CAB D0011483.A2/Final, (Alexandria, VA: CNA, 2005), 3–9.

[93] Ibid., 3, 13, 17, 22–29.

[94] Michelle Dolfini-Reed, Ann Parcell, and Benjamin Horne, "Patterns of Reserve Officer Attrition since September 11, 2001," CAB D0012851.A2/Final, (Alexandria, VA: CNA, 2005), 2, 10, 13, 16.

Hattiangadi and Parcell (2006) identified monetary incentives as a significant factor in reducing attrition for Marine Corps Reserve NPS and prior service SelRes enlisted. In this case, loss rates were determined at 6-month, 24-month, and 36-month intervals for NPS upon arrival at their SMCR units after completion of recruit training. Similarly, prior service SMCR unit loss rates were calculated at the same time intervals after receipt of a reenlistment bonus.

Using logit regressions, Hattiangadi and Parcell estimated a drop in attrition of 3.9 and 5.5 percentage points for the average NPS enlistee at the 24-month and 36-month intervals, respectively, although no statistical difference was observed at six months. The marginal effect for prior service reenlistees was a reduction of attrition by 11.4, 23.9 and 17.0 percentage points at the respective time intervals. Due to limited variation, they were unable to analyze the impact of different bonus amounts or lump sum versus installment payment options on attrition and recommended this for future research when enough data are available. Lastly, they recommended the Marine Corps Reserve implement FTAP goals to properly align and mirror SMCR units to the active component.[95]

C. RETENTION STUDIES

As with attrition, retention studies attempt to identify the factors and characteristics that impact the probability that an individual will decide to stay in the service upon completion of his obligatory contract. The following studies highlight the factors significant in this decision.

The first study discussed above under attrition also spent considerable time reviewing prior research in the area of retention. Consequently, it is discussed in this section as well. Doering and Grissmer (1985) established that present and expected future values of compensation affected retention. In particular, they pointed out the substantial increase in retention as retirement vesting approaches. However, they also identified the issue of nonrandom payments as a difficulty in identifying the impact of incentives and bonuses. For instance, a high demand low density military occupational

[95] Anita Hattiangadi, "SelRes Attrition and the Selected Reserve Incentive Program," 1–3, 26, 76–95.

specialty (MOS) might receive a bonus, while experiencing low retention rates, whereas, a high retention MOS would not receive one. This suggests reverse causation and selection bias affects efforts to isolate the effects of these variables. Lastly, Doering and Grissmer indicated that deployments and family separations negatively affect retention, though the strength of the relationship appeared to vary by service.[96]

Doering and Grissmer also identified several predictors of retention in the SelRes. Although they expected individuals to behave similar to "moonlighters" in the civilian sector with respect to pay and compensation, using experimental data they found that pay elasticity concerning bonuses was approximately 0.14–0.19 as compared to the approximate value of 1.0 for the civilian sector. However, Doering and Grissmer also observed that bonus payments tended to significantly reduce separation in the out-years. Other research based on survey data validated their finding with elasticities ranging from 0.1–0.3. Thus, Doering and Grissmer hypothesized that taste plays an important role and that the "reserve job seems to be somewhere between this kind of 'voluntary' participation and the typical monetary induced-moonlighter."[97]

Hansen and MacLeod (2004) identify several relationships that impact retention. First, they define the reenlistment rate as the proportion of service members who renew their reenlistments. They also provide DoD's measure of attrition as the total losses divided by the average strength over a given time period. Some of the relationships discussed by Hansen and MacLeod include increased continuation with rank for enlisted personnel, higher continuation rates for service members with 13–17 years of service (YOS) followed by a decrease after 20 YOS, as well as a confirmation of many of the previous demographic and educational attainment relationships previously discussed in this chapter. Although their data included RCCPDS files from FY2000–2003, Hansen and MacLeod were unable to account for individuals who had been activated or deployed during this time-frame.[98]

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[96] Zahava Doering, "Active and Reserve Force Attrition and Retention," 15–18.

[97] Ibid., 21–23.

[98] Michael Hansen and Ian MacLeod with David Gregory, "Retention in the Reserve and Guard Components," CRM D0009534.A4/1REVl, (Alexandria, VA: CNA, 2004), 1–4, 12–18.

Schumacher (2005) studied the impact of activation on an individual's decision to continue service in the Marine Corps Reserve. For his study, he included all service members in the Ready Reserve and Standby Reserve from 1988–1992 and 1996–2004. Schumacher's definition of retention counted only separations from the RC or transfer to the Retired Reserve as a loss. His thesis concluded that there was a positive relationship between activation and retention, though this impact decreased with the length of activation.[99]

Quester, Hattiangadi, and Shuford (2006) looked at the impact of deployment tempo on the retention of active component Marines. Specifically, their dataset included the FY2004 FTAP population and number of days spent away from home due to deployments, training, and temporary additional duty in the previous 36 months. Their research concluded that the number of days deployed had a greater negative impact on retention of enlisted Marines without dependents than those with dependents. In addition, never deploying negatively impacted retention. Thus, Marines who deployed between 1–100 days had higher retention than those deploying greater than 100 days or not at all. Lastly, all else equal, Marines with dependents were more likely to reenlist.[100]

Lien (2006) estimated the effect of bonuses on the reenlistment and continuation of SelRes service members in the U.S. Navy. Using a logit model, she estimated that sailors who accepted a reenlistment bonus were more likely to continue in the SelRes by approximately 12 and 17 percentage points for periods of 12 and 24 months, respectively, based on RCCPDS data from October 1999–March 2005. As with many prior regressions, limited variability in the data prevented determining the impact of differing bonus amounts.[101]

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[99] Joseph Schumacher, *Forecasting Retention in the United States Marine Corps Reserve*, (Master's thesis, Naval Postgraduate School, 2005), 18–22, 40.

[100] Aline Quester, Anita Hattiangadi, and Robert Shuford, "Marine Corps Retention in the Post-9/11 Era: The Effects of Deployment Tempo on Marines with and Without Dependents," CRM D0013462.A1/Final, (Alexandria, VA: CNA, 2006), 39–43.

[101] Diana Lien with David Gregory and Michael Hansen, "The Effect of Enlistment and Reenlistment Bonuses on Participation in the Navy Selected Reserves," CRM D0013385.A2/Final, (Alexandria, VA: CNA, 2006), 1–2, 48.

D. CHAPTER SUMMARY

Although we have reviewed only a selection of the vast number of studies conducted in the area of attrition and retention for the U.S. armed forces, several themes have developed. First, there is no one single definition of attrition or retention. Often, the best definition is that which best captures the behavior of interest.

Second, we have observed multiple ways by which to restrict the population of interest. However, care should be given to not mask the impact of certain categories of service by taking into account potentially diverse and systematically different behaviors. Examples have included the six various RCs; the SelRes, IRR and Standby Reserve; prior service and NPS; officer and enlisted; and junior and senior pay grades.

Next, the availability and integrity of data are limiting factors in any research, which ultimately prohibit the most thorough investigation and analysis. It is in this last regard, which unfortunately I will be unable to avoid completely.

Lastly, although sometimes contradictory, we have identified several common relationships existing between attrition and demographics, compensation, unemployment, educational attainment, ability, and activation. These relationships will form the foundations for the models specified in this thesis. In the next chapter, I will review the data used in the statistical analysis, specify the models primarily used to estimate the effect of activation and monetary incentives on loss rates, and describe the dependent and explanatory variables used in the models.

VI. DATA AND METHODOLOGY

A. INTRODUCTION

As discussed in Chapter I, the purpose of this thesis is to improve the SelRes end strength model. Reserve Affairs Personnel Plans and Policy (RAP) branch uses this model to develop the annual recruiting mission and the recently-implemented retention goal. This thesis focuses on the effect of activation and monetary incentives on the continuation rates of prior service SMCR service members in the grades of E3 to E5.

In this chapter, I will review the data used in the multivariate analysis, present the model specification, and describe the dependent and explanatory variables. Hypothesized effects of the explanatory variables and data restrictions will be presented along with an analysis of select cross-tabulated data.

B. DATA

1. Sources

a. Total Force Data Warehouse (TFDW)

My primary data source is the Marine Corps TFDW.[102] Pay and personnel data elements are entered into the Marine Corps Total Force System (MCTFS) approximately five times per week and then uploaded to TFDW on a monthly basis. The result is a monthly snapshot of the Total Force. Historical active component (AC) data elements are available via TFDW on the last day of each month from September 30, 1997 *sequence 103* to the present *sequence 252* and on the last day of each quarter dating back to 31 March 1972 *sequence 1*. Appendix 1 shows the sequence designator for each month and/or quarter where data is available in TFDW.

[102] The Total Force Data Warehouse (TFDW) is a restricted system of the Manpower Information Technology Branch of Manpower & Reserve Affairs (M&RA). It is the Marine Corps' official system of record for USC Title 10 end strength reporting. The TFDW houses more than 30 years of historical manpower data from a variety of USMC and DoD systems, including MCTFS, MASS, RCCPDS, MCTIMS and DEERS, in one central location to provide manpower analysts with a comprehensive view of a Marine's career from “street to fleet.”

Unlike the AC, Marine Corps Reserve data are available beginning on December 31, 1994 *sequence 92*. However, data between December 31 and October 31, 1998 *sequence 116* are inconsistent as a result of data storage issues.

For this thesis, 74 data fields were retrieved. Appendix 2 provides a list of each variable name and its description. The data represented 4,344,814 monthly-person observations from August 31, 2001 *sequence 150* to 31 October 2009 *sequence 248*. In addition, four data elements used to determine pre-9/11 service characteristics were retrieved from *sequence 92* to *149*. This data represented another 2,307,937 monthly-person observations. Lastly, eight data elements used to determine the composition of the entire Reserve Component (RC) (shown above in Chapter II) were retrieved for 30 September 2001 *sequence 151* and 30 September 2009 *sequence 247*. This data represented 432,569 monthly-person observations.

b. Center for Naval Analysis (CNA)

Seasonally adjusted, monthly unemployment data by state were obtained from CNA for *sequence 150* to *248* (August 2001 to October 2009). The same data are also available in raw form from the U.S. Bureau of Labor and Statistics (BLS) website.[103]

c. Reserve Affairs Personnel Plans and Policy (RAP)

SelRes enlistment, reenlistment, and affiliation bonus data were provided by RAP for FY2002 to FY2009. However, significant missing data were evident for FY2006 and FY2007. As mentioned previously, missing data for these two years will limit a future analysis of recent changes to monetary incentives. The data elements provided by RAP include *ssn*, *date*, and *service agreement*. Beginning in FY2006, bonus *amount* and *recoupment* flag data fields were provided as well.

d. Defense Manpower Data Center (DMDC)

DMDC is an organization under the Deputy Undersecretary of Defense for Program Integration responsible for collecting manpower and personnel data for the

[103] BLS data can be downloaded at http://www.bls.gov/lau/#tables.

Department of Defense (DoD). DMDC serves as the largest integrated personnel data repository of DoD manpower records and currently holds over 35 million personnel records.[104] Three data fields, unavailable for Reserve Marines in TFDW, were requested from DMDC, specifically MGIB usage data, monetary incentive data fields, and educational attainment. However, these fields were not made available with sufficient time for analysis in this thesis. Thus, this is one of several areas I will recommend for future research.

2. Data Cleaning and Restrictions

TFDW data often contains observations on individuals who are no longer serving in the Selected Reserve (SelRes) or are affiliated with an AC program. These observations were identified and removed from the SelRes master file. Specifically, deserters and separations were identified via a reserve record status code of *9* or *D* and removed from the Selected Reserve master file. Additionally, those reserve service members who have reenlisted in the AC (component code *COMPCODE 11*), joined an AC officer commissioning program (*COMPCODE KP*), retired and/or recalled to active duty (*COMPCODE* or reserve *COMPCODE* beginning with *A*), or accepted full-time orders as an extended active duty recruiter (*COMPCODE CD* and reserve reporting unit code *0*) were removed from the SelRes master file.

Since the purpose of obtaining data prior to *sequence 150* was to determine the characteristics of service (SMCR unit join dates, previous activation, and prior RC experience), those observations that did not coincide with a SelRes member in *sequences 150* to *248* were dropped from the SelRes master file. Additionally, all observations outside of fiscal years FY2002 to FY2009 were removed from the SelRes master file upon completion of coding since they were beyond the scope of this thesis. Additionally, analysis will not include FY2009 observations since the 12-month continuation behavior of these individuals cannot be tracked with available data. Lastly, the SelRes master file was divided into officer and enlisted master files. After cleaning the data, the SelRes

[104] "DMDC Profile," Defense Manpower Data Center, https://www.dmdc.osd.mil/profile/Profile_Overview.pdf (accessed March 9, 2010).

enlisted master file was reduced to 79,012 unique identification numbers and 2,917,243 monthly cross-sectional observations and the SelRes officer master file was reduced to 5,358 unique identification numbers and 190,565 monthly cross-sectional observations.

3. Coding

The online Marine Corps Codes Manual (CODESMAN) was used to interpret and code each data element from TFDW. Appendices 3–24 of this thesis contain a list of the codes used for this coding effort. Additionally, each observation is assigned an observation number based on the length of uninterrupted SMCR service (tour length) on that date. In this case, uninterrupted service is defined as not having a break greater than two months, for reasons, which will be discussed later in this chapter. If an individual drops from the SMCR units for a period of three months or more, and then later rejoins the SMCR, his observation number restarts at *1* and a binary variable is generated indicating this incident as a subsequent SMCR tour. Observation numbers are coded consecutively for temporary drops of less than three months and account for the elapsed time between these missing periods.

An unstated objective of this thesis was to develop a database of SelRes enlisted characteristics for future research. Consequently, the SelRes enlisted master file has been coded in such a way as to facilitate analysis of other potential populations of interest to include the active reserve (AR) program and individual mobilization augmentees (IMA) for both officer and enlisted, non-prior service (NPS) and prior service. Twelve-month continuation rates may be calculated for any observation number and the values of explanatory variables reflect the most current value at the time of that observation. A list of the variables present in the SelRes enlisted master file is included as Appendix 25.

4. Codebook

A codebook describing the final coded dataset is provided at Appendix 26 for the SelRes enlisted master file. The codebook describes each variable created for this thesis and provides descriptive statistics to include mean, standard deviation, and range where

appropriate. Although beyond the scope of this thesis, a codebook is also available for the SelRes officer master file from the Naval Postgraduate School, Graduate School of Business and Public Policy.

C. THEORETICAL FRAMEWORK

My general approach is to analyze how 12-month continuation rates are affected by activation and monetary incentives using cross-sectional snap-shots of the prior service SMCR unit population based on their observation number in SMCR unit Training Category Pay Group (TCPG) *A*. I will use regression analysis to isolate the independent effects of activation and monetary incentives, as well as demographics, background, economic conditions, ability, performance, person-job fit, prior reserve experience, and tour length.

1. Binary Response Model

Because the 12-month continuation outcome *y* is a binary response, our concern is the response probability *P* as shown in equation 3 given various individual characteristics x:[105]

$$P\left(y=1\middle|x\right)=P\left(y=1\middle|x_1,x_2,\ldots,x_k\right) \tag{3}$$

2. Probit Models

The use of linear probability models to estimate (3) have two major drawbacks: (1) probabilities are not restricted between zero and one, and (2) partial effects of the explanatory variables are held constant. To avoid these issues, I have modeled the response probability *P* as a function *G* as shown in equation 4, where $0<G\left(z\right)<1$:[106]

$$P\left(y=1\middle|x\right)=G\left(\beta_0+\beta_1x_1+\ldots+\beta_kx_k\right)=G\left(\beta_0+x\beta\right) \tag{4}$$

[105] Jeffrey Wooldridge, *Introductory Econometrics: A Modern Approach*, 4th ed. (Mason, OH: South-Western Cengage Learning, 2009), 575.

[106] Ibid., 575.

In particular, the probit model, which uses the standard normal cumulative distribution function, as shown in equations 5 and 6, will be used to estimate the parameters for 12-month continuation rates:[107]

$$G(z) = \Phi(z) = \int_{-\infty}^{z} \phi(\upsilon) dv \tag{5}$$

where $\phi(z)$ is the standard normal density

$$\phi(z) = (2\pi)^{-1/2} \exp(-z^2/2) \tag{6}$$

3. Model Specification

Based on the influential factors that were identified in the literature review and the prior service population, four models are specified in this thesis. The first model, shown in Figure 11, incorporates those factors from Chapter V that have been statistically significant in prior studies estimating the effects of activation and monetary incentives.

Model 1[108]
$P(Continuation = 1\|x) = G(\beta_0 + \beta_{1\text{-}3}Activation\ Frequency + \beta_4 Months\ Previously\ Activated + \beta_5 Deployed\ OCONUS + \beta_6 State\ Unemployment\ Rate + \beta_7 AFQT + \beta_8 Lump\ Sum\ Bonus + \beta_9 Bonus + \beta_{10\text{-}13} Race + \beta_{14} Gender + \beta_{15} Children + \beta_{16\text{-}17} Marital\ Status + \beta_{18} Age + \beta_{19\text{-}20} Rank + \beta_{21} Joined\ Prior\ to\ 9/11 + \beta_{22\text{-}27} Fiscal\ Year\ Effects)$

Figure 11. Model 1 Specification Using Explanatory Variables Drawn from the Literature Review

[107] Wooldridge, *Introductory Econometrics: A Modern Approach*, 576.

[108] Actual variable names are listed in Appendix 26. The names include: *ret_12mos_PS* (Continuation); *mob1*, *mob2*, *mob3* (Activation Frequency); *mos_mob_prior* (Months Previously Activated), *oconus_dep* (Deployed OCONUS), *unemployment* (State Unemployment Rate); *afqt* (AFQT); *bonus_fy06plus* (Lump Sum Bonus); *bonus* (Bonus); *nativeamerican*, *asian*, *black*, *pacificislander* (Race); *female* (Gender); *child1_plus* (Children); *married*, *divorced* (Marital Status); *age* (Age); *cpl*, *sgt* (Rank); *pre_9_11* (Joined Prior to 9/11); and *d03*, *d04*, *d05*, *d06*, *d07*, *d08* (Fiscal Year Effects). Continuation variables are coded under "*ret*" and activation variables are coded under "*mob.*"

In addition to the first model, the second model, as shown in Figure 12, incorporates person-job fit variables relevant to the Marine Corps Reserve. These include such factors as performance and conduct, physical and technical skill evaluations, and prior experience in the SelRes.

Variables hypothesized to increase the probability of 12-month continuation include activation frequency indicators, increases in the state unemployment rate, higher conduct marks, higher Marine Corps physical and technical test scores and qualifications, increased monetary incentives, prior reserve experience and tours, and the combat arms occupational specialty grouping. Alternatively, the following variables are predicted to decrease the probability of continuation: cumulative number of months activated, deployment OCONUS, unexcused absences from drill, female, being married, and age. The remaining variables are ambiguous a priori.

Model 2[109]
$P(Continuation = 1\|x) = G(\beta_0 + \beta_{1\text{-}3}Activation\ Frequency + \beta_4 Months\ Previously\ Activated + \beta_5 Deployed\ OCONUS + \beta_6 State\ Unemployment\ Rate + \beta_7 AFQT + \beta_8 Proficiency\ Rating + \beta_9 Conduct\ Rating + \beta_{10} Rifle\ Qualification + \beta_{11} Physical\ Fitness + \beta_{12} Basic\ Skills\ Testing + \beta_{13} Advanced\ Water\ Survival + \beta_{14} Unexcused\ Absences + \beta_{15} Retirement\ Qualified\ Years + \beta_{16\text{-}18} Prior\ Reserve\ Experience + \beta_{19} Lump\ Sum\ Bonus + \beta_{20} Bonus + \beta_{21\text{-}24} Race + \beta_{25} Gender + \beta_{26} Children + \beta_{27\text{-}28} Marital\ Status + \beta_{29} Age + \beta_{30\text{-}31} Rank + \beta_{32\text{-}33} General\ Occupational\ Groupings + \beta_{34} Headquarters/Force\ Units + \beta_{35} Joined\ Prior\ to\ 9/11 + \beta_{36\text{-}41} Fiscal\ Year\ Effects)$

Figure 12. Model 2 Specification with Marine Corps Reserve-specific Characteristics

[109] Actual variable names from Appendix 26 include the following variables in addition to those specified in Model 1: *prof_svc* (Proficiency Rating); *con_service* (Conduct Rating); *rifle_score* (Rifle Qualification; *pft_score* (Physical Fitness); *bst* (Basic Skills Testing); *wsc_advanced* (Advanced Water Survival); *unexcuse_12_mos* (Unexcused Absences); *satyrs* (Retirement Qualified Years); *true_reserve*, *SMCR_PS2*, *SMCR_PS3* (Prior Reserve Experience); *combat_arms*, *aviation_community* (General Occupational Groupings); and *mfr* (Headquarters/Force Unit).

