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THESIS

AN ANALYSIS OF THE EFFECT OF THE GLOBAL WAR ON TERROR ON THE RETENTION OF GRADUATES OF THE U.S. NAVAL ACADEMY

by

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March 2009

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13. ABSTRACT

This thesis aims to analyze the effect of the Global War on Terror (GWOT) on the retention behavior of the United States Naval Academy (USNA) graduate Navy and Marine Corps junior officers one year after their minimum service obligation (MSO).

The data used for the analyses covers cohorts from 1990 to 2007. Three logistic regression models were constructed to estimate the impact of increasing operational tempo due to the GWOT. Three separate models were created for the Marine Corps to measure the effect of hostile deployments. The models included demographic, service, and deployment variables, as well as a difference-in-difference estimator to capture the effect of the GWOT.

Deployments either before or after the GWOT had a positive effect on the retention behavior for both the Navy and the Marine Corps. However, hostile deployment decreased the likelihood to retain for the Marine Corps.

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LIST OF ABBREVIATIONS AND ACRONYMS

AFQT   Armed Forces Qualification Test

DMDC   Defense Manpower Data Center

DoD   Department of Defense

ETS   Expiration of Term of Service

FSA   Family Separation Allowance

GWOT   Global War on Terror

HFP   Hostile Fire Pay

IA   Individual Augmentation

IDP   Imminent Danger Pay

MOS   Military Occupational Specialty

MSO   Minimum Service Obligation

NROTC   Naval Reserve Officer Training Corps

OCS   Officer Candidate School

OEF   Operation Enduring Freedom

OIF   Operation Iraqi Freedom

USMC   United States Marine Corps

USNA   United States Naval Academy

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I. INTRODUCTION

A. BACKGROUND

The U.S. Navy and Marine Corps (USMC) constitute a large portion of the Department of Defense (DoD) and have a great effect on and significance in implementing the strategic goals of the United States of America in the continental U.S. and around the world. Maintaining the capability of the Navy and USMC has always been a critical issue for decision makers. A successful and careerist officer corps is one of the top priorities of management at every level of human resource planning. The efficiency of an armed force depends on the quality of its leaders, which has been proven true throughout the history. In the light of this idea, educating, training, and retaining these experienced and quality officers is vital for the U.S. Navy and Marine Corps.

The U.S. Navy has the following three main commissioning sources: The United States Naval Academy (USNA), the Naval Reserve Officers Training Corps (NROTC), and the Officer Candidate School (OCS). While the USNA is the most expensive source among these three, it has the highest rate of retention, followed by the NROTC and OCS (Lehner, 2008). Academy life contributes not only years of arduous education to midshipmen but also the training that the leadership of the Navy deliberately seeks in combat conditions and the inclination to stay in the Navy beyond the minimum service obligation (MSO). [1]

Deployment rates for all service members evidently increased during the 1990s[2] with the First Gulf War, Somalia, Haiti, Bosnia humanitarian efforts, and peacekeeping and enforcing operations, and peaked after 9/11 with the declaration of the Global War on Terror (GWOT), especially in Iraq and Afghanistan. The effects of an increased operational tempo after 9/11 have been observed for all services. With limited resources and increased operational commitments, defense officials want to ensure the billets are

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[1] Since the authors are only interested in active duty, when they say minimum service obligation, they are only referring to active duty service obligation.

[2] Operational tempo increased from 60% to 300% between 1986 and 2000 (Fricker, 2002).

adequately manned, trained, experienced, and equipped to respond to the full spectrum of military operations (Paissant, 2008). Furthermore, defense decision makers have been forced to understand active duty manning problems and make decisions to reverse potential manning problems to carry out future missions. Unless the impacts of deployments are fully understood, it becomes difficult to undertake the necessary actions to retain officers from the Naval Academy.

Some have blamed the growing number of deployments for retention shortfalls and personnel losses. This view is supported by surveys in which deployment is among the most likely reasons cited by service members for leaving the military (Fricker, Hosek, and Totten, 2003). Troops are seeing deployments that are more frequent and of greater length, as well as shorter rest periods in between deployments — factors thought to create a more stressful environment for service members (Tanielian and Jaycox, 2008).

Despite the increased levels of casualties among the officer corps and increased numbers of deployments to war zones with remarkably short turnarounds, the USMC has enjoyed outstanding popularity among midshipmen. In fact, it has become the second most popular choice (after Naval Aviation) of service selection in the brigade in the past two years (Burroughs, 2007).

It is not possible to predict what kind of operational tempo the Navy and Marine Corps are going to experience in the future, but determining the consequences of deployments on current retention decisions could help decision makers develop manpower plans for the future officer corps and avoid problems in manning leadership positions.

B.   THE PURPOSE OF THE STUDY AND RESEARCH QUESTIONS

The purpose of this study is to assess if the number and the characteristics of deployments are associated with changes in retention rates of Naval Academy graduates from 1990 to 2001 who were eligible to make voluntary stay-or-leave decisions during the pre- and post-GWOT periods. The study aims to quantify the effects of deployment on the retention of junior officers.

The primary research question for this study is as follows: Do hostile deployments affect the retention decision of USNA graduates? The secondary research question is the following: Is there a difference in retention behavior between Naval Academy graduates who select the Navy versus those who select the Marine Corps in the pre- and post-GWOT period?

The nature of military operations has been constantly changing since the 1990s. In the face of changing threats, operations are covering longer periods and spreading over wider theaters. Consequently, deployment duration and frequency are increasing. Under these circumstances, defense decision makers should understand the current problems to ensure possible solutions in the future. One should also be aware of the effects of other factors on the individuals' intention to stay. These factors include monetary, morale, family, and health issues.

C.   ORGANIZATION OF THE STUDY

The second chapter of the thesis provides a review of previous studies on retention and the effects of deployment on retention. The third chapter provides information about the data. The fourth chapter covers the methodology utilized by the authors, which includes a brief overview of logistic regression, and a description of the variables and statistical models. The fifth chapter presents the results of the analysis. The final chapter discusses the summary, recommendations, and limitations of the study.

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II. LITERATURE REVIEW

This chapter reports and discusses the results of previous studies on officer retention and enlisted reenlistment. It also discusses the data and methods used in order to provide a baseline for the models in this study. Most of the studies have yielded different results for enlisted and officer retention depending on the groups, periods, techniques and time-varying factors such as operational tempo and civilian employment opportunities. The studies have provided results on various reasons for retention and results for different grades, ranks, and services.

Recent research, surprisingly, contradicts the general assumption that there is a negative relationship between the number of deployments and the retention behavior of officers. Most of the findings about officers' decisions indicate that up to a certain level of deployments, about two or three deployments, officers tend to stay. The effects of deployments on junior officers, while smaller, are still positive.

To get a better grasp of the situation, provide a broader view of the problem, and elaborate the methodology, this chapter focuses on studies of both officer and enlisted personnel.

A. MARINE CORPS RETENTION IN THE POST 9/11 ERA: THE EFFECTS OF DEPLOYMENT TEMPO ON MARINES WITH AND WITHOUT DEPENDENTS BY QUESTER, HATTIANGADI, AND SHUFORD (2006)

Since the terrorist attacks of 9/11, Iraq and Afghanistan have been added to the operational plans of the U.S. Marine Corps as two critical theaters. Operation Enduring Freedom (OEF) was launched in Afghanistan in October 2001, and Operation Iraqi Freedom (OIF) was launched in March 2003. Marine Corps units have been engaged in intense operations since then. Viewing retention and reenlistment as two of the military's most critical issues, senior military leaders have been interested in the effects of deployments on manpower readiness. Therefore, researchers have focused more on this issue recently to help decision makers predict the future effects of deployment tempo.

In this study, Quester, Hattiangadi and Shuford examined the effects of deployment tempo on the retention behavior of Marine Corps officers and enlisted personnel. They tried to discover the influence of dependency status and service length basis on deployments. They categorized officers into the following three groups: 4-6, 9-12, and 12-20 years of service. In addition, they categorized enlistees as first, second, and third termers (zones A, B, and C).

Marine Corps retention data from March 2004 to March 2005 was used for this study. Deployments appeared to be intense for the Marine Corps during this period. The authors analyzed data on the most recent retention and reenlistment decisions. Results from 2002 and 2003 were also looked at for comparison purposes, specifically for enlistees. Deployment information was taken from the Defense Manpower Data Center (DMDC) for both hostile and nonhostile deployments, since the Marine Corps had not developed a database for this kind of information.

Researchers examined a one-year period in the post-9/11 era. The data file was detailed and covered an intense period of deployments. The study seemed to yield satisfactory results. Unobservable characteristics causing self-selection, such as motivation, might have been the reason for high retention rates (especially for Marine Corps officers), but these were hard to measure.

The researchers used a logistic regression model to estimate the probability of retention. They looked into the effect of deployments on retention decisions separately for length-of-service categories and different dependency status. While dependency status appeared to be a significant factor in predicting reenlistment decisions, it had little effect on officer retention decisions.

For first-term enlistees, deployments to hostile areas and a higher number of days deployed reduced reenlistment rates. Surprisingly, Marines with no deployment during their initial service period had lower reenlistment rates as well. Deployment tempo was found to have larger negative effects on first-term Marines without dependents than on those with dependents. Results revealed another interesting and substantial difference between Marines with and without dependents: Marines without dependents deployed

forty-nine days more, on average, than those with dependents did. This fact was explained by their tendency to volunteer for deployment, commanders' preferences, and the concentration of single Marines in Primary Military Occupational Specialties (PMOS), which deploy more frequently to hostile regions. For second- and third-term Marines no apparent relationship was found between duration or frequency of deployment and reenlistment behavior.

The study also examined retention rates for Marine Corps officers from March 2004 to March 2005 and took into consideration the impact of the total number of deployed days in the last forth two months before stay/leave decisions (for ranks of O-2 or higher). In their model, for all service groups they estimated logistic regression models and used retention rates (from March 2004 to March 2005) and retention plans (counting those who had not submitted separation or retirement papers as of March 2005) of officers as dependent variables to detect the association between deployment tempo and retention.

They found that in the early years of a career (4-6 years), officers with dependents retained at higher rates than those without dependents. The officers without dependents who reached their ninth year of service stayed at higher rates than who did have dependents. Deployments had a positive effect on the retention of non-retirement eligible officers. Deployments had an even higher effect on retention rates of officers with close to twenty years of service (and therefore eligible for retirement).

B. SERVING AWAY FROM HOME: HOW DEPLOYMENTS INFLUENCE REENLISTMENT BY HOSEK AND TOTTEN (2002)

This study aimed at finding whether deployments had an effect on reenlistment behavior. What made the research important was the increasing rates of deployment in the last decade and indications that deployment tempo would not decrease in the near future.

The researchers suggested that deployment experiences have a direct effect on enlisted personnel reenlistment decisions. People attend military with some pre-set estimates and expectations in mind about utilities, duration or content of duty. The type

and number of deployments surely make up a significant portion of this, as the actual domestic and international characteristics of the GWOT situation is considered. Upon completion of deployment, members review what they acquire from their experience, which helps them realize their own limitations and compare their experience with what they expected before enlistment. These factors along with personal, monetary and civilian opportunity issues constitute a foundation for modeling reenlistment decisions. Researchers call this learning and evaluating mechanism a "Bayesian updating process."

In this study, Hosek and Totten initially developed an expected utility model to measure the effect of learning from previous episodes on the reenlistment decisions of first-and second-term members by service. They calculated expected utility by using acquired benefits (net deployment pay) and time spent at home station and in theater, which were functions of duration and number of deployments. That is, if obtained utility goes up, the rate of reenlistment also increases. This mainly provided a good basis for additional studies. They created two probit models to find the effect of deployments on reenlistment.

The first model examined reenlistment decisions based on deployment, and two main specifications were used. Hostile and nonhostile deployments were included separately in a main-effects specification and were combined as deployment variables in full-interaction specifications. The latter contained type and number of deployments, education, the Armed Forces Qualification Test (AFQT), demographics, unemployment rate, and year variables to predict the reenlistment rate. In the second model, they calculated a main-effects specification to find the direct/indirect effects of deployment on speed of promotion to E-5, and then the promotion effect on reenlistment. They also used reenlistment and expected promotion time to E-5 as indicators to capture the relation between deployment and reenlistment.

Their results indicated that in the one-equation reenlistment model for first-termers, deployed enlistees had reenlistment rates as high as non-deployed personnel did. Their results showed that reenlistment increased with the number of nonhostile deployments, but was unaffected by hostile deployments. In the model with interaction terms, enlisted personnel with three or more nonhostile or hostile deployments had lower

reenlistment rates than those with two deployments of either type. For second-termers, reenlistment rates appeared to rise with nonhostile deployments and up to two hostile deployments, which suggested some differences from the effects for first-termers. Three or more hostile deployments reduced the reenlistment rate, which was still higher than that of personnel with no hostile deployment. In their two-equation model (reenlistment and promotion), they detected that nonhostile deployment is associated with earlier promotion, while hostile deployments had little effect on promotion, a result that appeared to be consistent for all services. Faster promotion was associated with increasing income, authority, and job satisfaction that translated into higher future expected utility.

Furthermore, these two researchers examined the effects of deployment with respect to dependency status for first-termers, based on the assumption that most second-termers were already married. They found a positive correlation between the number of hostile/nonhostile deployments and reenlistment for those with dependents, while for those without dependents reenlistment rose less rapidly with nonhostile deployments and remained unchanged with hostile deployments.

Hosek and Totten analyzed the Proxy PERSTEMPO file, which was acquired from the DMDC. It contained longitudinal data about personnel who were eligible to make stay/leave decisions between FY1996-FY1999. In addition to variables for service obligation, education, AFQT, demographics, year, expiration of term of service, unemployment rate, and dependency status information, they used hostile fire pay (HFP) [3] and family separation allowance (FSA) to identify the number and duration of past deployments. FSA was paid to personnel with dependents (wife and children) who executed duty away from their home station for more than thirty days, while HFP was paid to everyone who performed duty in hostile circumstances. For those who did not have dependents, nonhostile deployment information was obtained from a unit deployment indicator. In addition, stay/leave decisions were taken to be three months before expiration of term of service (ETS).

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[3] HFP is now called imminent danger pay (IDP) as in the authors' data file.

There were some strengths of the study. The authors initially developed a learning model to explain the member's way to review his or her past experiences and a utility model to describe how he or she utilized this information. The utility model was mainly dependent on the quality of deployments (number, frequency, length in months, pecuniary benefits, and cost) in order to understand explicitly the impact of past experiences on the member's decisions. The model had many explanatory variables such as the effect of zero, one, two, and three or more deployments separately and in interaction. The model used these variables to estimate the connection between deployments and various utility combinations acquired by members with different experiences. The model also controlled for unobserved factors contributing to promotion other than deployment, and used additional variables to capture previous promotion history (to E-4). Deployment information was constructed from FSA and HFP data, which was supposed to be more dependable than self-reports or surveys. Additionally, data covered members' decisions during the period from 1993 to 1999. The study had small weaknesses as well. The data did not contain bonus or military and civilian pay information, which were compensated for by using fiscal year variables as proxies for annual fluctuations in pay. Although deployments were measured accurately, ongoing operations were not included completely in terms of duration. In addition, nonhostile duties shorter than thirty days were not included. The researchers believed this created minor bias.

C.   THE EFFECTS OF PERSTEMPO ON OFFICER RETENTION IN THE U.S. MILITARY BY FRICKER (2002)

The author analyzed the effects of deployment on officer retention for all services. Data for the research were drawn from the responses on the Survey of Active Duty Personnel. Junior officers in all services listed deployment as the fourth most important reason for leaving active duty (DMDC, 2000).[4]

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[4] The survey results revealed that junior officers were slightly more likely to leave active duty because of deployment, which is one of the reasons for the authors' research topic.

Fricker used the receipt of FSA and IDP to measure deployment indications for officers who did not have a deployment indicator in the file.[5] He used the same deployment measure as Hosek and Totten (Hosek and Totten, 1998) to be comparable to them. He wanted to be able to compare officer results with enlisted results. The data were drawn from the PERSTEMPO database provided by the DMDC, which covers the period from 1990 to 1999.

He modeled each service separately to account for policy differences across the services. He also modeled officers separately in junior grades and middle grades, keeping in mind that junior officers may not be fully informed about the military lifestyle when making their first retention decision. On the other hand, midgrade officers are fully informed; if an officer stays in the military after the MSO, he or she is fully aware of the consequences. Secondly, junior officers can leave active duty only at a specific point whereas midgrade officers can choose to leave anytime after their MSO expires.

Fricker utilized logistic regressions for his model. He took into account the number of long deployments and the number of episodes of hostile deployments for the thirty-six months before the end of each officer's MSO[6]. To determine if an officer stayed on active duty he looked at one year after the termination of his or her MSO as the checkpoint. By allowing one year beyond the officer's MSO, he took into consideration events that increase one's service obligation. He created subgroups by occupation specialty. Beside deployment and specialty subgroups, his model included variables that represented gender, race, family status, and whether or not the officer was an academy graduate.

In his study, Fricker compared all four services and junior and midgrade officers. For the purposes of this thesis, the authors are interested in Navy and Marine Corps junior officers. Figure 1 shows that for the early 1990s, an increasing number of hostile

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[5] FSA is given to those who are separated from their families for more than thirty days and IDP is given to those who are deployed to hostile regions. These definitions will be further explained in Chapter III.

[6] The results were similar when the analysis was performed with the length of deployment.

deployments were associated with decreasing separation rates. On the other hand, during the late 1990s, separation rates increased as the number of hostile deployments increased.
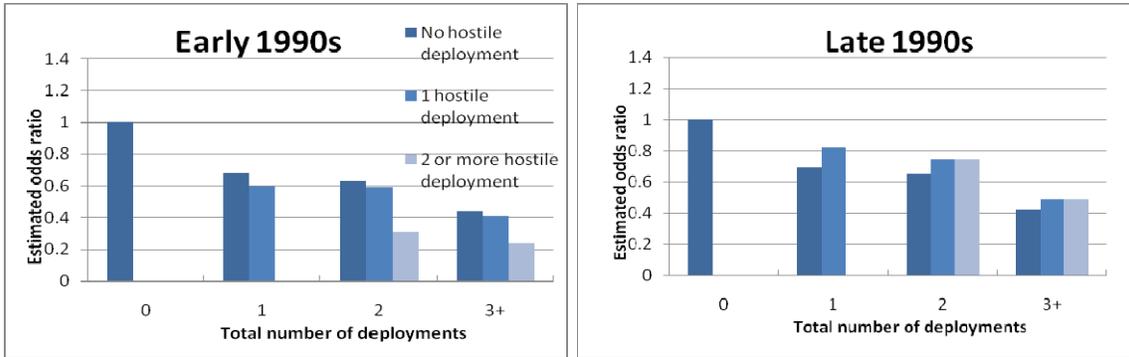
Figure 1.   Effects of Deployment on the Likelihood of Separation for Marine Corps Officers [From Fricker 2002]

Figure 2 shows that number of hostile deployments had no practically significant effect on the separation rate for junior officers on either the early or the late 1990s.
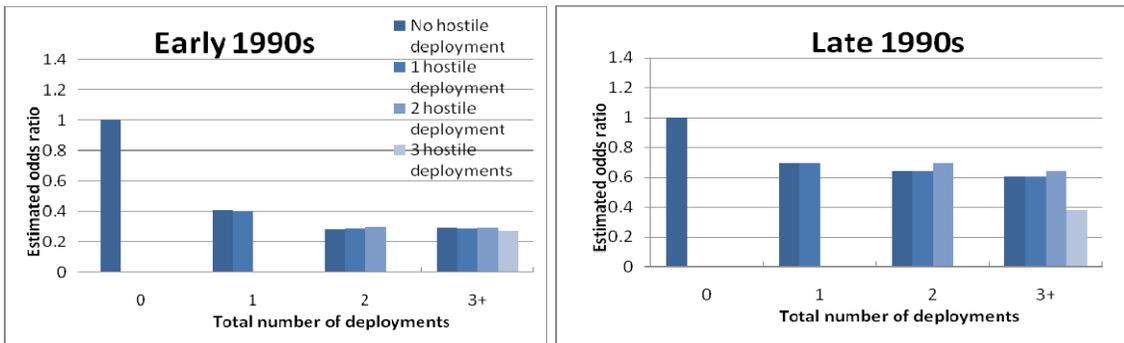
Figure 2.   Effects of Deployment on the Likelihood of Separation for Navy Officers [From Fricker 2002]

Fricker divided the entire period into two periods, namely the early 1990s and the late 1990s. The early 1990s represented the contraction in the U.S. military, while the late 1990s represented a more stable period. In the early 1990s, for the Marine Corps the odds ratio of separation decreased as the fraction of hostile deployments increased. The effects of deployment on retention were not so clear for Navy officers. In the late 1990s, increasing episodes of hostile deployments increased the estimated odds ratio of

separation for both Navy and Marine Corps officers. The effects of hostile deployment on separation rate were much more modest for Navy officers than for Marine Corps officers.