Models 3 and 4 use nearly the same specification as Model 2, except the prior service SMCR unit population is restricted based on prior military experience. Specifically, the prior service RC and prior service AC populations parameters are estimated separately to rectify omitted variable bias caused by aggregation of the data. The effect of activation will be shown to differ between the two population samples in Chapter VII.

Model 3 estimates the parameters for continuation of the prior RC population. The specification is the same as shown in Model 2, except several variables were omitted due to infrequent observation. Specifically, the race indicators of *nativeamerican* and *pacificislander* and the water survival qualification indicator *wsc_advanced* were dropped. More importantly, only six prior service RC service members were observed to have accepted an affiliation or reenlistment bonus; thus, the bonus indicators of *bonus* and *bonus_fy06plus* were both dropped from this Model.

Model 4 estimates the parameters for continuation of the prior AC population. Like the RC model, some variables were omitted due to infrequent observation to include the race indicator of *pacificislander* and the mob frequency indicator of *mob3*.

In all four models, parameters are estimated using individuals with the same tour length (4, 12, and 24 months). In the next two sections, we will discuss these variables in greater detail.

D. DEFINITION OF DEPENDENT VARIABLE

For prior service SMCR unit Marines, manpower analysts are most interested in predicting the SMCR unit continuation rates in the subsequent fiscal year (12-month period) to develop the annual recruiting mission (as discussed above in Chapter II) and fiscal appropriation requests. Unlike NPS that require additional time and resources to complete both recruit and military occupational specialty (MOS) training, the typical prior service Marine has the requisite MOS to make an immediate impact on unit readiness. Thus, a 12-month prediction is adequate.

1. Defining Continuation Rates

As previously discussed in Chapter V, attrition typically refers to the loss of service members during a time period prior to completion of their contractual service obligation. However, this definition is not indicative of SMCR prior service since these individuals do not have a binding contract with which to restrict their movement between Reserve Component (RC) TCPGs.

Alternatively, retention typically refers to the reenlistment of service members at the expiration of their contractual obligation. Once again, this definition loses relevance when describing the participation behavior of SMCR prior service who reenlist in the Ready Reserve vice the SelRes. In this case, annual continuation rates, which indicate the observed probability of the average service member to stay in the same TCPG over a one-year period most appropriately describes the behavior of interest.

It is also important to define both gains and losses to SMCR units. As discussed above in Chapter II, Marine Corps Recruiting Command (MCRC) does not receive mission credit for a prior service Marine until that service member has been with the SelRes for at least three months. Similarly, it is common for Marines to temporarily drop from an SMCR unit for one to two TFDW cycles due to an administrative error or oversight on the part of the Marine. Consequently, we avoid these issues by analyzing the behavior of SMCR unit prior service joins that have been with the unit for over three TFDW monthly cycles (sequences). Temporary drops of less than three TFDW monthly cycles are not counted as a loss.

2. Dependent Variable: *ret_12mos_PS*

The dependent variable *ret_12mos_PS* (12-month continuation) is dichotomous and indicates if a prior service SMCR unit Marine is still serving with an SMCR unit 12 months later. Figure 13 portrays this behavior on a monthly basis (by sequence) for prior service SMCR unit Marines in the ranks of lance corporal through sergeant. Also shown is the monthly on-hand strength (in 100s) of lance corporals through sergeants. This

comparison demonstrates the lag response of end strength to changes in continuation rates, the importance of accurate forecasts, and reinforces the principle of using small "course corrections" when adjusting future manpower.

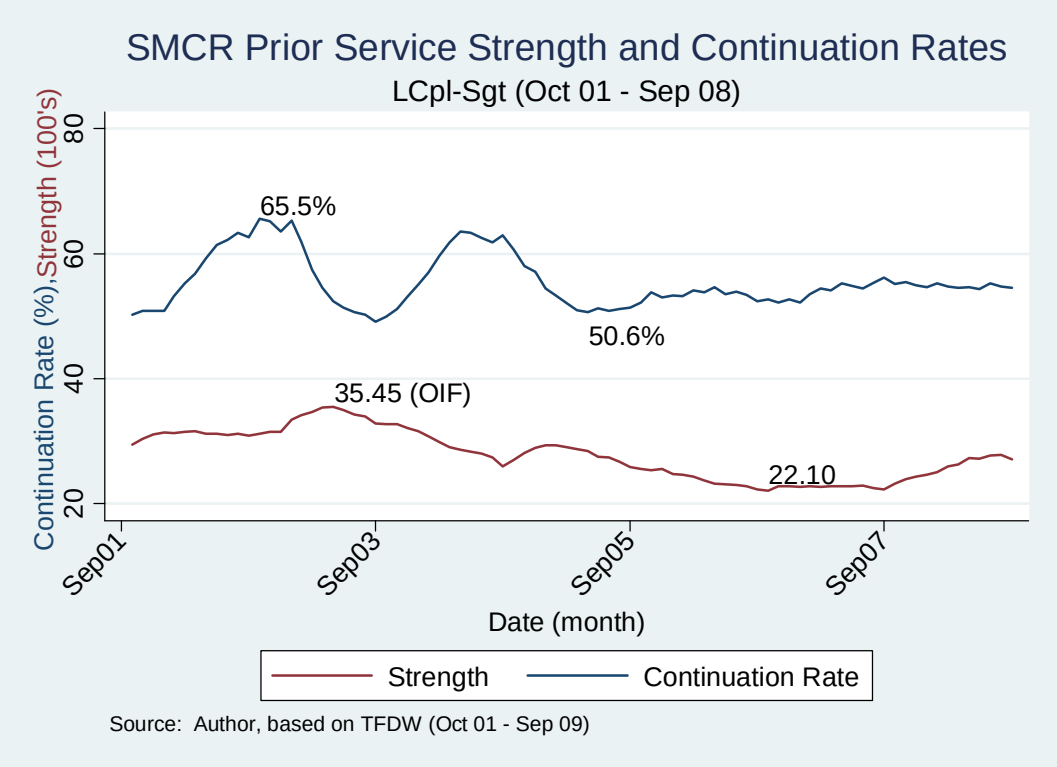

Figure 13. Continuation Rates and On-hand Strength

E. EXPLANATORY VARIABLES

Explanatory variables in the model include activation, state-level economic conditions, ability, performance, person-job fit indicators, monetary incentives, demographics, occupational groupings, and fiscal year differences. The observation number will be used as a restriction for tour length in all four models. In addition, prior service experience will be used as a restriction in Models 3 and 4. Each of these variables will be defined and described in the following paragraphs.

1. Activation

a. Activation Frequency: mob1, mob2, mob3

The binary activation frequency variables, *mob1*, *mob2*, and *mob3*, are representative of a service member's historical activation history in the SelRes at the point of observation dating back to December 31, 1994. As an example, an individual who has activated twice, including a current activation, would be represented by *mob1 = 0, mob2 = 1, and mob3 = 0.*

As discussed in Chapter III, prior service activations are semi-voluntary in nature. In recent years, units are aware of their activation schedule and actively recruit service members who desire and expect to be activated. Thus, prior service members not desiring activation are less likely to have frequent activations and choose to transfer to the Individual Ready Reserve (IRR). Due to this self-selection by SelRes service members, we would anticipate a positive correlation between activation frequency and continuation rates. The cross-tabulation of continuation rates and activation frequency shown in Figure 14 support this positive relationship.

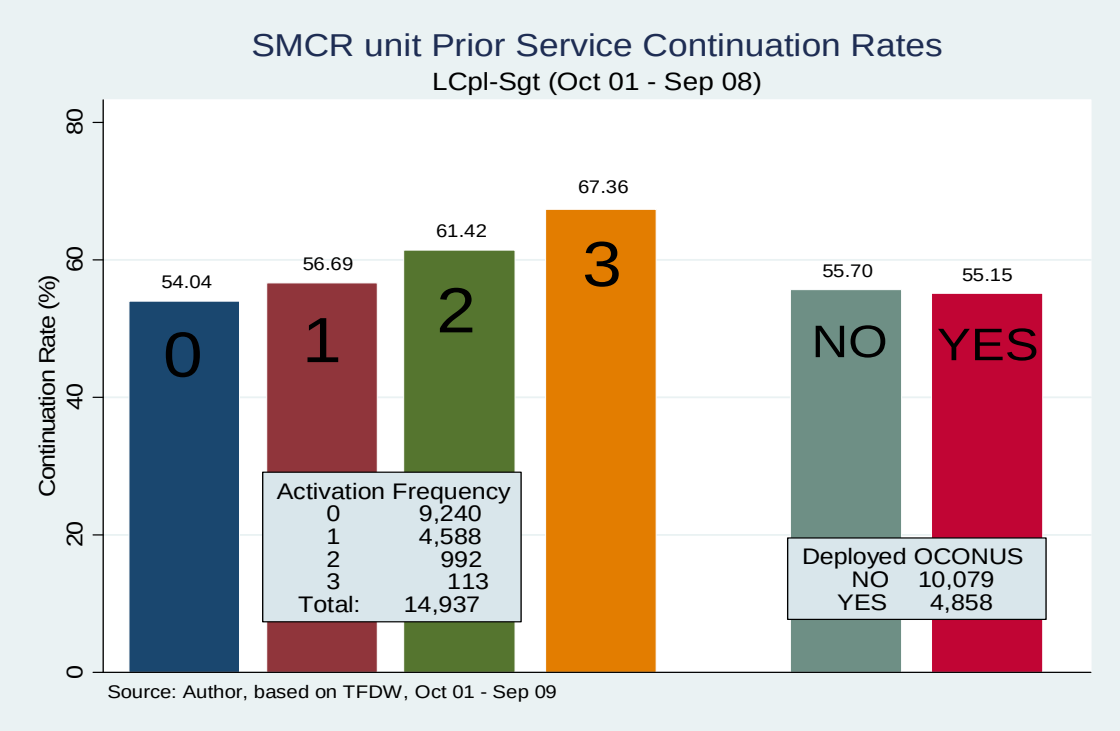

Figure 14. Continuation Rates by Activation Status

b. Months Previously Activated: mos_mob_prior

Months previously activated is an integer variable and counts all previous months on activation orders while a member of the SelRes, based on the current observation number. In general, we would anticipate activation to have a cumulative effect, regardless of an individual's RC participation status. Consequently, it does not reset to zero, nor do any of the activation dependent variables reset when a member breaks from the SelRes (permanently or temporarily). An individual with 12 months of prior activation would be represented by *mos_mob_prior = 12*.

Based on prior empirical results discussed in the literature review and taking into account the Expected Utility of Deployment model, we would expect decreasing marginal returns as the length of activation increases. If an individual in the ranks of lance corporal to sergeant desired extended active duty, then he would have reenlisted in the AC. Thus, we hypothesize that an inverse relationship exists between months activated and the probability of continuation. Depending on the magnitude of this relationship, the net effect of activation may be negative for individuals with higher cumulative months of activation.

c. Previously Deployed OCONUS: oconus_dep

Previously deployed OCONUS is a dichotomous variable that indicates where an individual deployed. If an individual activated at least once and deployed OCONUS, then this variable takes on the value of *1*, otherwise it remains *0*, regardless of an individual's activation history.

Considering the dynamics of deploying to a hostile fire zone as discussed in Chapter III, the effect of deploying OCONUS is uncertain.[110] On one hand, deploying to a hostile fire zone increases an individual's pay and career opportunities and partially satisfies an individual's pursuit of honor, recognition, and credibility as a Marine. Conversely, there is tremendous stress and turmoil for Marines who are subsequently separated from friends and family members. In addition, once an individual deploys to a

[110] Ninety-eight percent of all OCONUS deployments were to a hostile fire zone (see Figure 9).

hostile fire location, his desire for redeployment OCONUS may be satisfied. Lastly, although Figure 14 does not demonstrate a large impact on continuation, a service member must be activated to deploy. Thus, we would anticipate OCONUS deployment continuation rates to be positively biased by activation when not controlling for these effects. Consequently, the impact of deploying OCONUS is ambiguous a priori.

2. Unemployment Rate: *Unemployment*

The seasonally adjusted unemployment rate is a continuous variable based on an individual's home state of residence in the Marine Corps Reserve during the month of observation. The weighted average for all prior SMCR unit new joins during FY02–FY08 would be represented by *unemployment = 5.3*.

Based on the Annualized Cost of Leaving (ACOL) model discussed in Chapter IV, we would expect a rise in unemployment to increase continuation rates. Also, empirical results from the literature review suggest that a one percentage point increase in unemployment will increase continuation rates by 1.3 to 1.7 percentage points. Accordingly, we hypothesize a positive relationship between unemployment rates and continuation.

3. Ability: *afqt*

The Armed Forces Qualification Test (AFQT) is a continuous variable that represents the most recent test scores at the time of observation. According to the ACOL model discussed in Chapter IV, it is possible that an individual's intellectual ability as measured by the AFQT could increase a service member's military career opportunities and future expected earnings. Alternatively, a higher AFQT could also increase potential civilian earnings. Although prior studies discussed in the literature review empirically determined a lower attrition rate for first-term Marines, we cannot anticipate the same behavior for prior service Marines not obligated to drill in the SelRes by a binding service contract. Therefore, the effect of AFQT is ambiguous. However, given the minimal range in average scores, which increased from 60.0 to 61.4 across the first 48 observations, it is unlikely that AFQT will have a large effect on continuation, regardless of sign.

4. Monetary Incentives

a. Bonus

The variable *bonus* is binary with *bonus = 1* indicating that an individual received a bonus. We would expect a strong positive correlation between receiving a bonus and continuation. Although acceptance of a bonus does not legally obligate a service member to participate in SMCR units, failing to fulfill the service agreement results in the loss of future installment payments, or recoupment of funds in the case of a lump sum bonus. Considering the ACOL model and the high discounts rates estimated for enlisted service members in the literature review, we would expect bonuses to have a large positive effect on continuation. Figure 15 supports this hypothesis and indicates a 6.6 percentage point increase in continuation across all observations and a 10.5 percentage point increase during the first 12 months with respect to a bonus, not controlling for other factors.

We would also anticipate a strong effect of the bonus amount, which has varied widely over the past eight years, from $50/mo to $15,000/three years as indicated above in Table 5 (Chapter II). However, the absence of this data element in RA files prior to FY2006 combined with incomplete data from FY2006 and FY2007 make analysis of the bonus amount difficult. Inferring the amounts based on categorical variables is also problematic due to the litany of monetary incentives available each year. Thus, the model will not account for differences in bonus amounts.

b. Lump Sum Payment: bonus_fy06plus

The variable lump sum payment is dichotomous and indicates if a bonus was paid via a lump sum. Since the payment option is dependent on an individual receiving a bonus, the lump sum payment variable cannot take on a value of *1* unless a bonus *1* is also indicated. Conversely, one cannot infer whether or not an individual received a bonus based on a value of *0* for the lump sum payment variable.

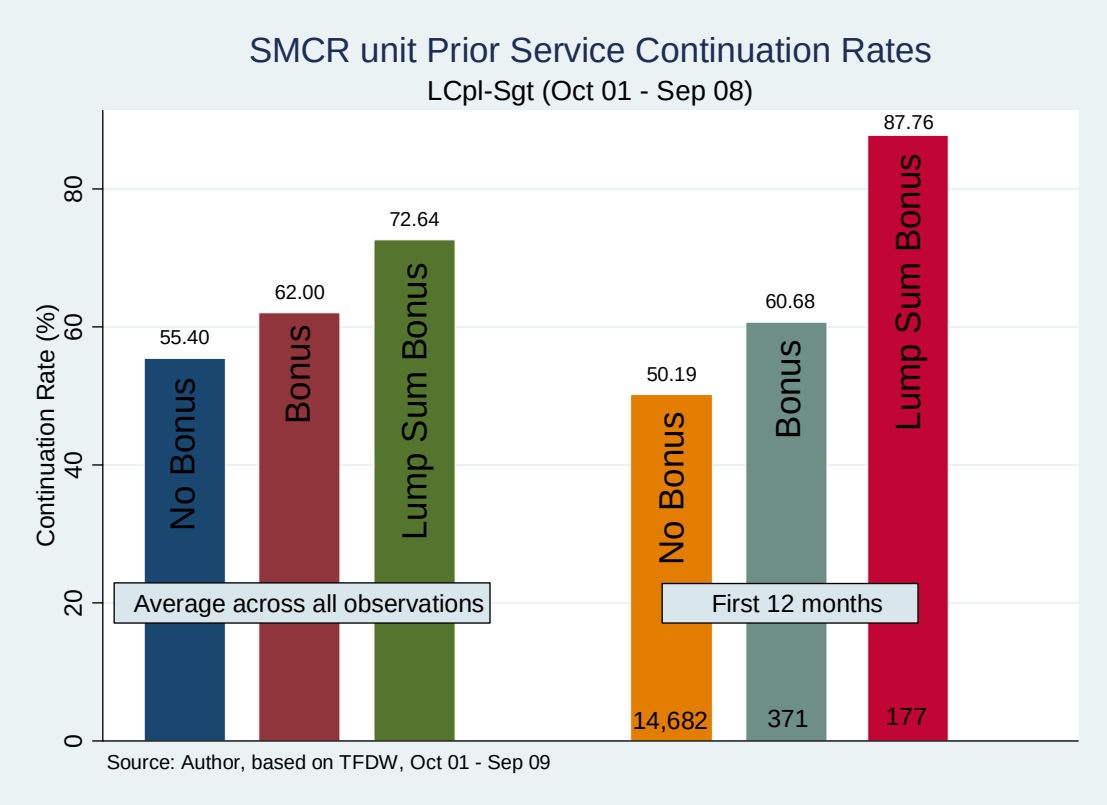

Figure 15. Comparison of Monetary Incentives and Continuation Rates

Although data were not available from RA designating the bonus payout method, I was able to infer this information given that all bonuses, except the $50 monthly affiliation incentive, were offered as a lump sum beginning in FY2006. After FY2006, installment payments were no longer offered. However, since significant increases in bonus amounts occurred simultaneously to a change in payment method, I will be unable to separate these two effects.

Based on the previous discussion of personal discount rates and the ACOL model, we would expect that a lump sum bonus would have a strong positive impact on continuation, independent from bonus size. Likewise, a significant increase in the payment amount could also positively impact continuation rates, given the minimal bonus amounts provided prior to FY2006. As shown in Figure 15, large increases in continuation rates over the first 12 months appear to support this hypothesis, though the effect appears to diminish over time, potentially after completion of the affiliation

requirement. Lastly, the limited number of monetary incentives granted (371 bonuses excluding missing FY2006 and FY2007 data) suggests that there is vast room for improvement of continuation rates if additional funding is allocated to this area.

5. Person-Job Fit

This category of variables is used to describe certain factors that indicate congruence of a service member's technical skills and abilities with Marine Corps criteria and evaluations. These variables also portray how well an individual has adapted to the Marine Corps, and on a personal level, denote competence and credibility as a Marine.

a. Performance: prof_svc

For Marines below the rank of sergeant, performance is measured on a 5.0 scale known as proficiency marks, with anything below a 4.0 indicating sub-standard performance. Marine Corps Order (MCO) P1070.12K describes the proficiency mark as follows:

> In addition to technical skills and specialized knowledge, relating to duty proficiency marks, the **"whole Marine concept"** must be considered. Such attributes as mission accomplishment, leadership, intellect and wisdom, individual character, physical fitness, personal appearance, and completion of professional military education.[111]

The proficiency variable chosen is continuous and reflects the cumulative average marks for a Marine's entire career, prior to that observation, measured at three to six-month intervals. Marines with an average mark below 4.0 are not eligible for reenlistment. As such, the proficiency variable has been converted to a range of 1.0 from 4.0 to 5.0.[112]

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[111] "Individual Records Administration Manual," MCO P1070.12K W/CH1, (Quantico, VA: U.S. Department of the Navy, 2000), 4–42.