Fricker modeled occupations separately to find out if specific occupations had higher retention rates than others, which would have affected the overall results of the model. He utilized separate models for each of the occupations in every service. Despite some exceptions, occupational trends were consistent with his general model. These results indicated that none of the occupations in the services affected the overall result of the models.

Officers who deployed had lower or neutral odds of separation compared to those who did not deploy. The results were similar among deployed officers who deployed to hostile regions or nonhostile regions. Fricker found that officers who were deployed to either hostile or nonhostile regions stayed on active duty at higher rates than their peers who were not deployed. Junior officers deployed to hostile regions stayed on active duty at lower rates than those deployed to nonhostile regions, but at higher rates than nondeployed junior officers did.

There were some self-selection issues in the study. Officers who did not like the military lifestyle might have already left or preferred positions that did not require deployment. It is also possible that officers who preferred the military lifestyle self-selected positions known to have higher possibilities of deployment. Nondeployed officers might have attrited on a larger scale because of increased tempo and stress, which would have caused the retention rate of deployed officers to appear higher.

The study had some limitations, as the author mentions. To be able to evaluate the causal effect of deployment and retention, officers would have to be assigned to duties randomly, which was not the case. Officers could influence their assignments, which, in turn, affected deployment.

Another limitation was the measure of deployment. To receive FSA, deployment had to exceed thirty days. This had two shortcomings: deployments less than thirty days were not counted in his study, and two short deployments in a single month or adjacent months were counted as one deployment.

To summarize, the basic pattern for junior officers was that retention increased as the total number of deployments increased. As hostile deployments increased, retention rates began to decrease.

D. HOW DEPLOYMENTS AFFECT SERVICE MEMBERS BY HOSEK, KAVANAGH, AND MILLER (2006)

Hosek, Kavanagh, and Miller prepared this study for the purposes of shedding light on the challenges faced by active-duty service members deployed to Iraq and Afghanistan. The biggest advantage of the study was that it explained the effects of deployment from not only an economic perspective, but also from a sociological and psychological perspective. They talked with active-duty service members from all services. They also analyzed *Status of Forces Surveys of Active Duty Personnel* (March 2003 and July 2003 surveys) conducted by the DMDC from the period of 2003 to early 2004. The authors aimed to find the effects of recent deployments and recognized that the data belonged to the early GWOT period. However, the results and implications are still relevant to the current (2009) situation.

They presented an expected-utility model of deployment and retention. Their model assumed that service members did not have any control over their deployment, and that deployments were made randomly. The model explained how the probability of deployment, expected duration of deployment, randomness of deployment length, base pay, and deployment itself affected individual utility. Satisfaction of service members while on deployment was dependent on individual and unit preparation, unit cohesion, combat conditions, living conditions, duration of deployment, length of duty day, communication with family, family support programs, and certainty about deployment. Likewise, satisfaction of service members while at home depended on length of duty day, participation in family events, family support programs, and quality of housing and recreational facilities.

According to the model, each individual would have a preferred deployment time. As the individual's actual deployment time got closer to the preferred deployment time, the individual would experience higher utility. Since some individuals would have less

expected deployment time than preferred, higher-than-expected deployment time would increase utility for those members. The opposite was also true for individuals who experienced less-than-expected deployment with low preferred deployment time.

The authors conducted focus groups with enlisted personnel and officers in each service in the first six months of 2004. There were 324 total respondents: 273 enlisted and 51 officers (59 Army personnel, 98 Navy, 71 Marine Corps, and 96 Air Force). The goal was to find the correlation between deployment and retention.

The focus groups reported training for deployment, personal preparation, family preparation, increased frequency and length of deployment, long work hours, intense work pace on deployment, exposure to danger, coping with the death of colleagues, physical and environmental conditions, uncertainty, separation from loved ones, reintegration with family, and readjustment to life at home as factors causing stress. The stress was relevant for nondeployers, too. They reported increased work pace, separation from family because of longer workdays caused by the lack of sufficient and experienced personnel, and reintegrating with returning units considering the strong bonds formed during deployment as stressors. These factors had different effects on individuals' reenlistment intentions.

Focus groups also reported pay incentives, the opportunity to use the training in real-life situations, reduction in stress by elimination of non-job related issues, duty fulfillment, respect shown in public for his or her service, and building strong bonds with other members of their unit as positive aspects of the deployment.

There were some factors called moderators that reduced stress. Training was the most significant moderator reported by the focus groups. Talking with friends who experienced the same deployment, leadership, family support programs, communication with family, counseling, medical care, equipment, exercise, and entertainment (video games and movies) were other moderators.

The authors' analysis of survey responses focused on stress and the intention to stay in the military. Stress and retention intention measures were based on self-reports. Hosek, Kavanagh, and Miller analyzed the following four intention measures to stay in the military:

- Intention to stay for a career of twenty years or more,

- Whether desire to stay increased in the last year because of deployment,

- Whether desire to stay increased in the last year because of being not deployed,

- Whether or not the service member felt that his or her spouse wanted him or her to stay in the military.

For their study, the authors estimated linear probability models (LPMs). The variables in their LPM model were the following categorical variables:

- The number of times in the past twelve months that the service member worked longer than the usual duty day

- Whether the member was away from his or her home station in the past twelve months

- An interaction of 'away' with indicators for number of times worked longer than usual

- Whether he or she was involved in combat operation in OEF or OIF

- Whether being away was longer or shorter than expected

- Whether the member felt prepared

- Whether the member felt his or her unit was prepared

- Rank

- Marital status

- Gender

- Race

The explanatory variables often had opposite effects on higher-than-usual work stress and intention to stay. In other words, if a variable increased higher-than-usual stress it also decreased the likelihood of intention to stay. The results for the regressions were as follows:

- Working longer than the usual duty day frequently increased the probability of higher-than-usual stress and, therefore, decreased the probability of intention to stay.

- Service members who were away from their home base in the past twelve months worked longer than the usual duty day and more frequently than those at the home base. This resulted in higher-than-usual-stress and a lower intention to stay in the military for both groups. The only difference in intention to stay was because of longer work hours deployed personnel experienced when compared to personnel at their home base.

- OEF and OIF had two separate effects, namely on the probability of higher-than-usual stress and on intention to stay. Involvement in OEF and OIF decreased higher-than-usual stress for airmen only among the enlisted community; it decreased Marine Corps officer stress and increased Army officer stress among officer corps. These operations decreased the intention to stay for Army officers and enlisted personnel.

- Being away much more than expected increased stress and decreased the probability of intention to stay.

- If the person felt that he or she and his or her unit were well prepared, the probability of higher-than-usual stress was lower and the probability of intention to stay was higher.

- Service members experienced lower levels of stress and lower performance quality decline when their expectations from the deployment were equal to actual situation.

- Senior personnel, both officers and enlisted, were more likely to stay than junior personnel.

- Being married did not affect stress, but increased the intention to stay. Women and white people were more likely to report higher-than-usual stress.

There was a positive association between higher-than-usual stress and intention to stay. Members were more likely to stay as higher-than-usual stress increased. The authors' explanation for this relationship was based on the existence of an internal sorting process, which allowed personnel with a good match to the military lifestyle to be assigned positions that had more deployments.

There were some differences between officers and enlisted personnel. Firstly, individual preparedness and unit preparedness did not significantly reduce stress for officers. In addition, working longer than usual duty days was often not significant for the intention to stay for officers.

Another result worth noting was the categorical variable for the number of times in the past twelve months that service member worked longer than the usual duty day was not a significant predictor of the intention to stay for those with twenty years or more of service. It meant service members who chose the military as a career did not make retention decisions based on current work circumstances. Service members who had the highest intention to stay in the military were more likely to report a decrease in their intention to stay because of deployment and stress.

The sociological part of the study helped to understand how the increased demands of operational tempo caused tension between work and family life and on unit cohesion, and how deployments affected morale, leadership, and combat motivation. The psychological part of the study helped to understand the relationship between stress and performance.

There were some issues with this study. Retention rates of deployed personnel appeared to be normal, but nondeployers had higher attrition rates. Senior personnel were more likely to stay in the military regardless of the deployment and stressors because they self-selected to stay in the military.

E.   **ASSESSING THE EFFECTS OF INDIVIDUAL AUGMENTATION (IA) ON ACTIVE COMPONENT NAVY ENLISTED AND OFFICER RETENTION BY FRICKER AND BUTTREY (2008)**

Fricker and Buttrey compared service members who had been deployed via individual augmentation, or IA (called IAers by the authors), with those who had not been on an IA deployment. Enlisted IAers refer to enlisted personnel who have been on an IA deployment and made at least one decision to stay or leave the military. Non-IAers refer to personnel who either had not ever been on an IA deployment or made a decision before the IA deployment. Officer IAers refer to officers who had an IA deployment and completed their MSO (all the officer results are cited from Paisant, 2008). The authors chose variable characteristics one year before the decision point, under the premise that service members would start to think about their decision sometime prior to their decision point.

The data set covered all active duty officers and enlisted personnel who had an IA deployment since March 2002, which was provided by Pers-4, and administrative records from October 1997 through September 2007 obtained from the DMDC. There were 233,444 total enlisted personnel in the data of who 1,963 had been on an IA deployment, and 98,708 officers of whom 4,048 had been on an IA deployment.

Fricker and Buttrey compared retention rates by aggregate comparisons, demographic characteristics, and multivariate models. Aggregate comparisons assessed the difference in retention rates by utilizing categories one at a time. According to aggregate comparisons, IAers retained at a higher rate by gender, family status, race/ethnicity, and pay grade, except for E-4s and E-5s (Non-IAer E-4s and E-5s had about one percent higher retention rates), for enlisted personnel. IAer junior officers' retention rates were also higher than non-IAers by gender, family status, race, and rank.

The same approach was conducted by including all variables in a multivariate model to measure the effect of each variable individually. To do this, Fricker and Buttrey employed logistic regression for their multivariate analysis. For the enlisted personnel, AFQT and education level for quality, pay grade for seniority, decision year for changes in economy and gender, family status, and race/ethnicity for demographics were used in the model. They ran two separate models; one estimating retention rate of IAers against non-IAers, the other for only IAers deployed to hostile regions (Iraq and Afghanistan) against all non-IAers. For the first model, they found that IAers had 1.53 higher odds of staying than non-IAers. The odds ratio was even higher for Iraq and Afghanistan IAers by 1.93 compared to non-IAers. The odds ratio increased from 1.3 in the aggregate comparison to 1.53 in the first multivariate model, and it further increased to 1.93 for Iraq and Afghanistan IAers.

Paisant used the same approach for the junior officers in his study. He utilized a chi-squared test and a logistic regression, with and without covariates. He included gender, race/ethnicity, family status, and warfare specialty variables in his model. Results showed that IAers had an odds ratio of 2.57. It was indistinguishable from the 2.56 odds ratio in the aggregate comparison.

In conclusion, the studies found that IAers had higher retention rates, contrary to the general view, for both officers and enlisted personnel. The only exception was the lower rates seen in E-4s and E-5s, which were practically insignificant.

Some issues must be kept in mind when assessing the results, as the researchers pointed out. IA has been conducted for the past six years. The research analyzed retention behavior of 2002 cohort, whose retention decision was the only observed one. The study should be updated, as more recent data become available about retention behavior of other cohorts. Operational tempo has varied too much since the beginning of GWOT. Results may not reflect the most recent situation. Researchers were not able to recognize volunteer IAers' high retention rates, which may be concealing lower retention rates for nonvolunteers. Due to self-selection, a causal relationship between IA deployment and rise in retention rates cannot be inferred. In addition, retention rates could have been higher if IA program had not been started, but there was no means to measure this.

III. DATA

A.   DATA SOURCE

The file used in this study was the Active Duty Personnel Cohort file that was obtained from the Defense Manpower Data Center (DMDC). It was mainly built from Active Duty Personnel Extract files, covering the period from December 1987 to September 2007. The DMDC provided information from the Active Duty Personnel file, the Active Duty Military Pay file, and the Desert Storm file, and these files were merged by social security numbers (SSNs). To avoid the official limitations (approval and time limitation) of using SSNs, we received a file arranged according to a specific identification number for each individual rather than by SSN. Some members had multiple entries that indicate breaks of their military service. The data set contained information on service, MOS, gender, education, race and ethnicity, active duty date, source of commission, marital status, and Desert Storm Operation deployment status. It also contained extracted data elements like family status, pay grade, occupation group, duty location, and a hostile/nonhostile deployment indicator. The Marine Corps file contained 39,339 records and the Navy file contained 129,692 records. The file consisted of information on active duty officers on a quarterly basis from 1993 to 2007. We utilized this information to determine the effects of characteristics of junior officers along with the deployments for the GWOT on their retention decisions.

The study defines retention based on observing each officer one year beyond the MSO (minimum service obligation) for each cohort. MSO is five years for USNA graduate officers, except for aviators and nuclear officers who have 7-8 years of MSO. This research will include possible extensions due to postgraduate education and/or training during the MSO. Thus, if an officer graduated in 1998, our threshold for his or her stay-or-leave decision will be 2004, one year after the end of the five-year obligation.

Unlike enlisted personnel, officers make stay/leave decisions each year for the rest of their career. If we intended to look at a five-year threshold, we would include some officers who had an extended service obligation as being "retained." However, that

may not be the case. As displayed in Figure 3, by looking at a 6-year window we allow extended service obligations to be included and prevent overstating retention.
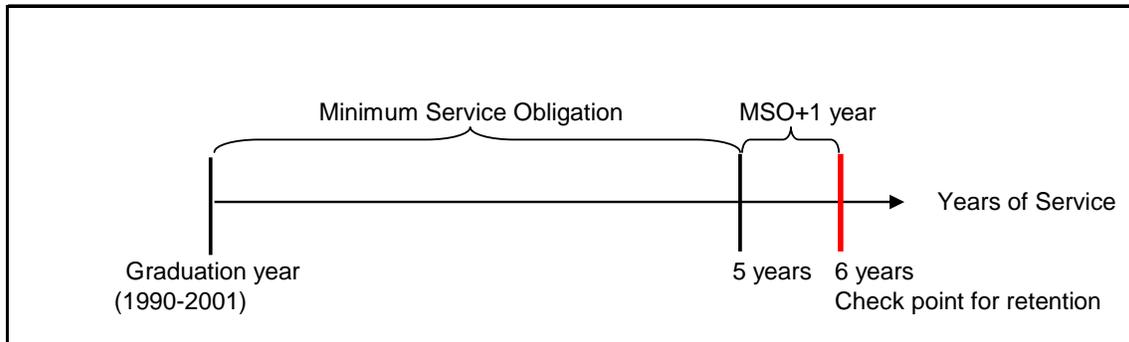
Figure 3. Explanation of 6-year Period to Determine Whether an Officer Stayed in Military

The data consisted of 129,692 longitudinal records of Navy officers and 39,339 Marines Corps officers at the beginning as shown in Table 1. Midgrade officers and officers other than U.S. Naval Academy graduates are not within the scope of this thesis. Moreover, the data covered the period until 2007. The retention point for this study is six years. We are not able to observe the decision of officers who graduated after 2002. After deleting these observations, there were 9,623 officers in the Navy file and 1,690 in the Marine Corps file. The retention variable was created based on having information at the second quarter of the sixth year. If the observation did not have information on his or her sixth year, it was accepted as attrited and coded "0". Some of the observations had no information from the beginning of their commissioning date for some reason. These observations would have overstated retention in our model. Thus, we looked through all records in the file and deleted observations that did not have any information for two and a half years from the commissioning date (because of inadequate information). Aviators and submarine officers are also out of scope of this study because of their longer MSOs. Removing them from the study left 6,894 observations in the Navy data and 1,005 observations in the Marine Corps data for analysis.

	Navy	Marine Corps
Original data	129,692	39,339
Delete non-academy grads	106,131	35,203
Delete <1990 & >2001	13,938	2,446
Remaining	9,623	1,690
Inadequate information	226	72
Aviators	2,132	613
Submarine	371	0
Final numbers	6,894	1,005

Table 1.   Explanation of Observation Numbers in Data Files

B.   DATA RESTRICTIONS AND LIMITATIONS

Nuclear officers, flight officers, and pilots undergo longer training periods and have longer MSOs than other officers have. Therefore, they are excluded in this study. Officers who are assigned to other services are not included due to difficulty in tracking them and obtaining their information.

Hostile deployment is determined by looking at deployments to Iraq and Afghanistan. However, not all the officers who deploy to these regions are exposed to danger. Front line officers are exposed to more life-threatening situations, but the data do not capture this information.

In the Navy data file, there was no indication of deployments to Iraq or Afghanistan, which led us to analyze all Navy deployments as general. We could not classify any deployment as hostile for the post-GWOT period. We had planned to divide the data into four categories: two for periods and two for deployment types. This drawback hampered our analysis of the effect of the GWOT on USNA graduates in the way we had intended.

Our threshold for the beginning of the GWOT period is the end of 2001. Cohorts from 1990 to 1995 are included in the pre-GWOT period, while cohorts from 1996 to 2001 are included in the post-GWOT period.

Reasons for leaving the military include voluntary separation, discharge, medical, and injury/death. We were not given specific information on separation date and reason. For a particular observation, if the officer did not have any information for ten consecutive quarters, we assumed that he or she had left the military.

While cleaning the data, we accepted the end of the data as the end of deployment. That is, if an officer was deployed in the second quarter of 2007 and returned in the second quarter of 2008, we calculated that specific deployment as six months, rather than a year.

Family status was categorized as joint marriage, married, single with family, or single without family. Considering previous studies, having dependents is a strong explanatory variable that affects stay/leave decisions. However, current available data provided information on marital status, but not the number of dependents. A married service member with five children was treated the same as with a married service member who has no children.

Deployment information was on a quarterly basis. It reflected the deployment status of an officer at the exact point when the information was recorded. An officer, who was in his or her deployment location at the time the data were recorded, would appear to have three months as deployment duration even if he or she was deployed for only one month. The opposite is also true. An officer who came back from deployment would not have that information if he or she happened to return before the data were recorded.

Another weakness of the data was missing values for MOS for the Marine Corps and designator for the Navy. Billet codes were used for these missing values to categorize military occupational specialties. Moreover, almost one-third of the observations had neither designator codes nor billet codes. These officers were placed into other MOS category along with the observations whose billet codes did not belong to any specific group.

As shown in Figure 4, the number of Navy observations in the 1990, 1991, and 1992 cohorts were higher than in the rest of the cohorts. As explained in Table 1, aviators and submarine officers were excluded from this study. In Table 2, this problem is explained in detail. Starting from 1993, designator information was more accurate, and information for submarine officers and aviators was more reasonable. However, in 1990, 1991, and 1992 a lot of the designator information was missing. Under our rule, those missing observations were classified as "other MOS" rather than aviator and submarine, and therefore remained in the data. Whereas, aviator numbers averaged 230 per year after 1993, they averaged eighteen per year before 1993. If we would have had better data, we could have classified aviators and submarine officers correctly and deleted them. These observations created the fluctuations in the USNA sample shown in Figure 4.

NAVY	Commissioning Year											
	90	91	92	93	94	95	96	97	98	99	100	101
SWO	45	92	73	165	198	167	170	162	155	163	154	188
Supply	28	34	22	55	47	54	38	87	88	70	97	71
Other MOS	744	667	719	331	297	272	250	245	234	251	238	223
Submarine	23	20	8	44	27	29	27	23	32	42	45	51
Aviator	20	13	22	245	167	246	266	247	238	201	243	224

Table 2.   Naval Officers' Designator Distribution by Cohorts

C.   ASSUMPTIONS

Prior enlistment was decided based on the difference between the pay entry base date and date of entry to officer ranks. Observations that had pay information in the data before entering the Naval Academy were considered as prior enlisted. If the difference was more than 48 months, the officer was assumed to be prior enlisted. If an officer did not have any information for ten consecutive quarters, he or she was considered to have left the military.

D.   PRELIMINARY ANALYSIS

Figure 4 displays the number of Naval Academy graduates in our data by graduation year. There were 6,894 observations in the Navy file and 1,005 observations in the Marine Corps file after deleting aviators and submarine officers. Approximately 15% of each cohort selected the Marine Corps each year on average. Fluctuations were caused by designators and data error as explained in the section on data limitations. The distribution was more homogenous before deleting aviators. For instance, the 1993 cohort had 67 Marine Corps officers, but 60 of them were aviators.