[112] Using a range of 1.0, prof_svc = 0.0 represents a 4.0 proficiency duty rating, prof_svc = 0.5 represents a 4.5 rating, and prof_svc = 1.0 represents a 5.0 rating.

Although it would seem that a service member with high proficiency marks would signify a relatively high person-job fit, it is also likely that these same attributes of performance are highly desired in the civilian sector. Thus, the hypothesized effect of performance on continuation is ambiguous.

b. Conduct: con_service

Conduct is evaluated for Marines below the rank of sergeant using the same scale and frequency of observation as proficiency. The conduct variable chosen is continuous and reflects the cumulative average marks for a Marine's entire career, prior to that observation, measured at three- to six-month intervals. Marines with an average mark below 4.0 are not eligible for reenlistment. Similar to proficiency, the conduct variable has also been converted to a range of 1.0.

As described below in MCO P1070.12K, a high conduct mark is indicative of a good person-job fit. Therefore, we would expect that high conduct marks are associated with higher continuation rates.

> In addition to observance of the letter of law and regulations, conduct includes conformance to accepted usage and custom, and positive contributions to unit and Corps. General bearing, attitude, interest, reliability, courtesy, cooperation, obedience, adaptability, influence on others, moral fitness, physical fitness as effected by clean and temperate habits, and participation in unit activities not related directly to unit mission, are all factors of conduct and should be considered in evaluating the Marine.[113]

c. Rifle Qualification Scores: rifle_score

Rifle marksmanship skills are considered a core competence for Marines. All enlisted SelRes Marines are required to qualify once every two years. Marksmanship skills are a source of pride and are displayed on dress uniforms by wearing marksmanship badges. Moreover, approximately one-sixth of a Marine's promotion score in the ranks of lance corporal and corporal is based on this score. Rifle qualifications are also included on fitness reports for sergeants and above.

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[113] "Individual Records Administration Manual," MCO P1070.12K, 4–39.

Per Appendix 9, the rifle score has been converted to a continuous variable using a 5.0 scale. Although, a high rifle score could be interpreted as a good indicator of person-job fit, the relationship between rifle scores and overall performance as a Marine is tenuous. Thus, the effect of hereditary shooting ability (hand-eye coordination) is ambiguous.

d. Physical Fitness: pft_score

Although physical fitness is also hereditary in nature, related to body composition and build, the physical fitness test (PFT) requires a certain level of dedication and effort by the Marine to maintain a satisfactory fitness-level. Therefore, we would anticipate a high pft score to reflect a good person-job fit. Similar to the rifle score, pft is a continuous variable converted to a 5.0 scale using Appendix 9 as a guide.

e. Basic Skills Test: bst

The BST is an annual knowledge and skills test. The recordable portion of the evaluation is a 50-question written test of a Marine's knowledge of customs, courtesies, and Marine Corps history. Although a high score could indicate a good person-job fit, this evaluation is pass or fail and does not normally impact a Marine's career. Accordingly, scores typically vary based on the emphasis that each unit places on the bst, so that the effect may be insignificant. This variable is continuous and ranges from zero to 50.

f. Advanced Water Survival: wsc_advanced

The advanced water survival variable is dichotomous and indicates whether a Marine obtained an advanced water survival certification, such as a safety swimmer, instructor, or instructor-trainer. All Marines are required to have a minimal water survival qualification based on their MOS. Since obtaining an advanced certification is not typical (1 out of 100), our base case is a service member who has not obtained an advanced certification.

Although hereditary and previous youth experience can play a large role in a Marine's water survival classification, attending an advanced water survival qualification course requires additional time and funding. Thus, we would only expect units to send individuals to training who are likely to provide a return on investment. Accordingly, we hypothesize that obtaining advanced water survival certification predicts a higher probability of continuation.

g. Unexcused Absence: unexcuse_12_mo

Unexcused absence is an integer variable that indicates the number of unexcused absences a Marine is awarded in the previous 12 months of observation. As discussed in Chapter II, SelRes Marines are required to satisfactorily complete 48 drills per year, typically scheduled once a month as a four-drill weekend. Therefore, missing one weekend of drills would result in four unexcused absences.

Failure to attend drills without an authorized excuse is likely a strong indicator that a Marine has a person-job fit conflict with his civilian career, family, or the Reserve unit. Consequently, we would expect an inverse relationship between the number of unexcused absences and a service member's continuation rate.

6. Military Experience

The next category of variables describes certain characteristics of a service member's military experience that could impact his decision to continue serving in an SMCR unit. Examples include prior experience in the SMCR units, rank, years of satisfactory service, and occupational groupings.

a. Prior Obligor: true_reserve

Prior experience in the SMCR as an obligor is a dichotomous variable. *True_reserve = 0* indicates an initial enlistment in the AC, while *true_reserve = 1* indicates an initial enlistment in the RC. As depicted in Figure 16, over 76 percent of all prior service recruits during the past eight years have previously served in the AC.[114]

[114] Note: 9,721/12,739 = 76.3 percent. The prior service experience of an additional 791 prior service individuals is indeterminate based on TFDW limitations prior to December 31, 1994.

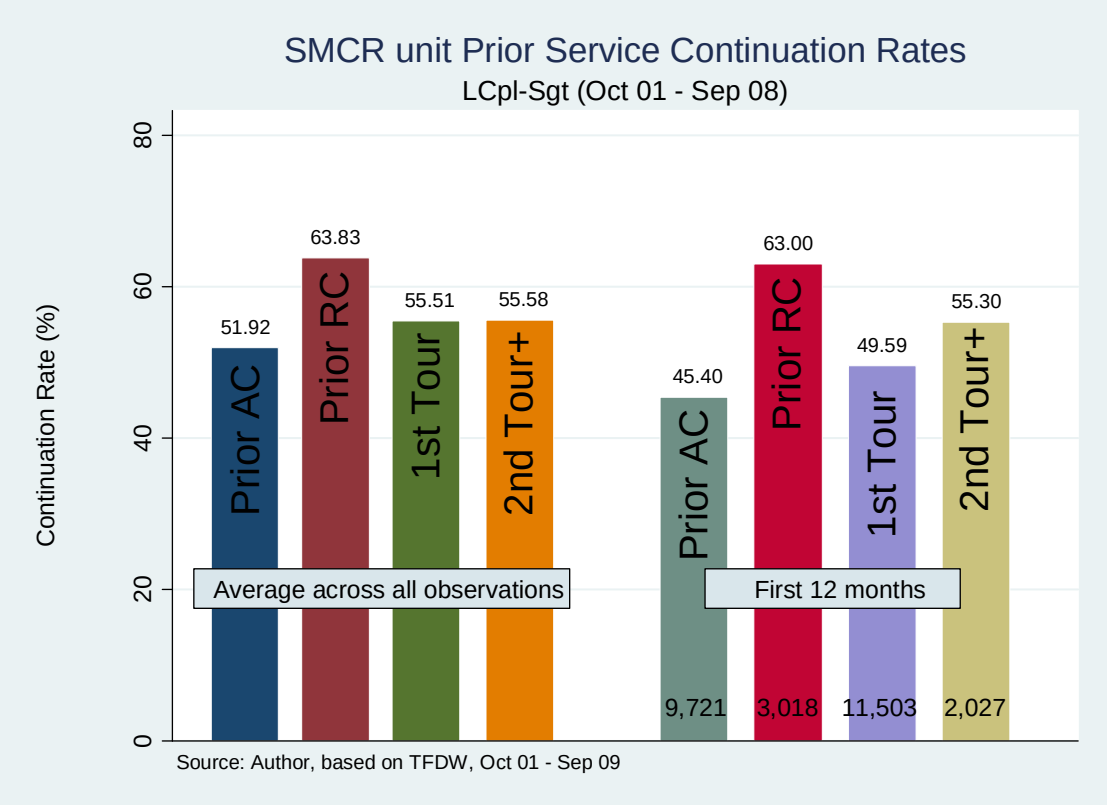

Figure 16. Continuation Rates and Prior Reserve Experience

Prior service Marines who initially enlist in the RC would have a much better understanding and expectation of service in an SMCR unit than a Marine whose prior experience was in the AC. Consequently, they would have a more realistic job preview and a better person-job fit. Hence, we would expect a positive effect on continuation rates. Figure 16 supports this hypothesis, showing a 12 percentage point increase in continuation over all observations and a 17.5 percentage point increase during the first 12 months. The decreased effect averaged across all observations suggests that this impact may be largest during the initial months after joining an SMCR unit.

b. Previous SMCR tours: SMCR_break_PS_gt1

One or more prior SMCR tours is a dichotomous variable indicating that a Marine re-affiliated with an SMCR unit after a temporary break in service greater than three months. As shown in Figure 16, this occurrence is common to approximately 15 percent of prior service recruits in the ranks of lance corporal to sergeant.[115]

Similar to prior experience in the SMCR as an obligor, we would expect that individuals returning for a second tour in the SMCR would also have a more realistic job preview. However, this behavior also suggests that they are more likely to transfer should a career opportunity arise elsewhere in the RC or other outside factors decrease their free-time available to drill. As such, we would anticipate an initial positive effect on continuation that diminishes over time. Figure 16 support this hypothesis showing nearly a six percentage point difference during the first 12 months, but no significant difference when averaged across all observations.

c. Retirement Qualified Years: satyrs

Satyrs is an integer variable that increases annually based on the anniversary date and obtaining 50 retirement credit points. As previously discussed in the ACOL model, the closer a service member is towards retirement the higher his net present value of future military earnings becomes. The literature review also supports this relationship between retention and proximity to reserve retirement vesting. However, with a median value of *satyrs = 5*, for prior service SMCR unit Marines in the ranks of lance corporal to sergeant, this retirement pull is likely weak. Therefore, the estimated effect of retirement qualified years towards retirement, given the subject population, is ambiguous a priori.

d. Rank: cpl, sgt

The experience category of rank includes the three binary indicator variables of *lcpl*, *cpl*, and *sgt*. In the model, lance corporal is indicated as the omitted variable when *cpl = 0* and *sgt = 0*.

[115] Note: 2,207/13530 = 14.9 percent.

Marines enter the ranks of non-commissioned officer (NCO) upon promotion to corporal. For some, this may be a moment of achievement or a point of pride, not leaving the Marine Corps as a lance corporal. Thus, it's conceivable that lance corporals might have higher continuation rates for this reason. Alternatively, empirical evidence from the literature review suggests that retention increases beyond the rank of corporal making promotion to sergeant an important career step. As such, the rank of corporal is a decision point for some on whether to pursue the Marine Corps as a career.

The cross-tabulation of rank and 12-month continuation rates in Figure 17 supports this concave relationship. Lance corporals have higher continuation rates while holding out for promotion to corporal. They then depart having met their goal and deciding against (at least temporarily) a Marine Corps career. The higher continuation rate of sergeants suggests that they have adjusted to the additional rank and responsibility as an NCO and are increasingly making the decision of a Marine Corps career. However, determining the independent impact of each of these variables is necessary to further support this hypothesis.

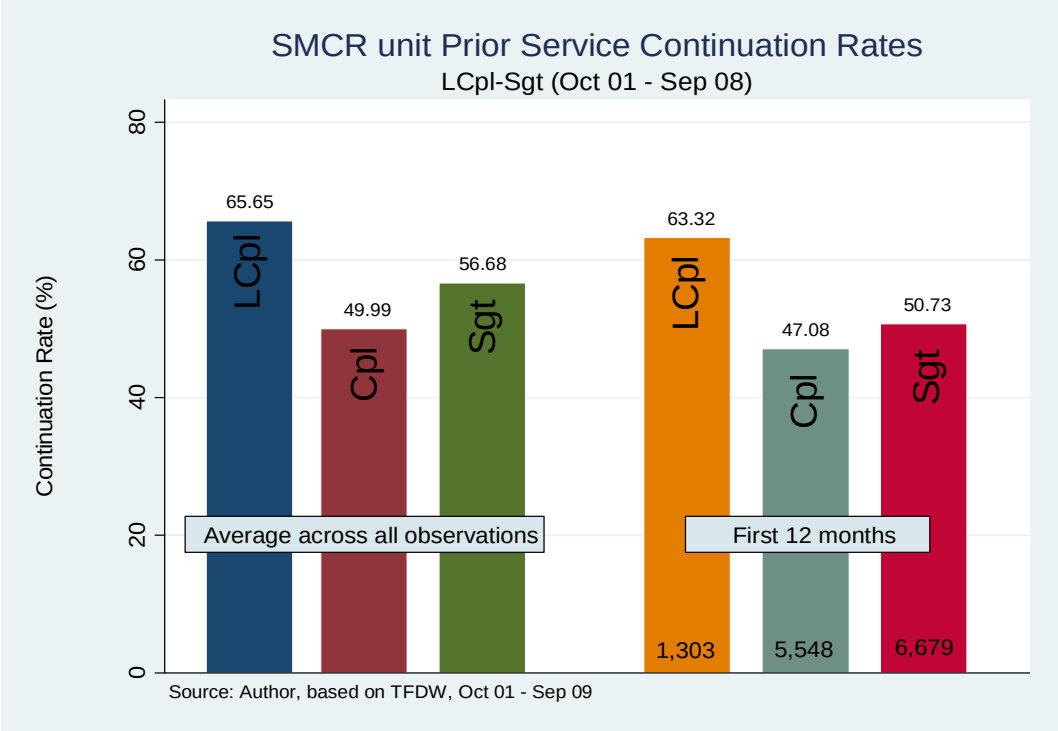

Figure 17. Continuation Rates for Lance Corporal through Sergeant

e. Occupational Groupings: combat_arms, aviation_community

All SMCR unit Marines can be divided into occupational groupings using the three general categories of ground combat arms, aviation, and support.[116] Two binary variables were generated to distinguish the three categories with support, the omitted variable, indicated by *combat_arms = 0* and *aviation_community = 0*.

In general, we might expect the combat arms community to receive less technical training. As a result, they would potentially have a lower net present value of future civilian earnings using the ACOL model. Therefore, we would expect higher continuation rates. Additionally, the likelihood of the combat arms community to work closely together in teams, maintaining unit cohesion and integrity, could also potentially increase continuation rates compared to other communities. By contrast, the likelihood of working in small detachments or being attached to another unit increases for the support community.

For the aviation community, we would expect a higher quality of life due to the proximity of large bases and airfields, as well as increased funding. Accordingly, we would expect higher continuation rates for the aviation community, diminished somewhat by the draw of their technical backgrounds.

f. Headquarters and Force Units: mfr

This dichotomous variable includes units assigned directly to Marine Forces Reserve (MarForRes), such as reconnaissance, air naval gunfire liaison, and civil affairs, as well as individuals assigned to the MarForRes staff. Force units are close-knit and offer more prestige than other units, attracting service members with a higher person-job fit. Additionally, assignment to a high-level staff reduces information asymmetry and increases autonomy, which can lead to higher job satisfaction. As a result, we would anticipate higher continuation rates by service members assigned to these types of units.

[116] For purposes of this thesis, ground combat arms includes PMOS of 03xx, 08xx, and 18xx, accounting for 33 percent of SMCR units. Aviation includes the PMOS categories of 59xx–79xx, excluding METOC, accounting for approximately 8.4 percent of SMCR units. The remaining PMOS are broadly categorized as "support."

7. Demographics

Demographic variables include gender, marital status, children, race groups, and age. Each variable is described in this section.

a. Female

The *female* variable equals *1* for a female and *0* for a male, which make up over 94 percent of the prior service population in the ranks of lance corporal through sergeant.[117] Although traditional family and occupational roles have slowly evolved, we would anticipate a lower continuation rate among females, since they are more likely to take career intermissions due to the birth of children. Also, we would expect females with young children to be more risk averse to activation and deployment OCONUS. In general, these hypotheses are supported both by empirical studies from the literature review and the cross tabulation of data. Figure 18 indicates an initial 4.4 percentage point lower continuation rate for females in the first 12 months, and a 7.5 percentage point difference averaged across all observations. However, it is also possible that the effect of children is negatively biasing the effect of gender for females. Thus, partialing out the differences using multivariate analysis will estimate more accurate effects.

[117] Note: 12,763/13,530 = 94.33 percent.

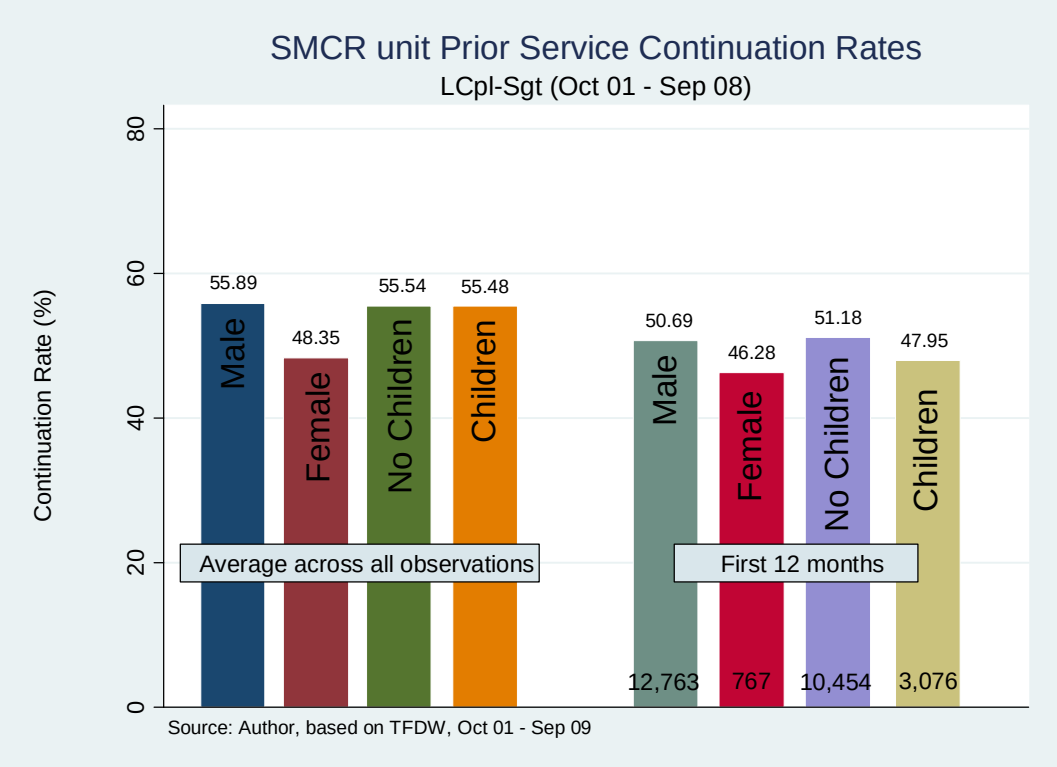

Figure 18. Continuation Rates by Gender and Parenting

b. Children: child1_plus

The variable for children is dichotomous and indicates if a service member has at least one child, *child_plus = 1*, or none at all, *child_plus = 0*. Over 77 percent of all prior service SMCR unit new joins in the ranks of lance corporal through sergeant have no children. Empirical results are mixed as to the effects of children on continuation rates. Although we would expect the preoccupation with child rearing to make an individual more risk averse to deployments and prolonged absence, it is also plausible that parenting could increase an individual's desire to protect the safety and security of the U.S. Moreover, raising children could reduce family earnings through the loss of spousal income, making supplemental income a priority. Additionally, programs, such as Tricare Reserve Select, with a flat-rate premium and no exclusions for pre-existing conditions (as discussed in Chapter III), could make continued service in an SMCR unit more attractive for single-income families with children. As such, the overall effect of children on continuation rates is ambiguous a priori.

c. Marital Status: Married, Divorced

Marital status is composed of three states; single, married, and divorced; as indicated by the three binary variables of *single*, *married,* and *divorced*. The single marital status represents 54.7 percent of all new joins in the ranks of lance corporal through sergeant[118] and is indicated in the model by omission when *married = 0* and *divorced = 0*. Empirical results from the literature for AC personnel suggest that being married is associated with higher retention. However, we would anticipate the opposite effect for reserve personnel. Specifically, participation in the Reserve is part-time for the majority of reserve service members and more akin to moonlighting as suggested in the literature review. Additionally, spouses are more likely to pursue a higher paying civilian career without the interruptions of military moves experienced by the AC; thus, the additional income of reserve participation may be less appealing. As such, we would expect that married reserve service members might be more risk averse to deployments and prolonged absence from family members. However, the literature review also suggested that certain age groups experienced more changes in marital status, and we would expect a change in marital status from single to married to have a negative effect on continuation rates. Thus, although Figure 19 suggests a lower continuation rate for married SMCR unit Marines, it is necessary to control for such other effects as activation, age, and children to accurately estimate the effect of marital status on continuation rates.