Number of USNA Graduates by Cohorts

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Marine Corps	59	61	95	7	118	84	94	90	98	102	97	100
Navy	817	793	814	551	542	493	458	494	477	484	489	482
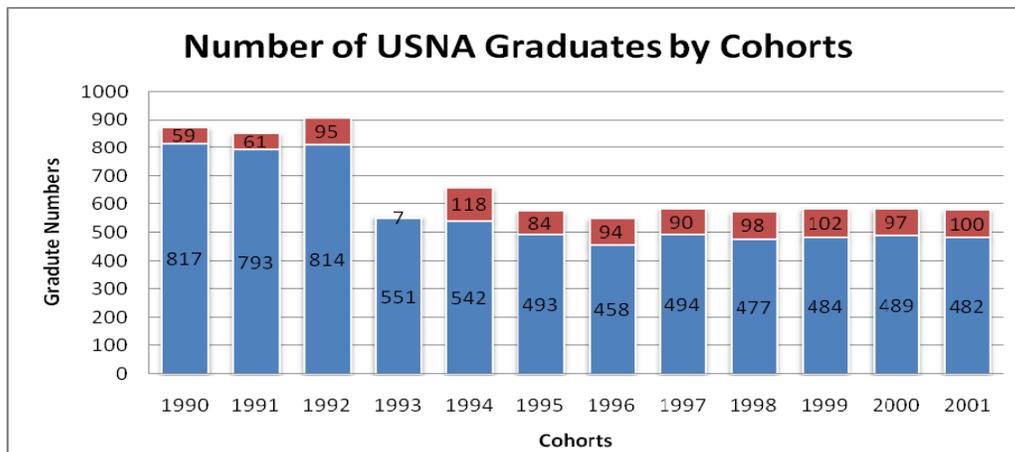
Figure 4.   Number of USNA Graduates by Service and Cohorts

As presented in Table 3 and Table 4, the majority of the officers in both services were white single males. The percentage of female officers increased by six percentage points for the Navy, from 10% to 16%, and by ten percentage points for the Marine Corps, from 4% to 14%. Approximately half of the officers were single and without dependents; officers in the other half either were married or had dependents or both. The proportion of married officers decreased by 8% for the Navy and by 10% for the Marine Corps after the GWOT. One can surmise that there was reluctance among officers to get married due to the lack of time to establish a stable relationship or because of high life-threatening deployments they may experience. There was a rise in the percentage of service members who married another service member between the two periods for both services.

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Naval officers had a general deployment rate of 15% in the pre-GWOT period and 18% in post-GWOT period.[7] Of the deployed naval officers, most of them were deployed only once. As to deployment duration, the majority of naval officers experienced deployments longer than a year regardless of the period. Being away from home and loved ones for such long periods might affect service members more, compared to going on two relatively short deployments. Although the Marines deployed more frequently, their deployment durations were concentrated in deployments of less than six months. While the Navy sent officers for fewer but longer deployments, the Marine Corps sent officers on more frequent but shorter deployments. No significant increase in deployments one year prior to the service member's decision to stay or leave the military was detected for either service.

Prior enlistment is included in the models as a separate variable by which to predict retention behavior of service members more accurately. Being aware of the military lifestyle and choosing this as a career, prior enlisted personnel are expected to retain at a higher rate than their peers do. The preliminary results indicated that there was almost no change in the proportion of prior enlisted in the post-GWOT period.

A significant change was observed in the ratio of military occupational specialties. The percentage of surface warfare officers and supply officers almost doubled in the Navy in the post-GWOT period.

The 1990, 1991, and 1992, Navy cohorts had data errors, which created a fluctuation in designators as presented in Table 2. Readers might think this error has the potential to bias the results. Therefore, to prevent the possibility of misinterpretation separate results were produced for the pre-GWOT Navy cohorts omitting the 1990-1992 cohorts. The results were similar for most of the variables, though. The proportion of observations in each designator changed drastically. As Table 3 shows, while the percentage of SWO and supply officers almost doubled, the number of officers in the "other MOS" (designator) category decreased by half. The ratio of officers experiencing

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[7] We mention general deployments to compare two services. The Navy file did not have any hostile deployment information.

a deployment rose from almost 15% to 20%. Figures for deployment frequency and duration did not change, despite an increase of five-percentage point increase in the proportion of deployed officers.

Characteristics	Pre-GWOT N = 4,010 (1990-1995 cohorts)	Pre-GWOT N = 1,586 (1993-1995 cohorts)	Post-GWOT N = 2,884	Pooled Sample N = 6,894
Gender (%)				
Male***	89.28	87.33	83.32	86.79
Female***	10.72	12.67	16.68	13.21
Race/Ethnicity (%)				
White***	83.04	78.81	73.40	79.01
Black	5.34	6.68	6.21	5.70
Hispanic***	4.86	6.24	12.14	7.91
Other Race**	6.64	8.27	8.25	7.38
Marital Status (%)				
Joint Marriage***	1.21	1.22	3.69	2.24
Married***	48.99	44.91	41.10	45.69
Single with Family***	1.59	3.20	3.90	2.55
Single without Family**	48.21	50.67	51.32	49.51
Age				
Average Age***	28.67	28.77	28.78	28.71
Prior Enlistment (%)				
Prior Enlisted	.1	.13	.1	.1

Characteristics	Pre-GWOT N = 4,010 (1990-1995 cohorts)	Pre-GWOT N = 1,586 (1993-1995 cohorts)	Post-GWOT N = 2,884	Pooled Sample N = 6,894
Military Occupational Specialty (%)				
Surface Warfare Officer***	18.45	33.42	34.40	25.12
Supply***	5.99	9.84	15.64	10.02
Other MOS***	75.56	56.75	49.97	64.85
Being Deployed in Last 12 Months Prior to Stay Decision (%)				
Last12	6.83	6.68	7.14	6.96
General Deployment Indicator (%)				
No Deployment***	85.36	80.96	81.66	83.81
General Deployment***	14.64	19.04	18.34	16.19
General Deployment Frequency Indicator (%)				
No Deployment***	85.36	80.96	81.66	83.81
One General Deployment***	13.02	16.65	15.78	14.17
Two or More General Deployments***	1.62	2.40	2.57	2.02
General Deployment Duration Indicator (%)				
No Deployment***	85.36	80.96	81.66	83.81
General Deployments < 6 Months	1.87	2.77	1.77	1.83
General Deployments >6	2.92	3.40	2.46	2.73

Characteristics	Pre-GWOT N = 4,010 (1990-1995 cohorts)	Pre-GWOT N = 1,586 (1993-1995 cohorts)	Post-GWOT N = 2,884	Pooled Sample N = 6,894
& <12 Months				
General Deployments >12 Months***	9.85	12.86	14.11	11.63

*** Chi2 statistic significant at .01 level

** Chi2 statistic significant at .05 level

* Chi2 statistic significant at .10 level

Table 3.   Characteristics of Naval Officers Eligible to Make Retention Decision

As shown in Table 4, for the Marine Corps, the difference between combat and combat support changed by 8% in the favor of combat support in the post-GWOT period, while the number of combatants decreased by seven percentage points and the number of officers in combat support units increased by the same percentage in the Marine Corps.

There was a huge gap between Navy and Marine Corps service members' deployment rates. Marine Corps service members had 70% and 55% general deployment rates in the pre- and post-GWOT period, respectively, compared to naval officers' 15% and 18% general deployment rates.

The proportion of Marine officers experiencing more than one deployment was considerably higher than for Navy officers. Approximately 30% of the officers deployed two or more times in the pre-GWOT period and 20% of the officers deployed two or more times in the post-GWOT period. The ratio of hostile deployed officers was almost 11% for all the officers and it increased to 18% among deployed officers in the Marine Corps.

In this study, hostile deployment was defined only for the GWOT-period deployments to Iraq and Afghanistan. There were no member locations coded as Iraq and Afghanistan in the Navy file. Therefore, the Navy did not have a hostile deployment indicator in this data. Figures showed that around 20% of the Marine officers experienced

hostile deployments. Of these officers, more than 80% were deployed only once and the remaining experienced two or more deployments. The number of hostile deployments shorter than six months is twice the number of deployments longer than six months.

Characteristics	Pre-GWOT N = 424	Post-GWOT N = 581	Pooled Sample N=1,005
Gender (%)			
Male***	95.05	85.54	89.55
Female***	4.95	14.46	10.45
Race/Ethnicity (%)			
White	81.84	80.72	81.19
Black	8.25	7.92	8.06
Hispanic	7.08	5.34	6.07
Other Race**	2.83	6.02	4.68
Marital Status (%)			
Joint Marriage***	3.09	7.09	5.41
Married***	46.32	36.68	40.74
Single with Family	1.43	.69	1.00
Single without Family**	49.17	55.54	52.85
Age			
Average Age***	29.26	28.78	28.98
Prior Enlistment (%)			
Prior Enlisted	2.36	2.75	2.59
Military Occupational Specialty (%)			

Characteristics	Pre-GWOT N = 424	Post-GWOT N = 581	Pooled Sample N=1,005
Combat **	52.02	44.29	47.55
Combat Support **	47.98	55.71	52.45
Being Deployed in Last 12 Months Prior to Stay Decision			
Last12*	8.96	12.39	10.95
General Deployment Indicator (%)			
General Deployments***	71.46	54.91	61.89
No Deployment***	28.54	45.09	38.11
Deployment Frequency Indicators (%)			
No Deployment***	28.54	45.09	38.11
One General Deployment*	41.75	36.32	38.61
Two or More General Deployments***	29.72	18.59	23.28
Deployment Duration Indicators (%)			
No Deployment***	28.54	45.09	38.11
General Deployments < 6 Months***	32.08	23.92	27.36
General Deployments >6 & <12 Months***	20.28	13.08	16.12
General Deployments >12 Months	19.10	17.90	18.41
Hostile Deployment Indicator (%)			
No Hostile Deployment	-	80.72	-
Hostile Deployment(s)	-	19.28	-
Hostile Deployment Frequency Indicators (%)			
No Hostile Deployment	-	80.72	-

Characteristics	Pre-GWOT N = 424	Post-GWOT N = 581	Pooled Sample N=1,005
One Hostile Deployment	-	16.35	-
Two or More Hostile Deployment	-	2.93	-
Hostile Deployment Duration Indicators (%)			
No Hostile Deployment	-	80.72	-
Hostile Deployments Less Than 6 Months	-	13.25	-
Hostile Deployments More Than 6 Months	-	6.02	-

*** Chi2 statistic significant at .01 level

** Chi2 statistic significant at .05 level

* Chi2 statistic significant at .10 level

Table 4.   Characteristics of Marine Corps Officers Eligible to Make Retention Decision

As stated in the previous studies, marital status was a key factor in the decision to stay or leave. Being single has mostly been associated with lower retention. Quester (2006) found in her study that single officers had higher deployment frequencies. However, we calculated almost an equal rate of general deployment for these two categories. The general deployment rate for married officers was 60% versus 64% for single officers. Tabulations of data in hand also showed that single officers without dependents were deployed longer than married officers. This gap increased as the duration of hostile deployments increased.

Figure 5 and Table 5 display the retention rates by marital status and by service. The highest rate of leaving at the initial decision point belonged to single officers while married officers and those with dependents had significantly higher retention rates. Single officers had a higher propensity to leave, whereas those with dependents preferred to

enjoy the stable benefits offered by the military. Naval officers apparently have had higher retention rates across all categories of marital status throughout the whole period covered in the study.
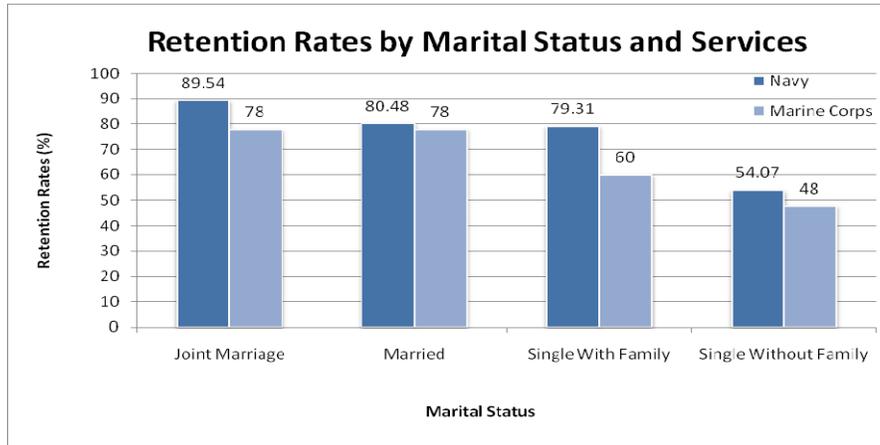
Figure 5.   Retention Percentages by Marital Status by Service

	Joint Marriage		Married		Single with Family		Single without Family	
	Navy	**USMC**	**Navy**	**USMC**	**Navy**	**USMC**	**Navy**	**USMC**
Attrited	16	12	608	92	36	4	1,550	273
Retained	137	42	2,507	315	138	6	1,825	255

Table 5.   Retention Numbers by Marital Status by Service

Figure 6 shows that retention rates for both services follow the same pattern across cohorts. However, naval officers always have higher retention rates (except for the first two years).
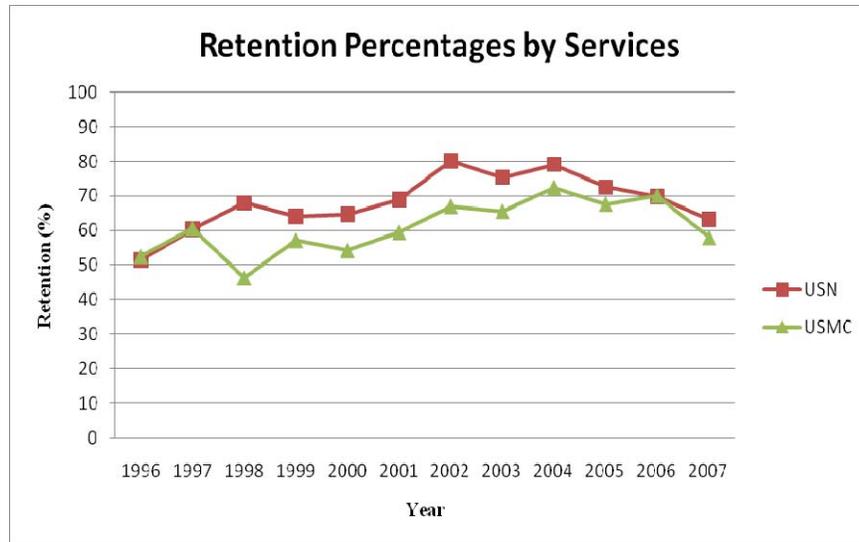
Figure 6.   Retention Rates by Services

1.   Deployment Frequency Analysis

Figure 7 shows that an increase in the number of deployments contributes to higher retention rates before the GWOT. The more deployments a naval officer experiences the more likely he or she prefers to stay in the military.
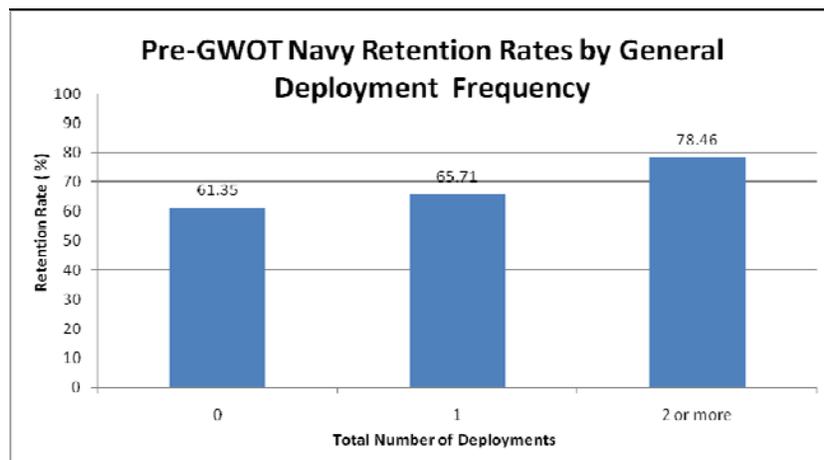
Figure 7.   Pre-GWOT Navy General Deployment Retention Rates

The same pattern is valid for the Marine Corps as well, as seen in Figure 8. An increasing number of deployments contributed to higher retention rates. More than half of the nondeployed officers preferred to leave the military. We believe this probably stems

from unsatisfied expectations about the military lifestyle. As these officers had the opportunity to increase their utility level, their propensity to stay increased as well.
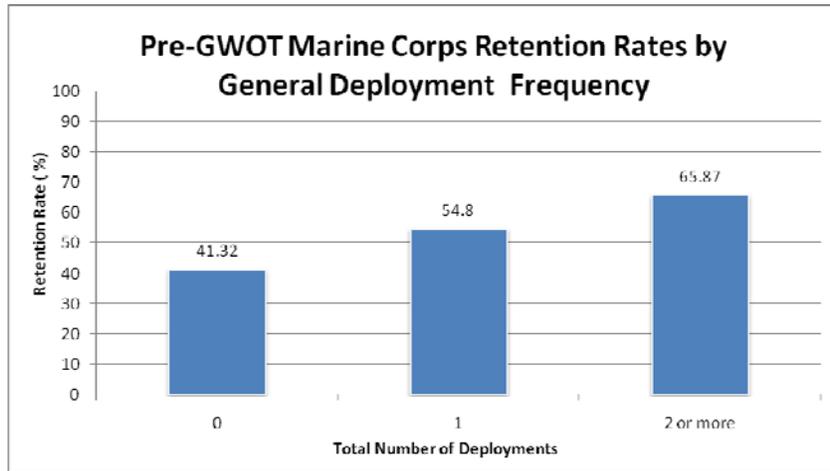
Figure 8.   Pre-GWOT Marine Corps General Deployment Retention Rates

Not surprisingly, nondeployed officers had a lower tendency to stay in the military compared to their deployed peers, as found in the previous literature. As shown in Figure 9, an increasing number of deployments helped to increase retention, more than in the pre-GWOT period. Compared to the pre-GWOT's four-percentage point increase from a 61% to a 65% retention rate, officers deployed at least once in the post-GWOT cohorts had a nine percentage point increase, from 71% to 80%.
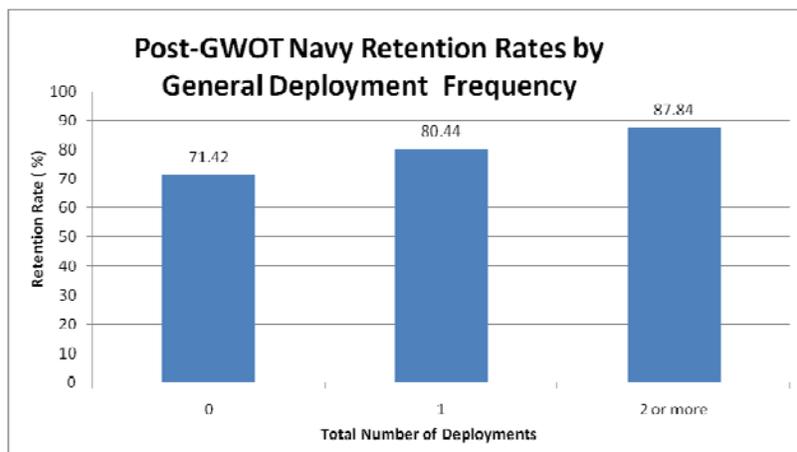
Figure 9.   Post-GWOT Navy Retention Rates