[118] Note: 7,404/13,530 = 54.72 percent.

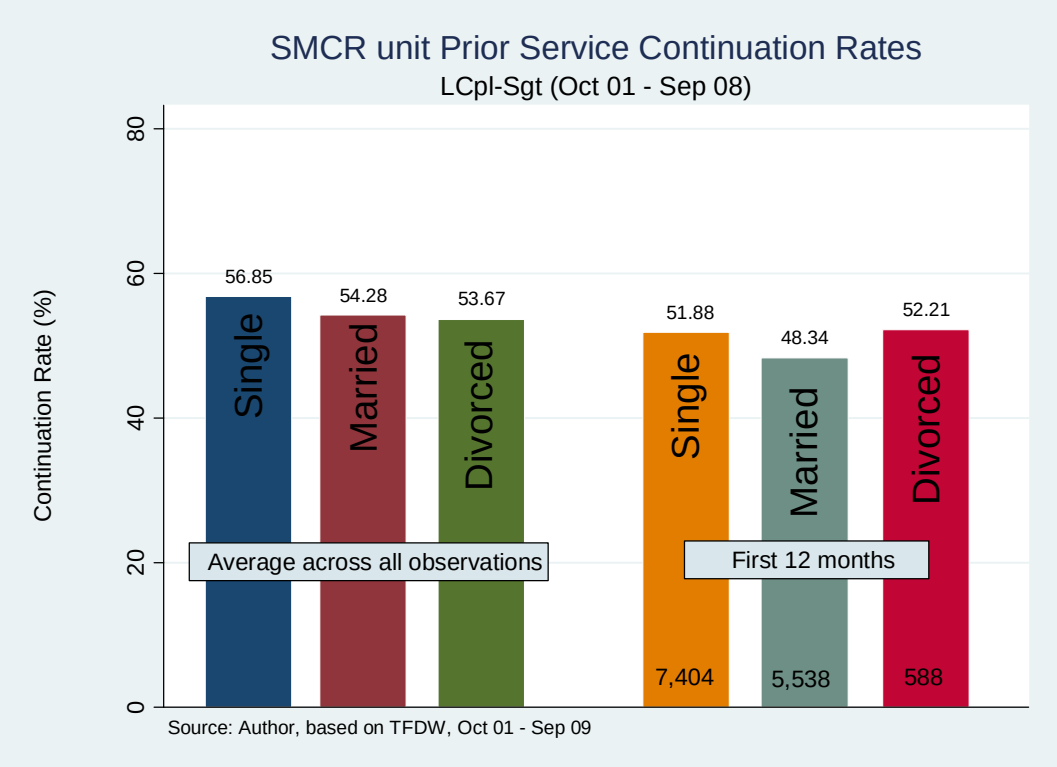

Figure 19. Continuation Rates by Marital Status

d. Race/Ethnicity: Black, Pacificislander, Nativeamerican, Asian

Race is defined by the five categories of *white* (84.6 percent), *black* (11.1 percent), *pacificislander* (2.9 percent), *nativeamerican* (1.1 percent), and *asian* (0.3 percent). TFDW did not account for the Hispanic population separately, and thus, they are included in the category of *white*.[119] In the model, white (and Hispanic) are indicated as the omitted variable by *black = 0*, *pacificislander = 0*, *nativeamerican = 0*, and *asian = 0*. Although historically minorities have been attracted to the services due to its perception of opportunity and equality, the proclivity of service during combat operations may be affected less by racial differences. As such, no hypothesis is given concerning the effect of race.

[119] Authors calculations based on TFDW data for SMCR unit new joins in the ranks of lance corporal through sergeant from October 2001–September 2008. Note: 1,930 Marines (14.3 percent overall) did not provide their race.

e. Age

Age is a continuous variable based on the date of observation. The average age for prior service SMCR unit new joins is 26.5. The Marine Corps is a physically demanding occupation and we would expect older Marines to find less job satisfaction in undertaking strenuous activities. Although we would expect a positive effect as the age of retirement vesting nears, Reserve Marines in the grades of lance corporal through sergeant are less likely to be affected by retirement decisions per our previous discussion of the ACOL model (Chapter IV). Additionally, older Marines are less likely to be affected by the desire for acceptance into adulthood as discussed in Chapter III. Accordingly, we hypothesize an inverse relationship between age and continuation rates.

8. Annual Effects

a. Fiscal Years: d03, d04, d05, d06, d07, d08

Fiscal year dummies account for differences due to unobservables that may affect each year differently. For instance, the U.S. population strongly supported the military for much of FY2002 in response to the terrorist attacks of 9/11. However, public opinion began to sour as operations in Iraq bogged down in FY2004 and FY2005. Moreover, the 202k "Grow the Force" Initiative in FY2006 and FY2007 attracted many prior service Marines to reenlist in the AC, in part due to significant monetary incentives. Overall, it is difficult to predict the balance of changing U.S. attitudes and force structure on each fiscal year individually. However, we would expect the base year of FY2002, indicated as the omitted variable, to have a positive effect on continuation rates.

b. Pre 9/11 Service: Pre_9_11

Prior service Marines joining prior to 9/11 did so with relatively low expectations of activation and deployment in the Marine Corps Reserve. However, those joining after this date had a more realistic job-preview regarding frequency of deployments based on both experience, unit rotation schedules, and written guidance

provided by the Secretary of Defense, as discussed in Chapters III and IV. Therefore, we would expect that individuals who joined prior to 9/11 would have a lower probability of continuation.

9. Tour Length: *obs_PS*

The variable *obs_PS* is an integer indicating the number of months an individual has served consecutively in the SMCR units.[120] The longer the tour length, the more likely it is that individuals with incongruent family lives, civilian jobs, person-job fit, personality conflicts, and unmet expectations have transferred from the SMCR to a TCPG with more compatible participation requirements. Therefore, we would anticipate that the effects of those factors, which decrease the probability of continuation, to diminish and the continuation rate to increase, as shown in Figure 20.

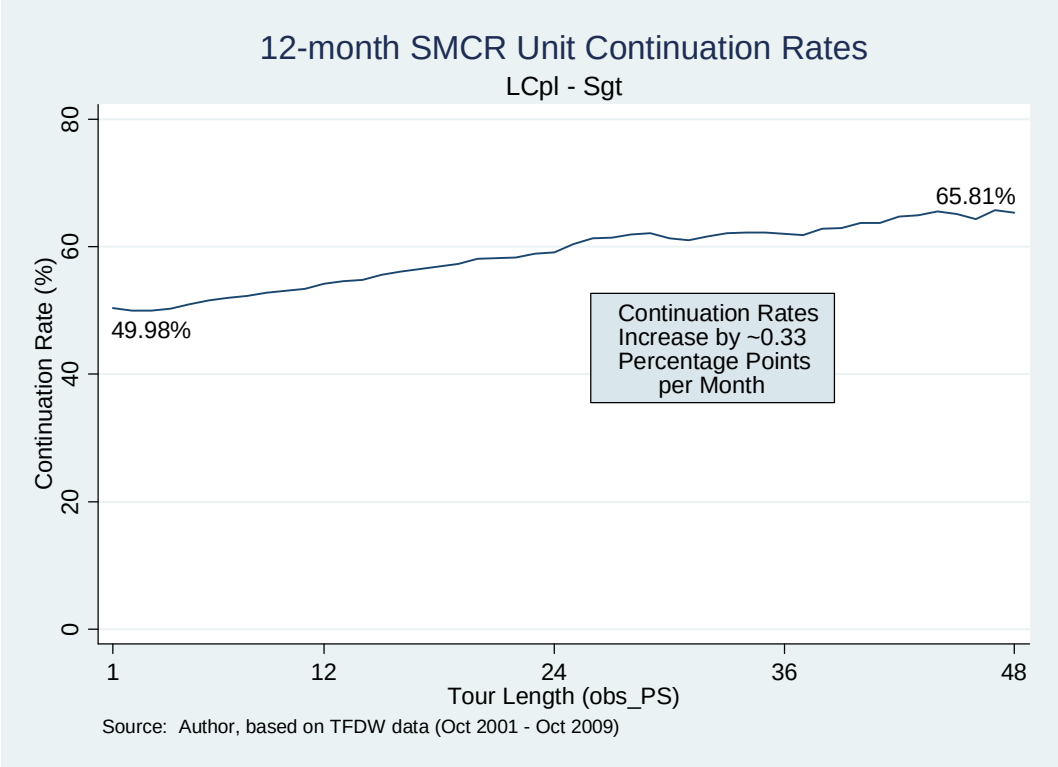

Figure 20. Continuation Rates by SMCR Tour Length

[120] As previously discussed, a break of service less than three months does not result in resetting the tour length variable (observation number) to zero.

In order to control for tour length, the population for each model is restricted by *obs_PS*. In particular, the analysis will focus on the three tour lengths of *obs_PS* = 4, *obs_PS* = 12, and *obs_PS* = 24. The first period was chosen based on the three-month service requirement for MCRC recruiting mission credit (discussed above in Chapter II). The 12-month tour length was chosen to estimate the 12-month retention rates following a full-year of service. Lastly, the 24-month tour length continuation rates coincide with the participation requirements for the majority of monetary incentives discussed in Chapter II.

Analysis of tour length as a dependent variable will not be addressed in this thesis and is a recommendation for future research. In particular, the probit model requires independence of the cross-sectional data. Difference-in-differences or pairs matching are two potential techniques for panel data. However, selection-bias due to sample truncation requires incorporating the entire Ready Reserve and AC populations. Obtaining this additional dataset from TFDW is an area for future research. Survival analysis is another possible approach; however, this method is also problematic due to activation-limited loss positively biasing continuation rates.

10. Summary of Hypothesized Effects

Table 6 summarizes the hypothesized effects of each explanatory variable on the dependent variable, *ret_12mos_PS*. Each of these effects will be analyzed using the three tour lengths discussed above and compared using marginal effects calculated at the mean.

Table 6. Hypothesized Effects of Explanatory Variables

Category	Variable Name	Type	Expected Sign	Models
Activation	mob1	Binary	+	All
	mob2	Binary	+	All
	mob3	Binary	+	1, 2, 3
Activation	mos_mob_prior	Integer	-	All
	oconus_dep	Dichotomous	.	All
unemployment		Continuous	+	All
Ability	afqt	Continuous	.	All
Monetary Incentives	bonus	Dichotomous	+	1, 2, 4
	bonus_fy06plus	Binary	+	1, 2, 4
Person-job Fit	prof_svc	Continuous	.	2, 3, 4
	con_service	Continuous	+	2, 3, 4
	rifle_score	Continuous	.	2, 3, 4
	pft_score	Continuous	+	2, 3, 4
	bst	Integer	.	2, 3, 4
	wsc_advanced	Dichotomous	+	2, 4
	unexcuse_12_mo	Integer	-	2, 3, 4
Military Experience	true_reserve	Dichotomous	+	2
	SMCR_break_PS_gt1	Dichotomous	+	2, 3, 4
	satyrs	Integer	.	2, 3, 4
	cpl	Binary	-	All

Category	Variable Name	Type	Expected Sign	Models
	sgt	Binary	-	All
	combat_arms	Binary	+	2, 3, 4
	aviation_community	Binary	+	2, 3, 4
	mfr	Dichotomous	+	2, 3, 4
Demographics	female	Dichotomous	-	All
	child1_plus	Dichotomous	.	All
	married	Binary	-	All
	divorced	Binary	.	All
	black	Binary	.	All
	pacificislander	Binary	.	1, 2
	asian	Binary	.	All
	nativeamerican	Binary	.	1, 2, 4
	age	Continuous	-	All
Fiscal Year Effects	d03	Binary	-	All
	d04	Binary	-	All
	d05	Binary	-	All
	d06	Binary	-	All
	d07	Binary	-	All
	d08	Binary	-	All
	pre_9_11	Binary	-	All

11. Descriptive Statistics

Table 7 provides a summary of the prior service SMCR unit dataset used to estimate the parameters for Models 1 and 2. Tables 8 and 9 provide a summary of the prior RC and AC datasets used to estimate Models 3 and 4, respectively.

As Table 7 shows, the average 12-month continuation rate for this period is 55.5 percent. As shown in Appendices 27–31, the average rate ranges from 50.0 to 59.1 during the 4-, 12-, and 24-month tour lengths used in this analysis. The continuation rate also varies significantly between the prior RC and prior AC populations. According to Tables 8 and 9, the average continuation rate for prior RC is 63.8 percent, while the prior AC rate is lower at 51.9 percent. Rates for the prior RC and AC populations at the 4-, 12- and 24-month tour lengths are shown in Appendices 32–41. As discussed previously, these disparities are expected given the differences in experience and realism of job previews between the AC and RC components.

The average number of months activated for the SMCR unit population is 4.7 months; this increases to 10.75 months when only considering the 37.7 percent of prior service who have activated once, and six percent for those who have activated more frequently. As shown in Appendix 28, only 15.4 percent of all prior service new joins have previously activated. Within 24 months, the activation rate increases to 58.3 percent. As can be expected, prior service RC Marines have a 26 percentage point higher average activation rate (as shown in Tables 8 and 9).

Table 7 shows that less than two percent of all prior service SMCR unit Marines received a monetary incentive, of which only six were prior RC.[121] There are two primary reasons why this number is so low. First, prior to FY2008, the maximum bonus amount ranged from $833 to $2,500 per year for a three year commitment, as shown previously in Table 5. Not until FY2008 was the bonus increased to $15,000, which was payable in a lump sum. As such, prior to FY2008 the vast majority of Marines were not willing to accept a commitment to serve in the SMCR units for the amount of money

[121] The actual number may be slightly higher due to incomplete FY06 and FY07 data.

being offered. Second, RA has a limited budget to provide bonuses, although this was not a major contributing factor prior to FY2008. Bonuses are given out on a first come, first served basis.

Another difference between the prior AC and RC populations is in AFQT scores. Tables 8 and 9 show on average, prior RC Marines scored nearly nine points higher than prior AC. Unfortunately, as indicated by the 28,761 fewer data points, approximately 12 percent of observations were missing this data element. Additionally, a relatively small number of impossibly low values also account for some of these missing data points.

Differences in descriptive statistics for the person-job fit variables between prior RC and AC Marines are unremarkable. For instance, the average duty proficiency and average conduct score of 4.5 is nearly identical for the two populations. Similarly, both population groups scored nearly the same on the 300-point PFT and 50-point BST.[122]

On the basis of military experience, the two prior service groups differ in both rank and MOS. Although both have the same percentage of corporals (29 percent), the prior RC is more lance corporal heavy (20 percent) and the prior AC has a higher percentage of sergeants (65 percent). In addition, prior RC are approximately 11 percentage points more likely to serve in combat arms and 50 percent less likely to serve in the aviation community.

Demographically, the prior AC population is more diverse than the prior RC population with nearly twice as many females and more married service members. Additionally, prior AC service members are more likely to be non-white and to have children.

Although the prior RC composes only 26.5 percent of the total SMCR unit observations, the differences mentioned above, particularly in the areas of activation, experience, and continuation rates, suggest important and systematic differences between the two populations. Thus, I will estimate the parameters shown in Figures 11 and 12 for prior RC and AC service members together in Models 1 and 2 and for Figure 12 separately in Models 3 and 4.

[122] Scores were converted from the 5.0- to the 300-point scale using Appendix 10.

Table 7. Descriptive Statistics, All Prior Service SMCR, E3–E5 (All Observations)

Variable	N	Mean	sd	Min	Max
ret_12mos_PS	234003	0.5552	0.4969	0	1
mob1	234003	0.3770	0.4846	0	1
mob2	234003	0.0567	0.2313	0	1
mob3	234003	0.0047	0.0686	0	1
mos_mob_prior	234003	4.7170	6.9700	0	62
oconus_dep	234003	0.3254	0.4685	0	1
unemployment	222680	5.4270	1.0280	2.2	11.4
afqt	205242	60.8900	18.7200	30	99
bonus	234003	0.0189	0.1361	0	1
bonus_fy06plus	234003	0.0051	0.0710	0	1
prof_svc	222039	0.5227	0.1260	0	0.9
con_service	222029	0.5120	0.1388	0	0.9
rifle_score	225159	4.1380	0.7039	0	5
pft_score	220192	4.4630	0.3680	3	5
bst	218690	44.7400	5.0490	10	50
wsc_advanced	234003	0.0130	0.1134	0	1
unexcuse_12_mo	234003	0.7318	3.5730	0	48
true_reserve	212891	0.2650	0.4413	0	1
SMCR_break_PS_gt1	234003	0.1445	0.3516	0	1
satyrs	209089	6.1690	1.8620	3	14
cpl	234003	0.2859	0.4518	0	1
sgt	234003	0.6300	0.4828	0	1
combat_arms	234003	0.3357	0.4722	0	1
aviation_community	234003	0.0839	0.2773	0	1
mfr	234003	0.0535	0.2250	0	1
female	234003	0.0496	0.2171	0	1
child1_plus	234003	0.3103	0.4626	0	1
married	234003	0.4475	0.4972	0	1
divorced	234003	0.0565	0.2308	0	1
black	234003	0.0959	0.2944	0	1
pacificislander	234003	0.0030	0.0545	0	1
asian	234003	0.0246	0.1550	0	1
nativeamerican	234003	0.0095	0.0970	0	1
age	232052	27.7000	4.0200	21	55.71
d03	234003	0.1723	0.3777	0	1
d04	234003	0.1527	0.3597	0	1
d05	234003	0.1438	0.3509	0	1
d06	234003	0.1232	0.3287	0	1
d07	234003	0.1162	0.3205	0	1
d08	234003	0.1327	0.3393	0	1
pre_9_11	234003	0.1865	0.3895	0	1
obs_PS	234003	16.7600	14.9400	1	99

Table 8. Descriptive Statistics, Prior RC Service SMCR, E3–E5 (All Observations)

Variable	N	Mean	sd	Min	Max
ret_12mos_PS	56418	0.6383	0.4805	0	1
mob1	56418	0.4811	0.4996	0	1
mob2	56418	0.1342	0.3409	0	1
mob3	56418	0.0143	0.1187	0	1
mos_mob_prior	56418	8.1550	8.3700	0	62
oconus_dep	56418	0.5406	0.4984	0	1
unemployment	56123	5.2600	1.0940	2.2	11.4
afqt	52277	67.5300	18.7000	30	99
bonus	56418	0.0022	0.0468	0	1
bonus_fy06plus	56418	0.0005	0.0223	0	1
prof_svc	55485	0.5032	0.1297	0	0.9
con_service	55481	0.5036	0.1339	0	0.9
rifle_score	55752	4.0250	0.7709	0	5
pft_score	53667	4.4510	0.3723	3	5
bst	54604	44.8400	5.0900	14	50
wsc_advanced	56418	0.0086	0.0925	0	1
unexcuse_12_mo	56418	0.6764	3.7140	0	48
SMCR_break_PS_gt1	56418	0.1336	0.3403	0	1
satyrs	49438	6.2760	2.0990	3	14
cpl	56418	0.2925	0.4549	0	1
sgt	56418	0.5091	0.4999	0	1
combat_arms	56418	0.4125	0.4923	0	1
aviation_community	56418	0.0575	0.2328	0	1
mfr	56418	0.0430	0.2029	0	1
female	56418	0.0320	0.1759	0	1
child1_plus	56418	0.2421	0.4284	0	1
married	56418	0.3740	0.4839	0	1
divorced	56418	0.0298	0.1699	0	1
black	56418	0.0765	0.2658	0	1
pacificislander	56418	0.0037	0.0609	0	1
asian	56418	0.0213	0.1443	0	1
nativeamerican	56418	0.0076	0.0871	0	1
age	54963	26.9100	3.6770	21	48.66
d03	56418	0.1464	0.3535	0	1
d04	56418	0.1502	0.3573	0	1
d05	56418	0.1436	0.3507	0	1
d06	56418	0.1369	0.3437	0	1
d07	56418	0.1555	0.3624	0	1
d08	56418	0.1794	0.3837	0	1
pre_9_11	56418	0.1039	0.3052	0	1
obs_PS	56418	16.9600	14.3700	1	96