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Figure 10 shows that the positive effect of deployment increased after the GWOT for the Marine Corps. The effect increases drastically when we look at only hostile deployments. One can see an upward trend in retention rates with an increasing number of deployments. Officers who are willing to select the Marine Corps expect to have more deployments than their peers do. Therefore, their actual utility will be closer to their expected utility as they experience more deployments. Having fewer non-job related duties and more opportunities to apply leadership skills, as well as using training in real-life situations, may explain their higher retention during the post-GWOT period.
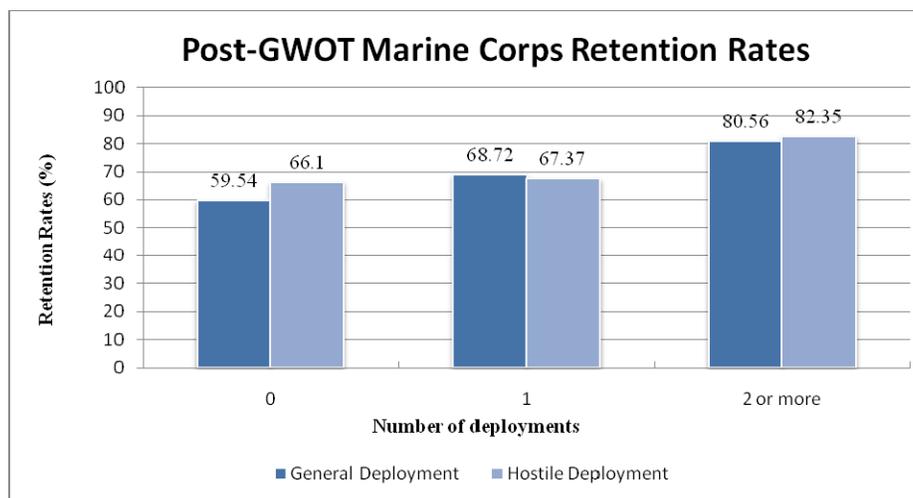
Figure 10.   Post-GWOT Marine Corps Retention Rates

2.   Deployment Duration Analysis

According to the retention rate tabulations by deployment duration in Figure 11, the highest retention rates belonged to naval officers who were deployed less than six months and more than twelve months, respectively. It is odd to see a lower retention rate for officers who were deployed between six and twelve months than for nondeployed officers. Nevertheless, we cannot say for sure that deployment duration influences the retention decision.
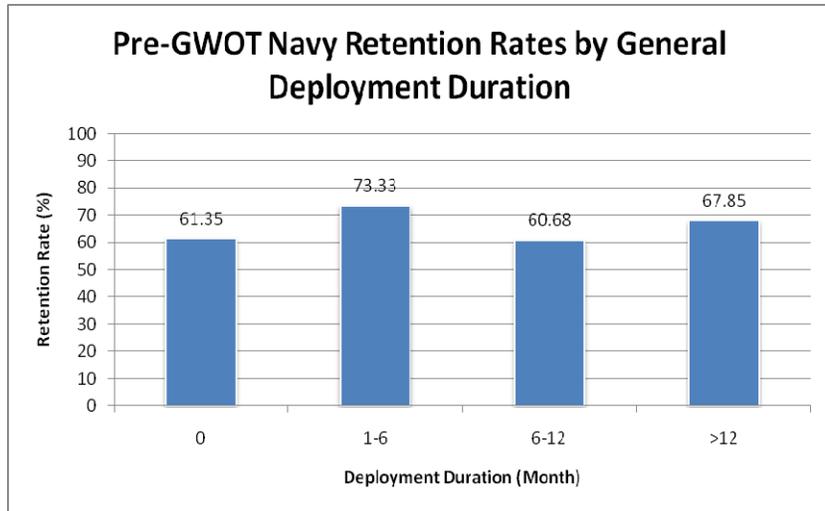
Figure 11. Pre-GWOT Navy Retention Rates by General Deployment Duration

Figure 12 shows that there is an obvious upward trend for pre-GWOT Marine Corps officers' retention by deployment duration. The longer a marine is deployed, the more likely he or she would prefer to continue military service. Marine Corps officers react more positively to longer deployments than their naval colleagues do.
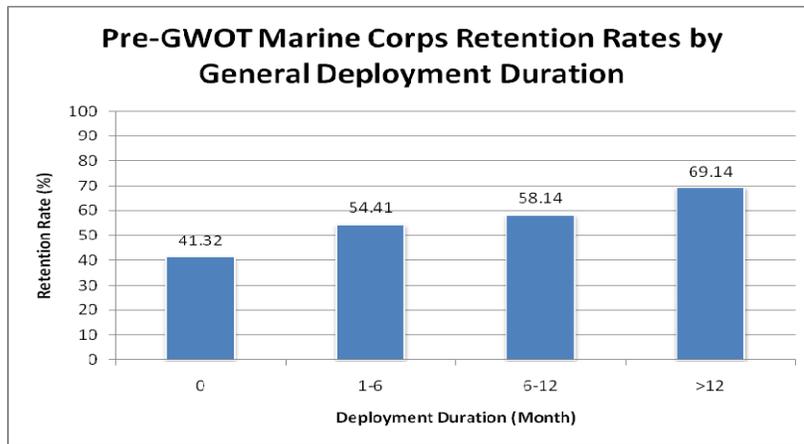
Figure 12. Pre-GWOT Marine Corps Retention Rates by General Deployment Duration

Figure 13 shows that, contrary to the pre-GWOT period, officers stayed in the military at higher rates in the post-GWOT period, regardless of the length of deployment. Whether because of the effect of psychological aspects like patriotism and nationalism or physical ones like better pecuniary benefits, retention rates among junior officers in the Navy were obviously higher than in the previous period as a whole. The highest retention

rate emerged for officers who were deployed less than six months, as in the pre-GWOT period. Another conspicuous trend is the decreasing retention rate with extended tours, as shown in Figure 13.
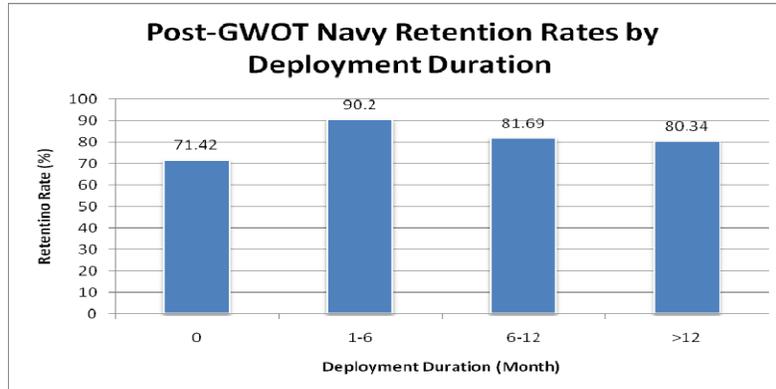
Figure 13.   Post-GWOT Navy Retention Rates by General Deployment Duration

In Figure 14, it appears that continuation rates increase with deployment duration. However, we believe that it is the effect of deployment itself, rather than its length, that affects continuation. The effect of duration on retention is almost the same for post-GWOT Marine Corps junior officers. Figure 14 shows retention rates for any of the periodical categories were significantly higher for deployed than for nondeployed officers. Moreover, when compared to the pre-GWOT period, we witness on average a 13% higher continuation rate.
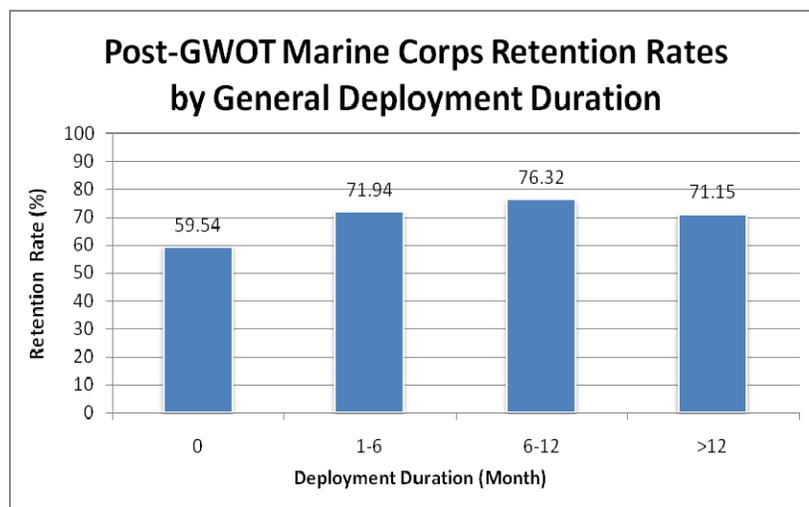
Figure 14.   Post-GWOT Marine Corps Retention Rates by General Deployment and Duration

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Figure 15 shows that hostile deployment contributes to a higher retention rate, but to a lesser degree than general deployments do. The continuation rate was substantially increased by longer deployments for officers deployed to hostile regions. The six percentage point increase in continuation rates can be attributed to being deployed rather than the duration. however, the eleven percentage point difference between deployments less than six months and those more than six months can be attributed to the duration of deployment.
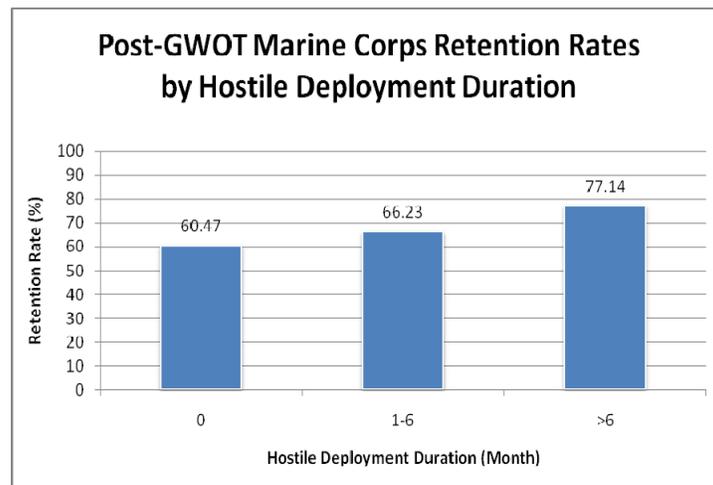
Figure 15.   Post-GWOT Marine Corps Retention Rates by Hostile Deployment and Duration

Table 6 presents the average deployment duration in months. The GWOT did not affect the duration of deployments for either services. Naval officers deploy longer on average than Marine officers. This might be a result of the two-year sea/shore rotation policy executed by the Navy. For the Marines, half of the deployments after the GWOT are hostile.

General Deployments				Hostile Deployments	
Pre-GWOT		Post-GWOT		Navy	Marine Corps
Navy	Marine Corps	Navy	Marine Corps		
20.89	12.09	21.22	12.66	-	6.70

Table 6.   Average Deployment Duration by Deployment Type, Service, and Period

IV. METHODOLOGY

A. ANALYTICAL METHOD

1. Theoretical Model

We wanted to analyze the individual decisions of eligible junior officers to stay or leave active duty. Therefore, logistic regression was preferred because retention is measured as a binary outcome. We defined the dependent variable for every observation (i) as Y_i, which was coded 1 if the officer decided to stay, and 0 otherwise.