Table 9. Descriptive Statistics, Prior AC Service SMCR, E3–E5 (All Observations)

Variable	N	Mean	sd	Min	Max
ret_12mos_PS	156473	0.5192	0.4996	0	1
mob1	156473	0.3373	0.4728	0	1
mob2	156473	0.0319	0.1757	0	1
mob3	156473	0.0017	0.0414	0	1
mos_mob_prior	156473	3.5840	6.1050	0	53
oconus_dep	156473	0.2506	0.4334	0	1
unemployment	156267	5.4550	1.0100	2.2	11.4
afqt	147435	58.5900	18.2000	30	99
bonus	156473	0.0274	0.1633	0	1
bonus_fy06plus	156473	0.0074	0.0856	0	1
prof_svc	153369	0.5237	0.1220	0	0.9
con_service	153369	0.5076	0.1380	0	0.9
rifle_score	153549	4.1660	0.6812	0	5
pft_score	149094	4.4810	0.3588	3	5
bst	150308	44.7300	5.0160	12	50
wsc_advanced	156473	0.0148	0.1209	0	1
unexcuse_12_mo	156473	0.7947	3.6160	0	48
SMCR_break_PS_gt1	156473	0.1321	0.3386	0	1
satyrs	146964	5.9520	1.6020	3	14
cpl	156473	0.2939	0.4555	0	1
sgt	156473	0.6544	0.4756	0	1
combat_arms	156473	0.3039	0.4599	0	1
aviation_community	156473	0.0922	0.2893	0	1
mfr	156473	0.0557	0.2293	0	1
female	156473	0.0593	0.2362	0	1
child1_plus	156473	0.3036	0.4598	0	1
married	156473	0.4430	0.4967	0	1
divorced	156473	0.0600	0.2375	0	1
black	156473	0.1009	0.3012	0	1
pacificislander	156473	0.0031	0.0553	0	1
asian	156473	0.0270	0.1621	0	1
nativeamerican	156473	0.0105	0.1020	0	1
age	155977	26.9800	2.9560	21	43.96
d03	156473	0.1747	0.3798	0	1
d04	156473	0.1505	0.3576	0	1
d05	156473	0.1442	0.3513	0	1
d06	156473	0.1211	0.3263	0	1
d07	156473	0.1082	0.3106	0	1
d08	156473	0.1274	0.3335	0	1
pre_9_11	156473	0.2019	0.4014	0	1
obs_PS	156473	16.1900	14.8900	1	98

F. CHAPTER SUMMARY

In this chapter, we reviewed four model specifications and three different tour lengths for multivariate analysis using the standard normal cumulative distribution function, probit. The first model focuses on the primary research question, "what is the impact of activation on continuation rates for prior service SMCR unit personnel in the ranks of lance corporal through sergeant" and on the secondary research question regarding the effect of monetary incentives on continuation. The second model will be used to identify other significant predictors of continuation. The third and fourth models estimate these effects separately for prior RC and prior AC sub-groups. Lastly, this chapter reviewed the dependent variable, 12-month continuation rates, the hypothesized effects of the explanatory variables, and presented cross-tabulations of select variables. The next chapter provides the results of the multivariate analysis followed by the conclusion and recommendations for future research.

VII. RESULTS OF THE ANALYSIS

A. OVERVIEW

The inverse cumulative distribution function (probit) regression model was used to estimate the effects of activation and monetary incentives on continuation. Demographics, state-level employment conditions, ability, and fiscal year effects were used as controls for the first model. Although not the primary focus of research, a second model was generated to identify the effects of military knowledge, skills and abilities (KSA), and military experience. The second model provides a starting point for additional research in predicting prior service continuation rates and non-prior service attrition rates for the Selected Marine Corps Reserve (SMCR) via service-specific approaches not discussed during the literature review. The third and fourth models were introduced to estimate changes to the effects of activation and monetary incentives by military experience (prior Reserve Component [RC] and active component [AC]). Table 10 summarizes the goals and key explanatory variables in the four models employed in this analysis.

Table 10. Summary of Empirical Models

Model	Purpose	Key Variables	Controls
1	Estimate effect of activation and monetary incentives.	Activation (frequency, length, and location), monetary incentive (bonus and payment method.)	Unemployment rate, ability, demographics, rank, and fiscal years.
2	Identify SMCR-specific predictors of continuation.	Military experience (prior service, prior tours, general MOS categories), performance (proficiency and conduct), KSA (testing and evaluations).	Model 1 variables.
3 & 4	Identify systematic differences for prior RC (Model 3) and AC (Model 4)	Same as above.	Model 2 variables[123]

[123] Table 6 lists several omitted variables due to insufficient observations.

For the multivariate analysis, I used pooled cross-sectional data to maximize the number of observations and then estimated 12-month continuation rates for prior service SMCR at various tour length intervals (4-, 12-, and 24-months). The purpose of this chapter is to review the overall model validity, to interpret the effects of the focus variables and control variables, to analyze potential policy implications, and to discuss the model limitations and areas for further research. We will begin by evaluating model goodness of fit.

B. OVERALL MODEL ASSESSMENT

1. Likelihood Ratio Test

The likelihood ratio test (LR test) is used to determine if the *unrestricted* fitted model is a statistically significantly better fit than the *null* model, which contains only the intercept β_0. The test statistic is twice the difference of the *unrestricted* $\mathcal{L}_{ur}$ and *null* log likelihoods, $\mathcal{L}_0$, approximated using a chi-square (χ^2) distribution.[124] As the p-values in Table 11 show, *Models 1–4* are found to be statistically significant at the .01 level. Based on this test, we reject the null hypothesis and conclude that at least one of the explanatory variables in each model helps to explain 12-month continuation rates better than the *null* model with only an intercept β_0.

[124] Wooldridge, *Introductory Econometrics*, 580.

Table 11. Comparison of Goodness of Fit (LR test and Pseudo R^2)

Model	Tour Length	Log Likelihood		χ^2	Degrees of Freedom	Prob > χ^2
		Null	Unrestricted			
1	4	-6,760	-6,957	394	27	0.0000
	12	-4,063	-4,168	212	27	0.0000
	24	-1,966	-2,028	124	27	0.0000
2	4	-5,686	-5,965	558	40	0.0000
	12	-3,356	-3,572	432	40	0.0000
	24	-1,703	-1,797	189	40	0.0000
3 (Prior RC)	4	-1,200	-1,257	113	34	0.0000
	12	-781	-837	113	34	0.0000
	24	-404	-461	115	34	0.0000
4 (Prior AC)	4	-4,445	-4,617	343	37	0.0000
	12	-2,529	-2,705	353	37	0.0000
	24	-1,242	-1,322	159	37	0.0000

2. Coefficient of Determination

Another method used to determine model validity is by determining how well the model predicts future outcomes. The coefficient of determination R^2 is a measure of the proportion of explained to total variance used in ordinary least squares (OLS) models. Since the probit model is estimated via maximum likelihood, a *pseudo* R^2 was calculated by subtracting the *unrestricted* log likelihood to *null* proportion from one as shown in equation 7:[125]

$$Psuedo\ R^2 = 1 - \mathcal{L}_{ur}/\mathcal{L}_0 \qquad (7)$$

Typically, *pseudo* R^2 values are lower for probit models than for OLS since log likelihoods are a measure of asymptotic probabilities and not a true measure of explanatory power. Moreover, the low *pseudo* R^2 values shown in Table 12, ranging from 0.025 to 0.125, are less important than the estimated coefficients, which will be used to predict the effects of the explanatory variables on continuation rates.

[125] Wooldridge, *Introductory Econometrics*, 581.

Table 12. Pseudo R^2 values for Models 1–4

Model	1			2			3 (Prior RC)			4 (Prior AC)		
Tour Length	4	12	24	4	12	24	4	12	24	4	12	24
Pseudo R^2	0.0283	0.0254	0.0306	0.0468	0.0605	0.0525	0.0449	0.0675	0.125	0.0371	0.0651	0.06

3. Classification Table

The third common measure of model validity is the classification table. This index measures the percent correctly classified based on a probability criteria of 0.50. As shown below, the percent correctly classified ranges from 58 to 72 percent for observed continuation probabilities of 48 to 67 percent for the different models and tour lengths. "Sensitivity" and "specificity" are measures of accuracy for occurrence and non-occurrence of each event. In this case, "sensitivity" measures how accurately the model predicted continuation for those observed to continue, while "specificity" measures how accurately the model predicted loss for those observed to leave the SMCR units within the 12-month period. Although the model does not perform well as a predictor of individual behavior, the purpose of the model is to predict the effects of activation and monetary incentives, while holding constant other predictors of continuation. As such, marginal classification effectiveness is not a large concern.

Table 13. Classification Table for Models 1–4

Model	Tour Length	Observed Probability	Correct		Incorrect		Correctly Classified	False Positive	False Negative	Sensitivity	Specificity
			Continue	Leave	Continue	Leave					
1	4	48.69%	2233	3610	1543	2656	58.19%	40.86%	42.39%	45.67%	70.06%
	12	53.6	2346	1165	1636	890	58.16%	41.08%	43.31%	72.50%	41.59%
	24	59.20%	1562	273	951	214	61.17%	37.84%	43.94%	87.95%	22.30%
2	4	47.22%	1922	3257	1295	2151	60.05%	40.25%	39.77%	47.19%	71.55%
	12	53.15%	2079	1163	1258	668	62.73%	37.70%	36.48%	75.68%	48.04%
	24	59.71%	1350	334	740	242	63.17%	35.41%	42.01%	84.80%	31.10%
3 (RC)	4	60.99%	1002	166	567	144	62.16%	36.14%	46.45%	87.43%	22.65%
	12	62.45%	713	128	347	77	66.48%	32.74%	37.56%	90.25%	26.95%
	24	67.89%	463	69	167	36	72.38%	26.51%	34.29%	92.79%	29.24%
4 (AC)	4	43.39%	891	3159	660	2039	60.04%	42.55%	39.23%	30.44%	82.72%
	12	50.14%	1404	1030	916	553	62.36%	39.48%	34.93%	71.40%	52.93%
	24	56.60%	872	329	509	221	62.20%	36.86%	40.18%	79.78%	39.26%

C. INTERPRETATION AND EVALUATION OF COEFFICIENTS

In this section, I will review the multivariate analysis results for each of the 40 explanatory variables discussed above in Chapter VI. Additionally, I will compare each model and discuss the differences that result from the four specifications and the three different tour lengths. In this regard, more emphasis will be given towards the prior RC (Model 3) and prior AC (Model 4) due to both hypothesized and estimated systematic differences in behavior. In the subsequent section, I will more closely examine the effects of activation and monetary incentives, apply them to notional Marines, and provide some policy applications. Marginal effects (computed at the mean) for key variables by model and tour length are provided in Tables 14–16. The full regression results to include coefficients, mean values, and z-stats are provided in Appendices 42–53.

Table 14. Results of Probit Continuation Model: Marginal Effects (4 months)

Variable	Model 1	Model 2	Model 3 (RC)	Model 4 (AC)
mob1	0.1078***	0.0984***	0.0779**	0.0909***
mob2	0.1428***	0.1493***	0.1256***	0.0818
mob3	0.2785***	0.292***	0.2519***	
mos_mob_prior	0.005***	0.0013	-0.0014	0.0054
oconus_dep	-0.0465***	-0.0915***	-0.0589*	-0.1275***
unemployment	0.0161	0.0182***	0.0324**	0.015**
afqt	0.0009***	-0.0001	-0.0008	0.0002
bonus_fy06plus	0.2826***	0.3136***		0.3504***
bonus	0.0709*	0.0874**		0.0828**
nativeamerican	0.0079	0.0221		0.0307
asian	-0.0238	-0.0266	-0.0859	-0.0049
black	-0.0082	0.0127	0.0913**	-0.0046
pacificislander	0.0569	0.0025		
female	-0.0414*	-0.0576**	-0.1498**	-0.0449*
child1_plus	-0.0020	-0.0034	0.0317	-0.0196
married	-0.052***	-0.0327**	-0.0591**	-0.0221**
divorced	-0.0083	0.0150	0.0544	0.0063
age	0.0026	-0.0030	-0.0121***	0.0015
cpl	-0.1855***	-0.0828***	-0.2381***	-0.0047
sgt	-0.1809***	-0.1009***	-0.1965***	-0.0289
pre_9_11	-0.0558*	-0.0725**	-0.1899	-0.065*
d03	0.0454**	0.0332*	0.0354	0.0276*
d04	0.0298	0.0319	0.0662	0.0223
d05	-0.0289	-0.0350	0.0072	-0.0478**
d06	-0.0106	-0.0232	0.0166	-0.027
d07	-0.0160	-0.0208	0.0646	-0.0463*
d08	-0.042**	-0.044**	0.0549	-0.0736***
prof_svc		-0.0680	-0.0494	-0.0877
con_service		0.1659**	0.3597*	0.1139
rifle_score		-0.0046	0.0307*	-0.0202**
pft_score		0.0344**	0.0681**	0.0223
bst		-0.0009	0.0009	-0.0015
wsc_advanced		0.0117		0.0118
unexcuse_12_mo		-0.0327***	-0.0168**	-0.0375***
satyrs		0.0096*	0.0012	0.015**
true_reserve		0.1506***		
SMCR_break_PS_gt1		0.0566***	0.0599*	0.0522**
combat_arms		0.0314**	0.0225	0.0318**
aviation_community		0.0515	0.0238	0.0496**
mfr		0.1497***	0.1015*	0.1604***
ret_12mos_PS	0.4869	0.4722	0.6099	0.4339
Observations	10,042	8,625	1,879	6,746

***Coefficient is significant at 1-percent or better
**Coefficient is significant at 5-percent or better
*Coefficient significant at 10-percent or better

Table 15. Results of Probit Continuation Models: Marginal Effects (12 months)

Variable	Model 1	Model 2	Model 3 (RC)	Model 4 (AC)
mob1	0.1202***	0.1114***	0.0529	0.1998***
mob2	0.2581***	0.2512***	0.1209*	0.3573***
mob3	0.3262***	0.3392***	0.1688	
mos_mob_prior	-0.0097***	-0.0158***	-0.0095***	-0.0288***
oconus_dep	-0.0971***	-0.1207***	0.0111	-0.1681***
unemployment	0.0035	0.0077	0.0154	0.0057
afqt	0.0017***	0.0004	0.0007	0.0003
bonus_fy06plus	-0.1559	-0.0947		-0.1207
bonus	0.1272***	0.1695***		0.1879***
nativeamerican	-0.1043	-0.0797		-0.0313
asian	-0.0687*	-0.0517	-0.1319	-0.0267
black	0.0048	0.0334	0.0396	0.0268
pacificislander	0.1127	0.1473		
female	-0.0687**	-0.0867***	-0.1788**	-0.0681*
child1_plus	0.0347**	0.0365*	0.0627*	0.0272
married	-0.0519***	-0.0506***	-0.0213**	-0.0591***
divorced	-0.0046	0.0106	0.0236	0.0056
age	-0.0046**	-0.007**	-0.0146***	-0.0009
cpl	-0.1618***	-0.1388***	-0.253***	-0.0631
sgt	-0.1095***	-0.117***	-0.2979***	-0.0278
pre_9_11	-0.0235	-0.0231	-0.1594	-0.0189
d03	-0.0812**	-0.0985***	-0.1456	-0.0994**
d04	-0.0290	-0.0582	-0.1374	-0.0521
d05	-0.1181***	-0.1246***	-0.2371*	-0.1029**
d06	-0.0748*	-0.085**	-0.1577	-0.078*
d07	-0.0616	-0.0675	-0.0906	-0.0817*
d08	-0.0228	-0.0309	-0.0458	-0.0593
prof_svc		0.0400	0.1919	0.0075
con_service		0.0314	-0.1032	0.0304
rifle_score		0.0146	0.0192	0.0131
pft_score		0.0399*	0.0594	0.034
bst		0.0007	-0.004	0.0022
wsc_advanced		0.0425		0.0626
unexcuse_12_mo		-0.0266***	-0.0341***	-0.026***
satyrs		0.0094	0.008	0.019**
true_reserve		0.1753***		
SMCR_break_PS_gt1		0.042*	0.0859***	0.0322
combat_arms		0.0056	-0.0314	0.0111
aviation_community		0.0417	0.0247	0.0304
mfr		0.0318	-0.0398*	0.0476
ret_12mos_PS	0.5360	0.5315	0.6245	0.5014
Observations	6,037	5,168	1,265	3,903

***Coefficient is significant at 1-percent or better
**Coefficient is significant at 5-percent or better
*Coefficient significant at 10-percent or better

Table 16. Results of Probit Continuation Model: Marginal Effects (24 months)

Variable	Model 1	Model 2	Model 3 (RC)	Model 4 (AC)
mob1	0.1588***	0.1588***	0.2391***	0.1402***
mob2	0.292***	0.2917***	0.3024***	0.2392***
mob3	0.3279*	0.2977*	0.28**	
mos_mob_prior	-0.012***	-0.0133***	-0.018***	-0.0135***
oconus_dep	-0.0872***	-0.1169***	-0.1355**	-0.1251***
unemployment	-0.0011	0.0019***	-0.0044	0.0079
afqt	0.0006	-0.0003	0.0012	-0.001
bonus_fy06plus	-0.0879	-0.0790		-0.0339
bonus	0.0076	0.0712		0.0751***
nativeamerican	0.1223	0.1424		0.1204
asian	0.0233	0.0501	0.1197	0.0076
black	-0.0092	-0.0083	0.1141*	-0.0644
pacificislander	0.1188	0.1602		
female	-0.1308***	-0.1372***	-0.127	-0.1396**
child1_plus	-0.0032	0.0099	0.092*	-0.0387
married	-0.0154	-0.0075	-0.0677	0.0224
divorced	-0.1077**	-0.0893*	-0.1123	-0.0909*
age	-0.009***	-0.0114***	-0.0222***	-0.0017
cpl	-0.094**	-0.0777	-0.2528***	0.1696**
sgt	-0.0444	-0.0132	-0.178**	0.2377***
pre_9_11	0.1749***	0.1608	0.0806	0.1703***
d03	-0.0199	-0.0223	0.0756	-0.0368
d04	0.1067*	0.0764	0.0665	0.0913
d05	0.1345**	0.0946	0.1433*	0.0851
d06	0.1187**	0.0982	0.1654	0.0718
d07	0.118*	0.0890	0.1404	0.0839
d08	0.0890	0.0581	0.2679**	-0.05
prof_svc		0.1517	0.9015***	-0.1084
con_service		-0.1370	-0.6318*	-0.0393
rifle_score		0.0213	0.013	0.0228
pft_score		0.0322	0.0396	0.0301
bst		0.0019	0.0034	0.0026
wsc_advanced		-0.0905		-0.1503*
unexcuse_12_mo		-0.013***	0.0209	-0.0139***
satyrs		-0.0036	-0.0084	0.0119**
true_reserve		0.1478***		
SMCR_break_PS_gt1		0.06*	0.0496	0.0702*
combat_arms		0.0224	0.0205	0.0176
aviation_community		0.0120	0.1558**	-0.0414
mfr		0.0888	0.087	0.0863*
ret_12mos_PS	0.5920	0.5970	0.6789	0.5660
Observations	3,000	2,666	735	1,931

***Coefficient is significant at 1-percent or better
**Coefficient is significant at 5-percent or better
*Coefficient significant at 10-percent or better

1. Activation

As discussed above in Chapter VI, activation was measured along several dimensions: cumulative frequency, length, and location. Using multivariate analysis, these effects were separated and the independent estimated parameters are shown in Tables 14–16. Our hypothesis was that activation would have a positive effect on continuation, while length would have a negative effect. Consequently, the net effect could be positive for shorter activations and negative for longer activations. The continuation effect of deploying OCONUS was ambiguous a priori.

As shown in Figure 21, all four models support the positive effect of activation frequency on continuation, though the effect of *mob2* is not statistically significant at four months (Model 4) and *mob1* and *mob3* are not statistically significant at 12 months (Model 3). The parameter estimates that are statistically significant range from 7.8 to 35.7 percentage points depending on the model and tour length with the majority of effects statistically significant at the .01 level of statistical significance. Given that the preponderance of prior AC SMCR service members have not activated in the RC during the first four months after initial join, the lack of statistical significance of *mob2* using the 4-month model is not unexpected. In general, prior RC have higher estimated positive effects of activation frequency at 4- and 24-month tour lengths, but lower than prior AC at the 12-month tour length.

Our hypothesis that cumulative activation length has a negative effect on 12-month continuation rates is overwhelmingly supported for both the 12- and 24-month models at the .01 level of statistical significance. Effects range from approximately a 1.0 to 2.8 percentage point decrease in continuation rates per month of activation computed at the mean. Conversely, the 4-month model does not show a statistically significant effect of cumulative activation, except in Model 1 (which is a positive 0.5 percentage points per month at the mean). Although this is in contrast to our expectation, the positive effect at four months is plausible given that Marines have recently made the decision to join or potentially stay (in the case of prior RC) and it is less likely that they would leave the SMCR soon thereafter, without a substantial change in the environment.

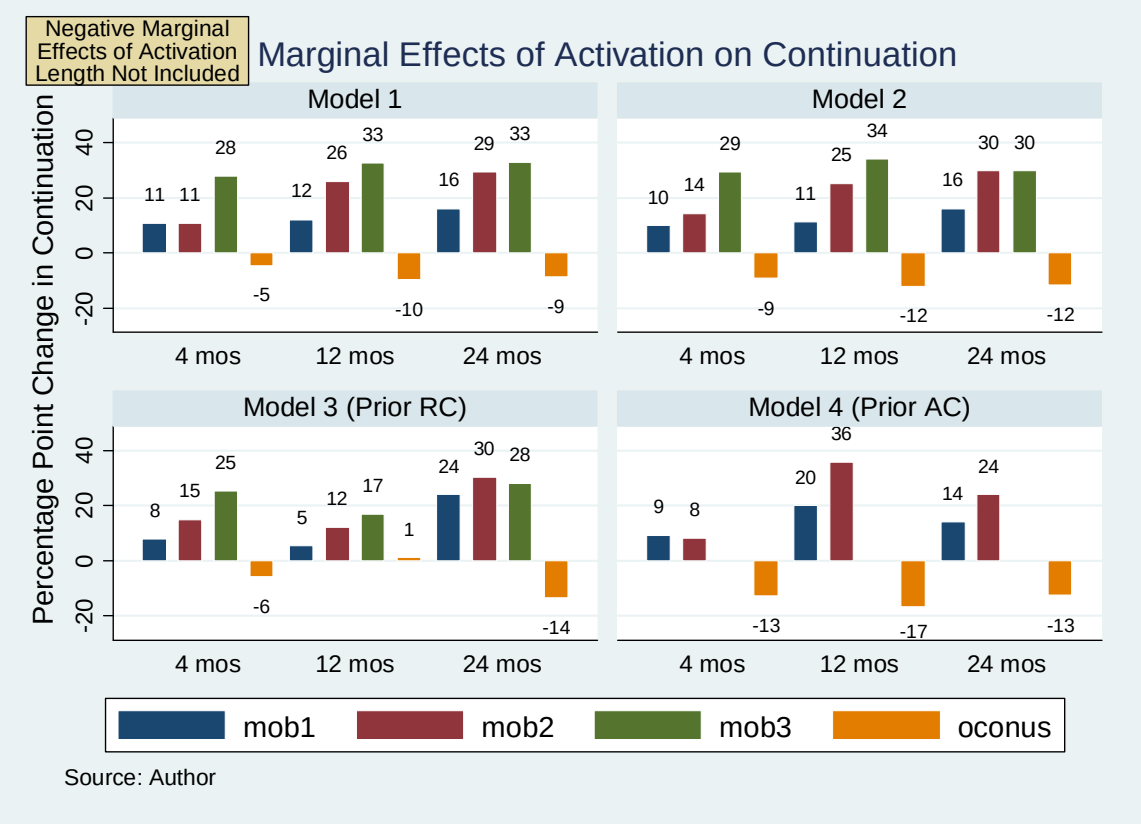

Figure 21. Summary of Marginal Effects of Activation by Model and Tour Length

With the exception of the 12-month prior RC model, the effect of deploying outside the continental U.S. (OCONUS) is statistically significant and negative, as shown in Figure 21. Depending on the model and tour length, the empirically estimated effect ranges from -4.6 to -16.8 percentage points. Thus, the evidence suggests that deploying OCONUS has a moderately large negative impact on continuation rates. This finding is consistent with our discussion of deployments in Chapter III; wherein, the incentive to deploy OCONUS based on career aspirations, credibility, and recognition is diminished after completing a prior deployment to a hostile fire location.

Given the independent effects of activation, the results are also consistent with the Expected Utility of Deployment model. Service members expect to be activated and deployed as part of their career choice. The net effects demonstrate decreasing marginal returns, and at some length, the net effect can become negative, indicating the service member's expectations are well-exceeded.

Although our specifications focus more narrowly on prior service SMCR than the models previously discussed in the literature review, the empirically determined relationships are consistent with results in the prior literature. However, some caution is necessary concerning the increased positive effects of mobilization frequency. Although Figure 21 shows an increase ranging from 12 to 23 percentage points between *mob1* and *mob3*, the overall net effect of activation includes decreasing returns due to activation length. More importantly, there is some potential for self-selection bias. For instance, those who desire a greater level of active duty could be volunteering for activation with other units. In this scenario, the increased effect might be indicative of those who have revealed this preference, as opposed to the prior service SMCR population as a whole.

2. Unemployment

In accordance with the ACOL model, we expected 12-month continuation rates to increase with unemployment. As shown in Table 14, this hypothesis is supported in Models 2–4 at the .05 level of statistical significance. The prior AC estimated effect is 1.5 percentage points for every one percentage point increase in the unemployment rate. This is consistent with historical estimates of 1.3 to 1.7 percentage points, which did not account for differences in prior military experience.

The much larger estimate of the effect of unemployment of 3.2 percentage points for prior RC is possibly the result of differences in career patterns and timing. For instance, prior RC are more likely to have recently transitioned from an obligor status. Thus, the prior RC SMCR service members are more heavily impacted by unemployment on the decision to leave, whereas the prior AC SMCR service members are less affected, given their recent decision to join the SMCR units.

With some exceptions, the unemployment rate does not appear to be a significant predictor of continuation in the 12- and 24-month models. Still, this result is consistent with our discussion of tour lengths and diminishing marginal effects as an SMCR unit career preference is potentially revealed.

3. Ability

As predicted, the effect of the Armed Forces Qualification Test (AFQT) as a proxy for ability is ambiguous in Table 6. As indicated in Figures 14–16, the *afqt* variable is significant in only one of the 12 models (Model 1, 4 months). However, even in this model, the size of the marginal effect requires an 11-point change in average AFQT scores to increase continuation rates by one percentage point. As such, AFQT does not appear to be an important predictor of average 12-month continuation rates for the entire prior service population.

4. Monetary Incentives

Monetary incentives in the form of affiliation and reenlistment bonuses are hypothesized to have a large positive effect on 12-month continuation rates. In addition, we hypothesized a larger magnitude for *bonus_fy06plus* due to the combined effect of a lump sum payment and increased payment amount. However, due to the limited number of prior RC service members who accepted a bonus (Model 3), we were only able to estimate the impact of monetary incentives on the prior AC SMCR unit population.

These hypotheses are overwhelmingly supported by the four-month parameter estimates as shown in Table 14. Figure 22 summarizes the effects of monetary incentives. Figure 22 includes only Model 4 results, but the estimated relationships and magnitude of effects are relatively consistent across all three models. The net effect for *bonus_fy06plus*, includes both the *bonus* effect combined with the effects of a lump sum and increased monetary amounts. This estimate (net effect) ranges from 35.4 to 43.3 percentage points for the four-month models. The effect of the *bonus* alone is significantly smaller at 7.1 to 8.7 percentage points.

Although not statistically significant, the negative relationship in Tables 15 and 16 between a lump sum payment (positive net) for the 12- and 24-month models is plausible. The incentive to receive future installment payments might outweigh the potential concern of paying back a bonus in the 12-month model. Moreover, the 24-month model is representative of prior service SMCR who have completed their three-year participation requirements. We might anticipate a higher percentage of these

Marines to depart the SMCR after having delayed a career decision until completion of their obligation. However, this hypothesis is not supported by the data as the net effects are generally positive in nature, though not statistically significant; thus potentially demonstrating a lingering bonus effect in the out-years.

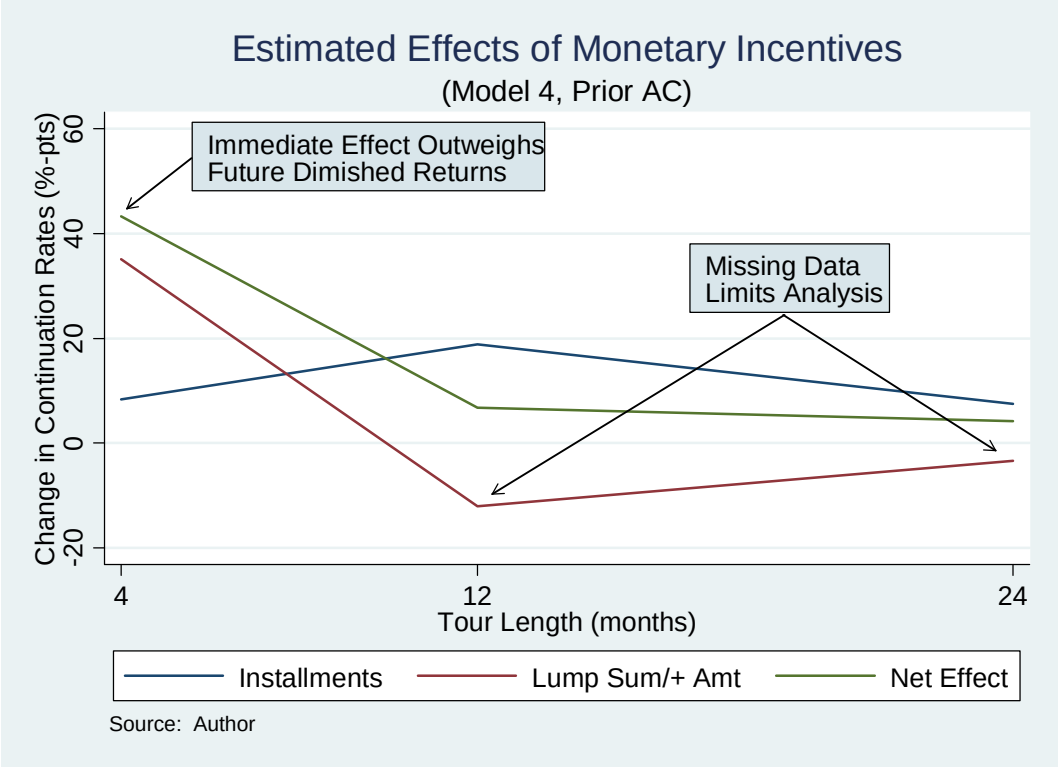

Figure 22. Parameter Estimates of Monetary Incentives

In the 24-month model, a positive lingering effect of monetary incentives, based on the coefficient of *bonus* in Model 4, could potentially signify two different hypotheses. One potential conclusion is that prior service SMCR who accept monetary incentives are revealing a tendency to pursue a reserve career. Thus, the monetary incentive becomes a proxy for and/or is positively biased by the omitted variable "career aspiration."

However, a monetary incentive might also serve to increase an SMCR member's service time to a point where the net present value of future military income exceeds that of his civilian career opportunity costs. This might result from several different factors.

For example, an individual might forego certain financially advantageous civilian career paths in lieu of accepting a more attractive bonus. Three years later, these civilian careers opportunities may have expired or decreased in value. Alternatively, economic conditions could deteriorate and reduce the estimated net present value of civilian career opportunities. Changes in the service member's military career can also occur. For instance, promotion to the rank of sergeant or staff non-commissioned officer (SNCO) may positively affect career aspirations and decrease the net preference for civilian life.

Another important factor to consider is the long-term effects of an initial increase in continuation rates, which can be easily misinterpreted in Figure 22. At first glance, it would appear than a bonus has a larger impact at 24 months based on the 12-month tour length continuation rates than that of the *bonus_fy06plus*. However, the cumulative effect is based on survival to the next period of observation.

Consequently, if the initial estimated net *bonus_fy06* effect is 40 percentage points and the net effect 12 months later is 5 percentage points over a stable baseline continuation rate of 50 percent, the cumulative 24-month effect is 24.5 percent of the original sample. Conversely, if the original estimated *bonus* effect was 10 percentage points and increased to 20 percentage points at the 12-month estimate, then the cumulative 24-month effect is 17 percent (7.5 percent lower than *bonus_fy06* effect).[126] Thus, using this hypothetical example, we can demonstrate that the 12- and 24-month net effects shown in Figure 22 can be deceiving and lead the casual observer to an erroneous conclusion. We will revisit this issue later in this chapter to estimate the cost-effectiveness of monetary incentives in terms of additional man-days and reinforce the principle of larger up-front effects.

As a word of caution, complete analysis of the *bonus_fy06* effect in the 12- and 24-month models is inconclusive without additional data.[127] Thus, our discussion

[126] Note: (100 * 0.5 * 0.5)–(100 * .9 * .55) = 24.5 percent of the original sample. Whereas, (100 * 0.5 * 0.5)–(100 * .6 * 0.7) = 17 percent of the original sample.

[127] As previously mentioned, the 24- and 36-month outcomes cannot be tracked with available FY08 data. Limited observations from FY06 and FY07 reduce the probability of a statistically significant outcome.

beyond the 4-month models is hypothetical and advanced for the purpose of identifying future research issues. On the other hand, the estimate of *bonus* using the 12-month models is statistically significant and conclusive based on FY02–FY05 data.

5. Person-job Fit

The person-job fit explanatory variables discussed above in Chapter VI can be divided into three main areas: (1) proficiency and conduct, (2) technical competence and physical ability, and (3) drill participation.

a. Proficiency and Conduct

Prof_svc does not appear to be a significant predictor of continuation, which is consistent with the hypothesis in Table 6. However, in the 4-month models, there is some evidence to suggest that conduct marks positively affect continuation. Nonetheless, changes in service average conduct scores are unlikely to vary by more than 0.01 points as shown in Tables 7–9. Therefore, the magnitude of this effect at the mean, regardless of significance, would not be greater than 0.36 percentage points and is likely much lower.

Consequently, neither proficiency, nor conduct scores are important predictors of continuation rates at the SMCR-level for prior service. In part, this ambiguity may be the result of service policies, which attempt to maintain a relatively static Reserve-wide average score; thus, absolute changes in the service-wide duty proficiency and conduct scores are unlikely.

Of concern is the magnitude and sign of these effects in the 24-month prior RC model, where a 1.0 increase in average conduct scores is estimated to be associated with a 63 percentage point decrease in continuation. Conversely, a 1.0 increase in average proficiency scores is estimated to have 90 percentage point increase in continuation. Although, this large of an increase in service average scores is not mathematically possible, these estimates suggest error in the sample, small cells, or correlation with an unobserved effect.

b. Technical Competence and Physical Ability

The variables *Rifle_score*, *pft_score*, *bst*, and *wsc_advanced* were hypothesized to be proxies for person-job fit. As discussed above in Chapter VI, the hypothesized effects of *rifle_score* and *bst* were ambiguous, while *pft_score* and *wsc_advanced* were hypothesized to have a positive effect on continuation rates. As discussed in Table 10, Models 2–4 were used to estimate these effects.

Rifle_score is not statistically significant at the 12- and 24-month tour lengths. However, the results are mixed for the 4-month length. Specifically, there is evidence to indicate a small positive effect on the prior RC continuation rates, and a strong negative effect on prior AC continuation rates. Both of these relationships are plausible given the systematic differences between the two populations. Similarly, the effect of *bst* is not statistically significant in any of the models. Therefore, the empirical evidence does not support rifle qualification scores or basic skills test (BST) as significant overall predictors of SMCR prior service continuation.

Although *pft* is significant in only three of the nine regressions, all estimates are positive and range from 2.2 to 6.8 percentage points. In particular, the effect is larger in the prior RC models than in the prior AC models. Given the fewer number of prior RC observations, it is possible that a larger dataset might find statistical significance for the prior RC model. As such, the physical fitness test score (PFT) appears to have some potential as a predictor of continuation, but requires additional research.

Lastly, our hypothesis that an advanced water survival qualification certification would positively affect continuation rates is not supported by multivariate analysis. In particular, limited occurrence in the prior RC population did not facilitate inclusion in Model 3. For the two models, which did include this factor, the results are positive, but not significant at 4 and 12 months. The estimated effects are negative and statistically significant at the .1 level for the prior AC model. Considering the infrequent

occurrence in the prior AC model (ranges from 42–96 observations), the estimated effects are inconclusive and it does not appear that advanced water survival qualifications are a significant predictor of continuation.

c. Drill Participation

Failure to attend required drill weekends is hypothesized to have a negative relationship with continuation rates. For instance, unexcused absences could signify an incongruence of Reserve participation and personal priorities due to family, civilian career, or strong personal preference for leisure. In each case, except the prior RC 24-month model, there is strong statistical evidence (at the .05 level or better) to support our hypothesis with estimates ranging from a -1.3 to a -3.8 percentage point difference in continuation rates.

6. Military Experience

Military experience variables can be categorized into prior experience, rank, occupational groupings, and years toward retirement. As summarized in Table 10, we hypothesized that prior experience would have a strong positive effect on continuation along with the occupational groupings of *combat_arms*, *aviation_community*, and *mfr*. The ranks of *cpl* and *sgt* were expected to have a negative concave effect compared with that of the omitted variable *lcpl*. Lastly, the effect of *satyrs* was ambiguous a priori.

a. Prior RC Experience and Multiple Tours

As shown in Figure 23, prior experience in the RC as an obligor is strongly associated with increased continuation. Specifically, estimated effects ranged from 14.8 to 17.5 percentage points across the three tour lengths and were statistically significant at the .01 level. Thus, there is overwhelming evidence to support our hypothesis that prior RC experience increases continuation rates due to a more realistic job preview.

This same relationship is also observed between multiple tours in the SMCR and continuation rates. The estimated effect ranges from 3.2 to 8.6 percentage points and is statistically significant in seven of the nine models. As such, strong evidence also exists to indicate that multiple tours is associated with higher continuation rates, potentially revealing an SMCR career preference.

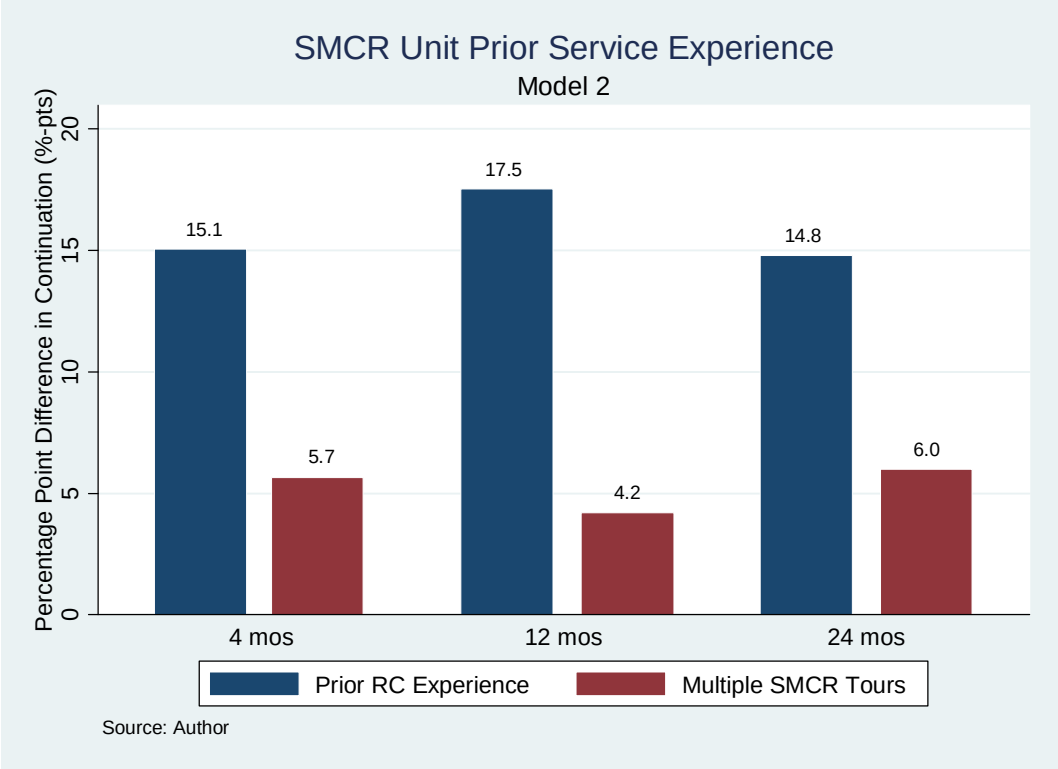

Figure 23. Effects of Prior RC Experience and Multiple Tours on Continuation

b. Occupational Groupings and Force-Level Units

Tables 14–16 show that, although the estimated signs are mainly consistent with the hypothesized effects, none of the variables *combat_arms*, *aviation_community*, and *mfr* are reliably associated with a positive effect on continuation rates. Though there is some evidence to support this hypothesis in the prior AC model, the results are not conclusive. Consequently, general occupational grouping and force-level units are not identified as significant predictors of continuation.

c. Rank

Our hypothesis that the rank of non-commissioned officer (NCO), particularly corporal is a decision point for SMCR unit prior service Marines is in part supported by the estimated parameters. However, there is also additional evidence of systematic differences between prior RC and AC SMCR service members as previously suggested. In the prior RC model, the estimated effects of corporal and sergeant have consistent, strong negative effects compared to the rank of lance corporal as shown in Figure 24. The estimated effects are statistically significant at the .01 level with parameters ranging from -23.8 to -25.3 percentage points for corporal and -17.8 to -29.8 percentage points for sergeant. However, additional research into the continuation rates of SNCO for prior RC SMCR unit service members is necessary to validate the hypothesis of career decision points and concavity.

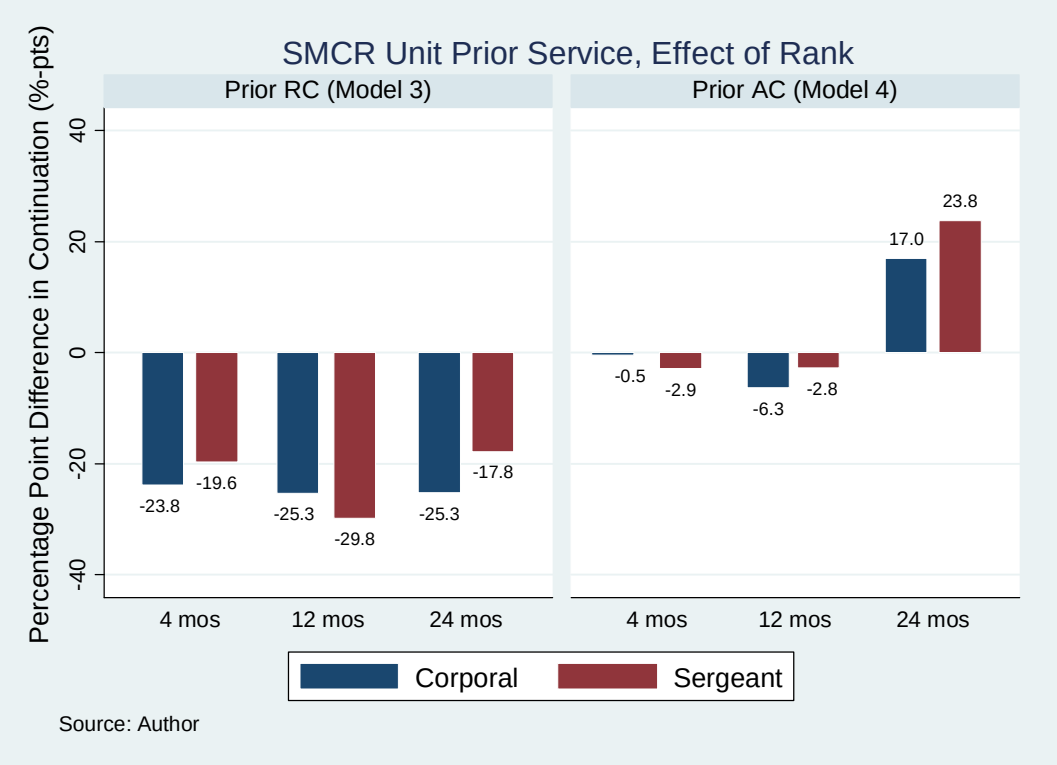

Figure 24. Comparison of Rank Effects on Continuation by Prior Experience and Tour Length

As shown in Figure 24, our hypothesis concerning the effect of rank is not supported for the prior AC SMCR unit members. Specifically, rank is estimated to be a statistically significant predictor of continuation in the 4- and 12-month models. However, given the recent career decision to affiliate with the SMCR for prior AC, it is not surprising that rank is initially insignificant. Moreover, the strong, positive effect of *cpl* and *sgt* in the 24-month prior AC model is most likely the result of a shrinking population of prior AC lance corporals (reduced from 691 to 81 during this period). Potentially, the remaining prior AC lance corporals have reached their terminal rank and thus depart the SMCR at a higher rate.

d. Satisfactory Years Toward Retirement

As with many of the explanatory variables discussed so far, there appears to be important differences between the effects of *satyrs* on continuation in the prior RC and AC models. However, this may be due to omitted variable bias. Specifically, retirement qualification is based on satisfactory years toward retirement; whereas, retirement pension amounts are calculated using the number of retirement qualifying points divided by 360, and then multiplied by 2.5 percent of the effective monthly base salary.

Prior AC Marines typically have at least 1,461 points upon entry into the RC and even more prior to joining the SMCR.[128] In contrast, prior RC Marines may have as few as 558 points for a 6x2 contract.[129] Thus, the variable *satyrs* is positively biased by the unobserved retirement credit points, which should have a positive effect on continuation due to the potential of an increased retirement pension. Specifically, the prior AC Model consistently estimates a 1.2 to 1.9 percentage point increase in continuation per additional retirement qualifying year, while the prior RC estimates are

[128] As discussed in Chapter II, service members receive one point per day of active duty. Consequently, successful completion of a 4-year active component enlistment results in 1,461 points.

[129] Assuming 13 weeks for recruit training, five weeks for Marine Combat Training, eight weeks for MOS school, 14 days of annual training, and 48 drills per year, a six-year obligation would result in at least 558 retirement points.

insignificant and of smaller magnitude. As such, the effect of retirement qualifying years is inconclusive and future research should include a variable for the omitted cumulative retirement credit points.

7. Demographics

Explanatory control variables for demographics included gender, race, marital status, children and age. For gender we hypothesized a negative continuation effect for females due to physiological differences, such as childbirth that might result in more career interruptions, as well as the traditional societal influences on career paths. Although we anticipated a negative effect of being married, we were unable to adequately form a hypothesis regarding the strength of this relationship without controlling for other demographic variables, such as gender, age, and number of dependents. The remaining variables were ambiguous a prior.

a. Gender: Female

As hypothesized, the effect of being female is consistently estimated to have a large negative effect on continuation as shown in Figure 25. All parameters are statistically significant except the 24-month prior RC model, which has consistently suffered from small numbers for several explanatory variables (N=27 females here, as shown in Appendix 26). Additionally, the prior AC model demonstrates that the magnitude of this relationship is increasing over time. As before, this trend most likely illustrates the difference between prior RC members who have previously served with the SMCR as an obligor and prior AC service members who have recently made the decision to join the SMCR.

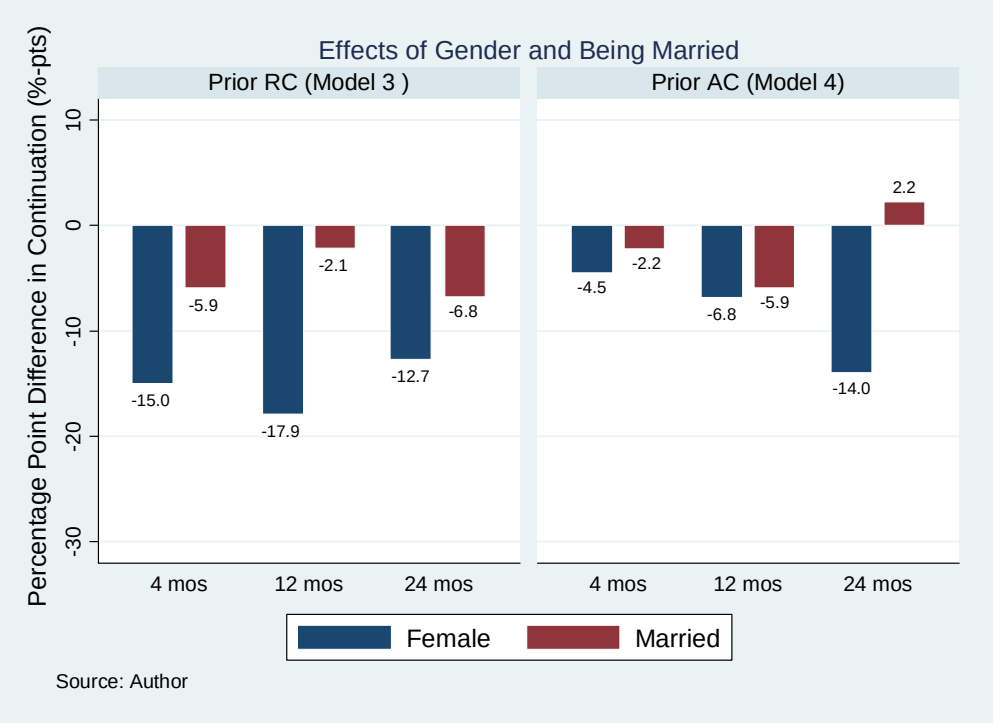

Figure 25. Comparison of Gender and Being Married by Prior Experience and Tour Length

b. Marital Status: Single, Married, Divorced

Marital status consists of the three states of single, married, and divorced with single represented by the omitted variable. Estimates for being married in the 4- and 12-month tour length models are consistently negative and statistically significant as shown in Figure 25 and Tables 14–16. However, this effect in the 24-month prior AC model reverses signs and is not significant. Thus, there is evidence to suggest that the spousal effect is greatest upon initial decision to join the SMCR, but loses value as a predictor as those with incongruent family lives transition away from the SMCR career path.

Being divorced demonstrates the opposite trend to that of being married. Although not a statistically significant predictor in the 4- and 12-month models, the estimated magnitude and significance increase over time. Specifically, the 24-month estimates range from negative 9.0 to negative 11.2 percentage points and are statistically

significant in three out of four models. As such, being divorced has potential as a predictor of continuation for longer tour lengths; however, additional research is required to both understand this phenomenon and validate its potential.

c. Number of Children

The effect of number of children on continuation is estimated to be positive for prior RC and is statistically significant in the 12- and 24-month models. The magnitude of this effect increases from 3.2 to 9.2 percentage points over the three tour lengths. In contrast, the effect of having children on the prior AC population is inconsistent and inconclusive. As with being divorced, this factor may be influenced by the timing of life-changing events for service members. One plausible explanation is that patterns for having children and/or getting divorced are more likely to occur several years into the tour length as opposed to during the period of initial join and/or transition to a non-obligor status. As such, further research into the area of tour lengths and the effects of children are necessary prior to determining the usefulness of this variable to predict prior service SMCR unit continuation rates.

d. Race/Ethnicity

The variable *black* for the prior RC model is the only explanatory variable that demonstrates any potential as a significant predictor of continuation in the race/ethnicity category. Although the categories of *asian*, *nativeamerican*, and *pacificislander* are inconclusive, they may also be impacted by their infrequent occurrence in the population as shown in Tables 7–9.

One potential explanation for the difference in estimated effects between the prior RC and AC models is the equality argument posited previously in the literature review. Specifically, prior AC members who have a strong preference for military service based on equal opportunity would have reenlisted and remained in the AC. Thus, those who are released from AC have different priorities or do not perceive the service as the preferred option in terms of equality. In contrast, minority prior RC service members might continue in the RC for the same argument as those AC members who opted to continue an AC career over discharge, for reasons of equal opportunity.

e. Age

Although no hypothesis was given with regards to age, the prior RC model consistently estimates a negative effect of age (statistically significant at the .01 level). The overall magnitude of this relationship is substantial and ranges from -1.2 to a -2.2 percentage points at the mean for a one-year increase in age. This relationship is consistent with the empirically estimated relationship for SMCR service members in the literature review.

The effect of age on the prior AC population remains ambiguous using Model 4. Specifically, the magnitude is near zero and switches signs across the three tour lengths. Although Models 1 and 2 estimate statistically significant negative parameters for age, the models likely suffer from omitted variable bias due to the systematic differences between the prior RC and AC populations discussed thus far in this chapter.

8. Fiscal Year Effects

The interpretation of fiscal year effects is problematic for a number of reasons. First and foremost, multiple environmental changes occur simultaneously, often across fiscal years. For instance, during FY2003, stop loss was implemented in conjunction with Operation Iraqi Freedom. Thereafter, public opinion towards American involvement in Iraq began to deteriorate.

Moreover, fiscal year effects can differ by both tour length and prior service category (RC versus AC). For instance, the 202k "Grow the Force" initiative offered large monetary incentives and expanded eligibility to the majority of prior service AC SMCR unit Marines. Consequently, this factor would negatively impact the prior AC 4-month, and to some extent the 12-month, models while having little effect on the 24-month models. As such, the 202k effect is supported by the statistically significant negative effects estimated in the prior AC 4-month model in contrast to the insignificant positive parameters estimated for the prior RC 4-month model.

However, trying to sort out and explain the multitude of fiscal year effects is pointless without a desired end result or hypothesis. In particular, it is first necessary to project a potential future event or environmental effect that could affect future year

continuation rates. Only then is it possible to attempt to isolate this effect in historical data through multivariate analysis. In this regard, the empirical results can then be applied to a predictive model in the form of sensitivity analysis.

In the remaining sections of this chapter, we review potential policy applications of the estimated effects of activation and monetary incentives. In addition, we summarize the advantages and disadvantages of each model, while determining if the coefficients in Models 3 and 4 are statistically different from each other.

D. BASE CASE COMPARISON AND POLICY IMPLICATIONS

In a probit regression model, the marginal effects for continuous variables are normally computed at the mean. However, the mean values are often unrealistic, so the median or other values are often used instead. Moreover, end strength planners are often concerned about the net effect of two different policies or changes in the values and distribution of predictors due to other factors. As an example, it would be more helpful for end strength planners to estimate the net effect of a 12-month activation in accordance with current policy than the marginal effect of increasing or decreasing cumulative activation by one month from the mean of 4.7 months in our data set (as shown in Table 7).

Using the models estimated in this chapter, we can estimate continuation rates at successive 12-month intervals based on a "baseline Marine" who represents *Policy A*, and a "notional Marine" who represents *Policy B*. The only difference in the values of explanatory variables for these two individuals will represent the shift in activation policy. Therefore, we can determine the difference in continuation rates at each 12-month interval for each policy. Using these 12-month continuation rates, we can then compute the successive survival rates at each 12-month interval as shown in equation 8:

$$Survival_{t+12} = Survival_t * 12\text{-month Continuate Rate}_t \quad (8)$$

For our analysis of activation, we will select common characteristics for prior RC and AC SMCR Marines as our baseline policy *Base* (no prior activations). We will compare the baseline Marine to a notional Marine who represents the change in policy

Mob A who activated once in accordance to the current 12-month activation policy. Thus, the coding of the relevant variables is: *Base: mob1 = 0, mos_mob_prior = 0; Mob A: mob1 = 1, mos_mob_prior = 12*. For reference purposes, a summary of the selected baseline and notional characteristics are shown in Table 17. The prior RC Marine continuation rate effects are estimated using Model 3 at 4-, 16-, and 38-month tour lengths, while the prior AC Marine continuation rate effects are estimated using Model 4 at these same tour lengths. For simplicity, we will keep *mob1* and *mos_mob_prior* constant for each tour length; however, we could also increase these values at each 12-month interval to reflect different activation timelines.

Our analysis of monetary incentives will be similar to that of activation, but will not include a prior RC SMCR baseline and notional Marine due to the issues previously discussed. The first notional Marine is coded as: *Bonus A: bonus = 1, bonus_fy06plus = 0*, which represents a 3-year installment bonus of up to $2500. The second notional Marine is coded as: *Bonus B: bonus = 1, bonus_fy06plus = 1*, which represents a 3-year lump-sum bonus and payment (which could range from $5,000 to $15,000, as shown in Table 5). Model 4 is used to estimate the effects at 4-, 16, and 38-months.

Table 17. Baseline and Notional Values for Policy Change Modeling

Variable	Prior RC		Prior AC			
	Base	***Mob A***	***Base***	***Mob A***	***Bonus A***	***Bonus B***
mob1	0	1	0	1	0	0
mob2	0	0	0	0	0	0
mob3	0	0	.	.	.	.
mos_mob_prior	0	12	0	12	0	0
oconus_dep	0	1	0	1	0	0
unemployment	5.3	5.3	5.3	5.3	5.3	5.3
Afqt	60	60	60	60	60	60
prof_svc	0.5	0.5	0.5	0.5	0.5	0.5
con_service	0.5	0.5	0.5	0.5	0.5	0.5
rifle_score	4.1	4.1	4.1	4.1	4.1	4.1
pft_score	4.5	4.5	4.5	4.5	4.5	4.5
Bst	45	45	45	45	45	45
wsc_advanced	.	.	0	0	0	0
unexcuse_12_mo	0	0	0	0	0	0
Satyrs	6	6	5	5	5	5
SMCR_break_PS_gt1	0	0	0	0	0	0
bonus_fy06plus	.	.	0	0	0	1
Bonus	.	.	0	0	1	1

Variable	Prior RC		Prior AC			
	Base	***Mob A***	***Base***	***Mob A***	***Bonus A***	***Bonus B***
nativeamerican	.	.	0	0	0	0
Asian	0	0	0	0	0	0
Black	0	0	0	0	0	0
Female	0	0	0	0	0	0
child1_plus	0	0	0	0	0	0
Married	0	0	0	0	0	0
divorced	0	0	0	0	0	0
Age	26.5	26.5	26.5	26.5	26.5	26.5
Cpl	1	1	1	1	1	1
Sgt	0	0	0	0	0	0
combat_arms	0	0	0	0	0	0
aviation_community	0	0	0	0	0	0
Mfr	0	0	0	0	0	0
pre_9_11	0	0	0	0	0	0
d03	0	0	0	0	0	0
d04	0	0	0	0	0	0
d05	0	0	0	0	0	0
d06	0	0	0	0	0	0
d07	0	0	0	0	0	0
d08	1	1	1	1	1	1

1. Activation

By predicting the continuation rates for the base and notional Marines using 4-, 16-, and 38-month tour lengths for Models 3 and 4, we can then use equation (8) to calculate the survival rates at each 12-month interval (assume 100 percent strength initially).[130] These values are shown graphically in Figure 26.

[130] Marginal effects were computed using the STATA/IC 10.1 statistical software package.

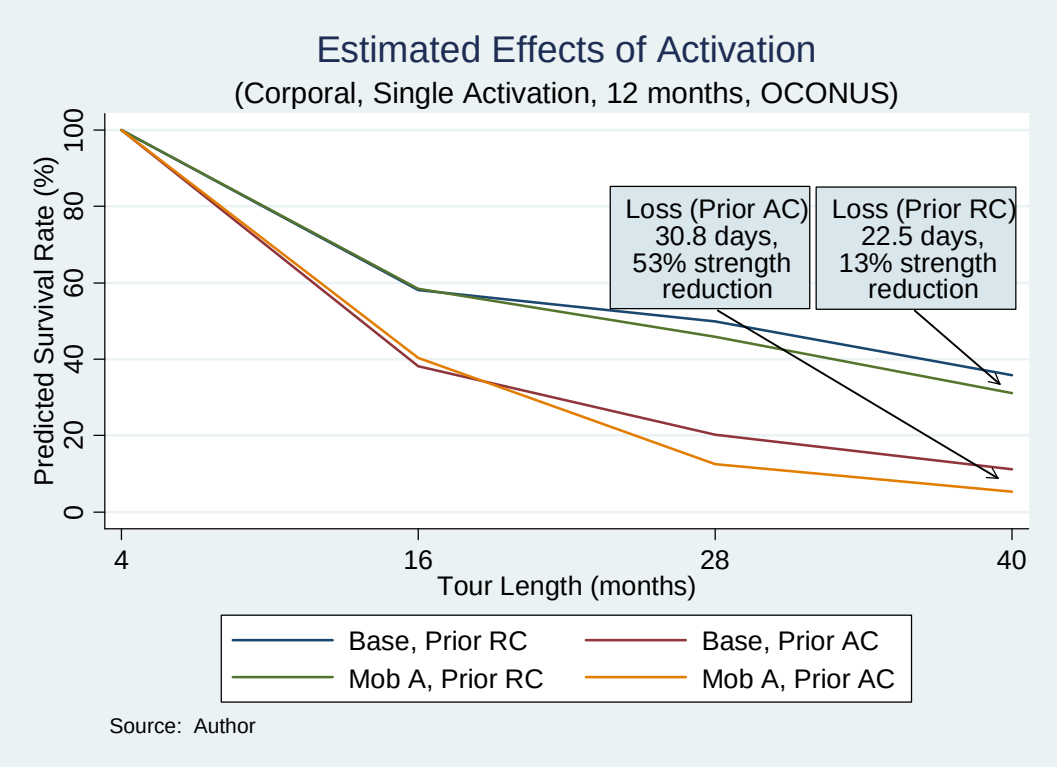

Figure 26. Estimated Effects of a 12-month Activation Policy

The area under each curve is the predicted cumulative manpower supply based on these estimates and the area between the curves is the net gain (or loss). In order to convert to days, we multiply each area by 365.25 (days) and divide by 12 (months). Next, we subtract the area of *Mob A* from the *Base* and divide by 100 (percent) to approximate the net gain (+) or net loss (-). The percent gain (or loss) is calculated by dividing the net difference by the *Base* and then multiplying by 100 (percent). Using these calculations, we approximate a 30-day net loss of manpower per prior AC Marine and an 11.7-day loss per prior RC Marine over a 36-month period. This represents a 7.7 percent loss of potential prior AC manpower and 2.2 percent loss of prior RC manpower.

Although the impact on end strength is reasonably minor and can be restored through an increased recruiting mission, if we conclude our analysis here, policy makers are likely to overlook the larger concern. To emphasize this point, we will concentrate on the prior AC manpower survival prediction at the 40-month tour length. Although, the net cumulative loss of manpower was estimated at 7.7 percent (Figure 26), the on-hand

strength declined by approximately 53 percent more than the baseline. As such, the net negative effects of activation for prior AC may result in a long-term net loss of Marines choosing to remain in the SMCR until retirement eligibility or longer.

While increased recruiting missions can increase end strength, the more important concern in this scenario is the loss of senior non-commissioned officers (NCO) who are the feeder population for the future senior enlisted leadership in the Reserve. As such, a complete analysis of a potential policy change for activation should also include the effect on promotions rates and flow points. In particular, a targeted monetary incentive could better address the latter concern.

However, considerable caution is advised to modifying policy or the overall recruiting mission without developing a fully integrated SMCR model and applying sensitivity analysis to provide a range of potential effects. For instance, the above estimates do not consider the consequences of activation on NPS attrition rates, NPS-to-prior service transition rates, or SNCO prior service continuation rates. Likewise potential fluctuations in other explanatory variables should be incorporated as well. Any changes to behavior in these populations could either counteract or worsen the estimated negative effects of 12-month activation rates.

2. Monetary Incentives

A second potential application of the continuation model is to estimate the cost-effectiveness of monetary incentives as shown in Figure 27. Using 12-month continuation rate estimates for *Bonus A* and *Bonus B* at 4-, 16-, and 28-month tour lengths, survival rates are predicted using equation (8).

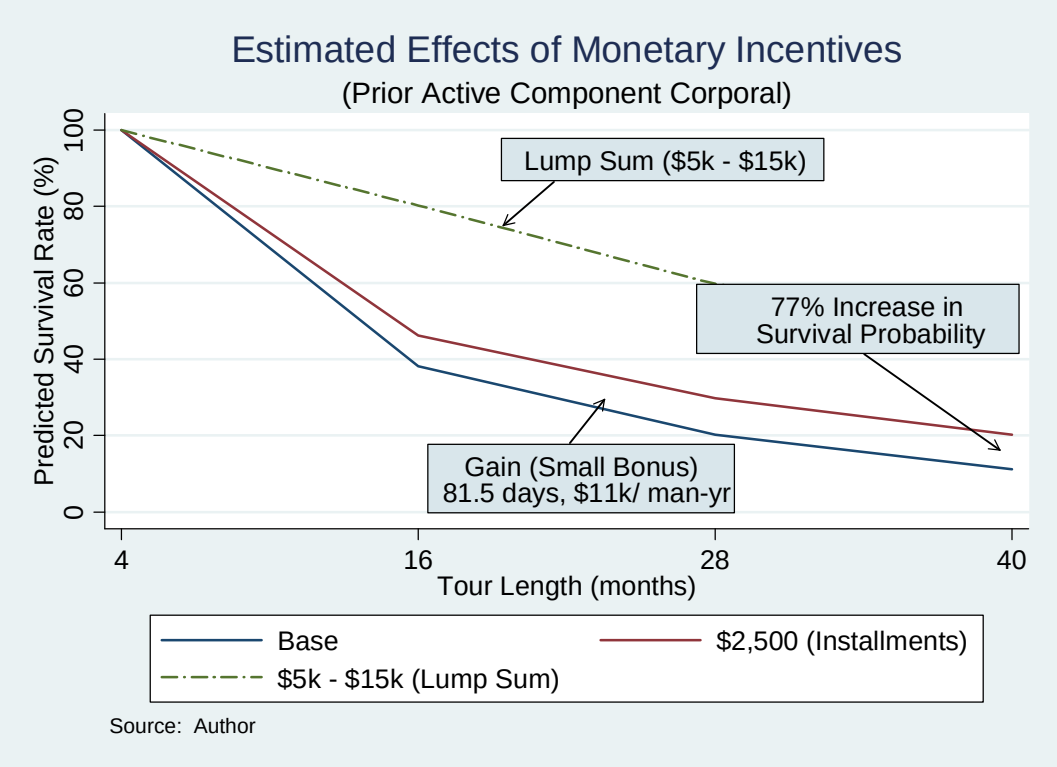

Figure 27. Cost Effectiveness of Monetary Incentives

As before, the three-year net gain is calculated by subtracting *Bonus A* from the *Base*. However, for comparison to other potential end-strength initiatives, one-year (365.25 days) is divided by the net gain (in days) and multiplied by the bonus amount to determine the cost per man-year. The result ($11k) can then be used for cost-benefit analysis of other potential policy changes and initiatives. Another interesting result is the predicted 77 percent increase in survival at the 40-month tour length (compared to the baseline). Thus, this incentive could potentially nullify the 53 percent loss of manpower observed in the previous scenario.[131]

As mentioned previously, the estimation of effects due to bonus payment methods and amounts, as well as validation of the 12- and 24-month bonus parameters, cannot be completed with the available data. As such, an analysis of bonus amount and payment method is recommended for future research once DMDC data is obtained. In addition,

[131] 53 percent * 77 percent = 0.94 percent.

estimation of NPS parameters is necessary to complete a comprehensive program evaluation and determine the most cost-effective mix of incentives currently offered in Table 5 (Chapter II). The review should also include other programs, such as the Prior Service MOS Retraining Program (PSMRP) and an investigation of the potential introduction of obligor/non-obligor transition programs. Thus, an overarching monetary incentive policy can be developed, which properly balances manpower requirements and fiscal realities.

E. MODEL COMPARISON

During this chapter, we analyzed the effects of activation, monetary incentives, and other potential predictors of 12-month continuation using four different specifications across three distinct tour lengths. Although the first model was the least burdensome, it omitted several significant predictors of prior service SMCR continuation, such as unexcused absence as a person-job fit indicator, retirement qualified years, and prior experience indicators. Moreover, there is sufficient evidence to suggest that the systematic differences between prior RC and AC SMCR unit service members is biasing the key activation variables, unemployment effects, demographic controls, and rank. Thus, the first model is not preferred for predicting continuation effects.

The second model includes most of the majority of variables missing from Model 1. However, it is also maybe biased due to missing interaction effects between the two systematically different SMCR prior service populations and the key variables. Given that approximately 26 percent of the SMCR unit prior service population is composed of prior RC service members, these differences should not be ignored in modeling end strength.

As such, it would appear that a combination of Models 3 and 4 best predict 12-month continuation given the four different specifications presented in this thesis. However, empirical evidence is also necessary to support the hypothesis that the prior RC and AC populations are systematically different. Using a Chow Test, we can empirically test for differences in the coefficients of the two models, as well as test for structural

changes over the three tour lengths.[132] As shown in Table 18, there is overwhelming evidence, at the .01 level of statistical significance, that the model coefficients are different. Thus, we reject the null hypothesis that there are no structural differences between the AC and RC prior reserve SMCR unit populations. Likewise, we reject the null hypothesis that there are no structural differences between tour lengths.

Table 18. Chow Test for Structural Differences Between 4-, 12-, and 24-Month Tour Lengths and Prior RC and AC SMCR Unit Populations

Chow Test		χ^2	**Degrees of Freedom**	**Prob > χ^2**
Models	3 & 4	140.2	36	0.0000
Tour Length	4 mos	291.6	36	0.0000
	12 mos	163.6	36	0.0000
	24 mos	162.7	36	0.0000

F. CHAPTER SUMMARY

In this chapter, we completed an overall model assessment, systematically reviewed the empirical estimations for each explanatory variable, compared their effects to the hypothesized relationships, and assessed their potential for future use as predictors of SMCR prior service continuation in an end strength model. Additionally, we have reviewed several policy applications for the estimated effects of activation and monetary incentives. Lastly, we compared each model and determined that there was sufficient evidence for the use of Models 3 and 4 over Models 1 and 2. In the next chapter, I will provide thesis conclusions and recommendations for future research.

[132] Wooldridge, *Introductory Econometrics*, 245–246, 449–450.

VIII. CONCLUSIONS AND RECOMMENDATIONS

A. REVIEW OF RESEARCH GOALS AND OBJECTIVES

The purpose of this thesis was to assist Manpower and Reserve Affairs (M&RA) in improving the SelRes end strength model used by the Reserve Affairs Personnel Plans and Policy (RAP) branch to develop the annual recruiting mission and retention goals. As discussed in Chapter II (Figure 7), the recruiting mission is segregated into non-prior (NPS) and prior service missions. Although substitutions between these two separate missions is sometimes initiated by larger, more important Total Force objectives, systematic differences between these two populations due to dissimilar service requirements can lead to long-term manning issues. The independent contribution of each recruiting mission to end strength over various tour lengths is more important than the absolute sum of both missions; thus, uncompensated mission swaps (as observed in FY2008) should not be entertained lightly.

As discussed above in Chapter I, this thesis focused on prior service continuation over NPS attrition for three main reasons. First, the proportionate share of Selected Marine Corps Reserve (SMCR) prior service to overall SMCR strength has dropped by over 20 percent since 9/11. This drop mainly occurred during a four-year period from FY2004–FY2007 (Figure 2). Second, prior service Marines are a critical component of readiness due to their technical proficiency, leadership, and combat experience. Lastly, the non-contractual nature of prior service affiliation and numerous career paths in the Ready Reserve make them more susceptible to changes in the military, economic, and political environment. As such, they can serve as a bellwether for the Reserve Component (RC) as a whole.

The continuation of lance corporals, corporals, and sergeants were modeled for several reasons. First, these Marines are not overly influenced by the potential draw of a military pension. Their perceived discount rate is so high as to reduce the draw of an already minimal reserve retirement annuity. Second, and most important, the transition from lance corporal to non-commissioned officer (corporal and sergeant) is a major

career decision point. Those who venture beyond this point will make-up the core of the Marine Corps' future senior enlisted leadership. Consequently, the ill health of this population segment can result in unanticipated consequences and manpower deficiencies in the SNCO ranks for 10–20 years thereafter.

B. PRIMARY RESEARCH QUESTIONS

1. Activation

There were two primary research questions presented in this thesis. The first was to determine the effect of activation on SMCR prior service, specifically in the grades of E3–E5. This question was addressed by isolating the independent effects of activation frequency, cumulative length of activation, and deployment location. Our hypothesis, based on the Expected Utility of Deployment Model and previous empirical evidence, was that a positive relationship existed between activation and continuation. However, the negative marginal effects of activation duration were expected to generate a point at which the net effects of activation would reduce continuation rates.

The results of multivariate analysis using a probit model to estimate 12-month continuation rates provided overwhelming evidence (at the .01 level of statistical significance) to support our hypothesis. However, the estimated magnitude of these effects differed between the prior RC and Active Component (AC) SMCR populations. Although the effect of OCONUS deployments was ambiguous a priori, there is strong evidence to suggest a large negative effect.

However, policy makers are more interested in the net effects of activation based on current guidelines and operational requirements. As such, the cumulative effects of the current 12-month activation policy were evaluated for various tour lengths (4 to 40 months) in the SMCR units. The results indicate that there is a slight decrease in continuation for prior RC beyond 28 months of service and for prior AC Marines beyond 16 months of service. In addition, the model identified grade strength deficits as a potential concern that may need policy consideration to ensure a long-term sustainable Reserve.

One primary concern regarding the effects of activation is the potential for bias in the parameters. In the literature review, Dolfini-Reed (2005) hypothesized that the inclusion of individuals currently on activation orders would artificially lower the loss rate since these individuals are unable to leave. However, by looking at individuals six months after activation, Dolfini-Reed was unable to identify a baseline for comparison. In this thesis, we have attempted to eliminate this potential bias by looking at 12-month continuation rates. However, a hybrid model, which encompasses the Dolfini-Reed post-activation model and the tour-length specification introduced in this thesis, has the potential to overcome both of these limitations and is recommended for future research.

2. Monetary Incentives

We hypothesized a strong positive effect of monetary incentives on continuation. In addition, we expected an even larger effect due to the shift to lump sum payments. In the 4-month model, we estimated a 7.1 to 8.3 percentage point increase in continuation rates due to bonuses authorized prior to FY2006. This effect increased to between 12.7 to 18.8 percentage points in the 12-month model. As suggested in the literature review, we also estimated a 7.5 percentage point increase in the 24-month model, which suggests the potential for a lingering effect over time.

Although we were unable to isolate the effects of bonus amount and the lump sum payment method, the 4-month model predicted a 28.2 to 35.0 percentage point effect for bonuses issued beginning in FY2006 for prior AC SMCR Marines. The overall net effect of a bonus issued on or after FY2006 using the 4-month model was estimated to range from a 35.3 to 43.3 percentage point increase. Due to unavailability of data, we were unable to estimate the effect of bonuses issued in FY2006–FY2008 using the 12- and 24-month models.

Lastly, we introduced one potential method in which to estimate the cost effectiveness of monetary incentives. The analysis empirically estimated the pre-FY2006 bonus to cost approximately $11,000 per additional man-year; however, cost-savings due to recruiting, accession training, and increased productivity were not included. This method is recommended for incorporation of future analysis of other incentives to include

the Prior Service Military Occupational Specialty Retraining Program (PSMRP) and potential re-alignment of incentive funding and policies around cost-effectiveness and manpower requirements.

C. SECONDARY RESEARCH QUESTION

A tertiary objective of this thesis was to identify other predictors of continuation for potential inclusion in the Reserve Affairs Personnel Plans and Policies (RAP) end strength model. In this regard, additional explanatory variables in the areas of state economic conditions, ability, person-job fit, military experience, and demographics were introduced and hypothetical effects evaluated. Table 19 summarizes the finding for each of these areas. Variables are categorized as "recommended" for use, further evaluation "potential", or "poor" (not recommended) with empirically estimated relationships designated as positive (+) or negative (-).

Table 19. Summary Evaluation of Predictors for 12-month Continuation

Category	Recommended	Potential	Poor	Comments
Activation	Frequency (+), length (-), OCONUS location (-)			
Monetary incentives	Bonus (+)	Amount, method		Additional data required
Economic conditions	Unemployment (+)			4-month model only
Ability			AFQT	Magnitude is inconsequential
Person-job fit	Unexcused absence from drill (-)	PFT	Proficiency, Conduct, BST, Water Survival	PFT is positive, but not statistically significant
Military experience	Prior AC/RC (+), multiple tours (+), rank (~)	Occupational groupings, retirement qualified years		Occupation is tour length dependent, rank is experience dependent, use prior AC/RC as a model restriction
Demographics	Female (-), married (-), age (-)	Children, black	Other marital status and race	Age for prior RC only
Tour length	Observation number			Use as a model restriction

Several variables were identified, but unavailable for analysis at this time. These include educational attainment, MGIB-SR usage, additional bonus data, and retirement credit points. Future research in this area should consider these potential influencers for inclusion into end strength modeling.

D. RECOMMENDATIONS/FUTURE RESEARCH

This thesis was successful in identifying the effects of activation and monetary incentives within the constraints of the available data. Two potential applications of these effects were introduced for incorporation into future recruiting mission analysis, promotion planning, and monetary incentive programs evaluation. Ten additional variables were recommended for incorporation into RAP end strength modeling.

An overarching objective of this thesis was to provide a starting point for future research into the area of Reserve manpower planning. In this regard, analyses of other populations are necessary. The following topics are recommended for future research.

- Monetary incentive and PSMRP program funding allocation. This topic includes analysis of incentive amount and payment methods
- Non-prior service attrition modeling
- Non-prior service/prior service transition modeling
- Continuation modeling of staff non-commissioned officers (SNCO)
- Continuation modeling of officers
- Attrition modeling of Officer Candidate Course-Reserve graduates
- Activation modeling using the Dolfini-Reed (2005) approach with tour lengths as the baseline for comparison.

Lastly, an integrated analysis that tracks the prior service population across training category pay groups (TCPG) throughout their career is needed to truly understand the activation phenomenon. This analysis should consider career patterns, RC retention, and the probability of transitioning between states given the volatile nature of the Ready Reserve described in Chapter II.

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APPENDICES

The ensuing appendices describe the data and provide the complete results of the multivariate analysis. Included are the Marine Corps Total Force System (MCTFS) codes used to interpret Total Force Data Warehouse (TFDW) data, a comprehensive codebook and descriptive statistics of the enlisted master file, additional descriptive statistics for the restricted data set, and the multivariate analysis regression results. The guide below is included as a reference. The following link connects to the different appendices mentioned in this thesis.

http://edocs.nps.edu/npspubs/scholarly/theses/2010/Mar/10Mar_Price_Appendices.pdf

Appendix	Description
1–25	MCTFS/TFDW Codes
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42–44	Regression Results, Model 1
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   Monterey, California

8. Margery A. Westerbeck
   Manpower and Reserve Affairs (ATTN: RAP)
   Quantico, Virginia

9. Deputy Commandant for Manpower and Reserve Affairs
   Quantico, Virginia

10. Director, Reserve Affairs Division
    Quantico, Virginia

11. Dr. Michelle Dolfini-Reed
    Center for Naval Analysis
    Alexandria, Virginia