The theoretical model is:

$$\log (P_i / (1-P_i)) = \beta_0 + \beta_1 X_1 + .. + \beta_n X_n$$

where :

$\log (p_i / (1-p_i))$ = Log of odds ratio for individual i

pi = Probability of stay for individual i

β_0 = Intercept

β = Estimated coefficient (change in log odds for a unit change in Xs)

X = Values of explanatory variables

2. Model Specification

a. General Deployment Model

The purpose of this model was to capture the effect of being deployed (regardless of type of deployment) or not being deployed. An interaction of the GWOT dummy with being deployed was included to reflect the treatment effect.

Thus, the model is as follows:

$$\ln(P_i / (1-P_i)) = \quad \beta_0 + \beta_1\text{FEMALE} + \beta_2\text{BLACK} + \beta_3\text{HISPANIC} +$$
$$\beta_4\text{OTHERRACE} \quad + \quad \beta_5\text{JOINTMARRIAGE} \quad +$$
$$\beta_6\text{SINGLEWITHFAM} + \beta_7\text{SINGLEWOFAM} + \beta_8\text{AGE} +$$
$$\beta_9\text{PRIORENLISTED} + \beta_{10}\text{SWO} + \beta_{11}\text{SUP} + \beta_{12}\text{LAST12} +$$
$$\beta_{13}\text{GENDEP} + \beta_{14}\text{GWOT} + \beta_{15}\text{GENDEP\_GWOT}$$

where:

FEMALE = being female

BLACK = being African American

HISPANIC = being Hispanic

OTHERRACE = being other race except white, black, or Hispanic

JOINTMARRIAGE = being married with a spouse who is also in the military

SINGLEWITHFAM = being single with dependent(s)

SINGLEWOFAM = being single with no dependent

AGE = age of the officer

PRIORENLISTED = being enlisted prior to USNA

SWO[8] = being a surface warfare officer (SWO)

SUP= being a supply officer

LAST12 = being deployed in the last twelve months prior to the end of a MSO

GENDEP = being deployed either to a hostile or nonhostile region

GWOT = period after 9/11 (2001)

GENDEP_GWOT = the effect of treatment (GWOT)

---

[8] SWO and SUP are MOS variables for Navy models. COMBAT and COMBATSUPPORT replace these variables for the Marine Corps models.

b. General Deployment Frequency Model

This model captured the effect of the number of deployments of any type. The model is stated as follows:

$$\ln(P_i / (1-P_i)) = \beta_0 + \beta_1 FEMALE + \beta_2 BLACK + \beta_3 HISPANIC + \beta_4 OTHERRACE + \beta_5 JOINTMARRIAGE + \beta_6 SINGLEWITHFAM + \beta_7 SINGLEWOFAM + \beta_8 AGE + \beta_9 PRIORENLISTED + \beta_{10} SWO + \beta_{11} SUP + \beta_{12} LAST12 \beta_{13} ONEGENDEP + \beta_{14} TWOMOREGENDEP + \beta_{15} GWOT + \beta_{16} ONEGENDEP\_GWOT + \beta_{17} 2MOREGENDEP\_GWOT$$

where:

ONEGENDEP = being deployed only once

2MORE_DEP = being deployed two or more times

ONEGENDEP_GWOT = the effect of treatment (GWOT) for one deployment

TWOMOREGENDEP_GWOT = the effect of treatment (GWOT) for two or more deployments

c. General Deployment Duration Model

This model captured the effect of the duration of deployments, regardless of deployment type. It is stated as such:

$$\ln(P_i / (1-P_i)) = \beta_0 + \beta_1 FEMALE + \beta_2 BLACK + \beta_3 HISPANIC + \beta_4 OTHERRACE + \beta_5 JOINTMARRIAGE + \beta_6 SINGLEWTITHFAM + \beta_7 SINGLEWOFAM + \beta_8 AGE + \beta_9 PRIORENLISTED + \beta_{10} SWO + \beta_{11} SUP + \beta_{12} LAST12 + \beta_{13} DEPLESS\_6 + \beta_{14} DEP6\_12 + \beta_{15} DEPMORE\_12 + \beta_{16} GWOT + \beta_{17} DEPLESS\_6\_GWOT + \beta_{18} DEP6\_12\_GWOT + \beta_{19} DEPMORE\_12\_GWOT$$

where:

> DEPLESS_6 = being deployed for six months or shorter
>
> DEP6_12 = being deployed between seven and twelve months
>
> DEPMORE_12 = being deployed for longer than twelve months
>
> DEPLESS_6_ GWOT = the effect of treatment (GWOT) for deployments shorter than six months
>
> DEP6_12_ GWOT = the effect of treatment (GWOT) for deployments between seven and twelve months
>
> DEPMORE_12_ GWOT = the effect of treatment (GWOT) for deployments longer than twelve months

d. *Hostile Deployment Model*

This model captured the effect of hostile deployments versus nonhostile deployments. We did not include an interaction term between hostile deployments and GWOT, because all deployments to Iraq and Afghanistan after the GWOT were considered as hostile in our model. The model is as follows:

$$\ln(P_i / (1 - P_i)) = \beta_0 + \beta_1 FEMALE + \beta_2 BLACK + \beta_3 HISPANIC + \beta_4 OTHERRACE + \beta_5 JOINTMARRIAGE + \beta_6 SINGLEWITHFAM + \beta_7 SINGLEWOHFAM + \beta_8 AGE + \beta_9 PRIORENLISTED + \beta_{10} COMBAT + \beta_{11} LAST12 + \beta_{12} HOSDEP + \beta_{13} GWOT$$

where:

> HOSDEP = being deployed to a hostile region at least once

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e. Hostile Deployment Frequency Model

This model captured the effect of the number of hostile deployments. The model is as follows:

$$\ln(P_i / (1-P_i)) = \beta_0 + \beta_1 \text{FEMALE} + \beta_2 \text{BLACK} + \beta_3 \text{HISPANIC} + \beta_4 \text{OTHERRACE} + \beta_5 \text{JOINTMARRIAGE} + \beta_6 \text{SINGLEWITHFAM} + \beta_7 \text{SINGLEWOFAM} + \beta_8 \text{AGE} + \beta_9 \text{PRIORENLISTED} + \beta_{10} \text{COMBAT} + \beta_{11} \text{LAST12} + \beta_{12} \text{ONEHOSDEP} + \beta_{13} \text{TWOMOREHOSDEP} + \beta_{14} \text{GWOT}$$

where:

ONEHOSDEP = being deployed to hostile region once

TWOMOREHOSDEP = being deployed to hostile region two or more times

f. Hostile Deployment Duration Model

This model captured the effect of duration of hostile deployments and is stated as follows:

$$\ln(P_i / (1-P_i)) = \beta_0 + \beta_1 \text{FEMALE} + \beta_2 \text{BLACK} + \beta_3 \text{HISPANIC} + \beta_4 \text{OTHERRACE} + \beta_5 \text{JOINTMARRIAGE} + \beta_6 \text{SINGLEWTITHFAM} + \beta_7 \text{SINGLEWOFAM} + \beta_8 \text{AGE} + \beta_9 \text{PRIORENLISTED} + \beta_{10} \text{COMBAT} + \beta_{11} \text{LAST12} + \beta_{12} \text{HOSDEPLESS\_6} + \beta_{13} \text{HOSDEPMORE\_6} + \beta_{14} \text{GWOT}$$

where:

HOSDEPLESS_6 = being deployed to hostile region for six months or shorter

HOSDEPMORE_6 = being deployed to hostile region more than six months

B.   VARIABLE DEFINITIONS

1.   Dependent Variable (RETAINED)

A binary variable was used to capture the decision of retention. If an officer decided to stay in the military at the end of his or her MSO, this variable was given the value of 1 and the officer classified as "retained." In this study, we accepted an officer as retained if he or she had any information in the sixth year, as explained in detail in Chapter III. If no information was detected beyond his or her MSO, he or she was classified as attrited and this variable was given a value of 0.

2.   Explanatory Variables

a.   Demographic Variables

(1)   Gender (MALE, FEMALE): The gender variable was binary and took the value of 1 for female officers and 0 for male officers. The base case was male officers, who make up the majority for both services. The burden of the family is mainly on females. With increasing operational tempo and longer deployment durations, every service member is affected in a negative manner, but females perhaps more. In the case of deciding between family and military, female service members are expected to be more inclined to choose family. Therefore, the expected sign of the FEMALE variable is negative.

(2)   Race/Ethnicity (WHITE, BLACK, HISPANIC, OTHERRACE): Race/Ethnicity was categorized in four separate variables: white, black, Hispanic, and other race. Each of them was binary and took a value of 1 if an observation belonged to that specific group, and 0 otherwise. The base case was white, which makes up the majority in both services again. If non-white officers believe they have a level of opportunity equal to white officers in the military, or better opportunities than in civilian life to promote and have a career, they become more likely to stay. Stewart and Firestone (1992) concluded in their study that there is a white male dominance in the military. All of the services have programs to boost minority accessions and ensure minority officers

have a chance to succeed and be promoted in the military. It would be reasonable to expect minorities to stay in the military at a higher rate than their white peers. The expected sign for race/ethnicity for each group, other than white, is positive.

(3)   Family   status   (JOINTMARRIAGE,   MARRIED, SINGLEWITHFAM, SINGLEWOFAM): Family status was categorized into several variables: (1) joint marriage for couples who are both service members; (2) single with family for single service members with children; (3) single without family for service members who are single and have no dependents, and (4) married for married service members (regardless of number of children). The base case was married for this variable. Service members with dependents, whether married or single, are expected to have higher retention rates than others. Increasing frequency and duration of deployments and the uncertainty of acquiring a satisfactory civilian job might have a negative retention effect for every family status category. Single service members are expected to leave military more readily than their peers who are married and/or have children. Single service members without family are expected to have a negative coefficient of retention, and all other marital statuses are expected to have positive ones.

(4)   Age (AGE): We calculated age at the time of the decision to stay or leave. It was computed by adding six years to the date of commissioning and subtracting the date of birth. The older the service member, the more likely he or she is to be married and have dependents, and the more eager to have a reliable income and health benefits.

b.   Service Variables

(1)   Prior enlisted (PRIORENLISTED): An officer was categorized as prior enlisted if he had pay entry information prior to entrance to USNA. Prior enlistment is expected to have a positive effect on service members' retention decisions for two reasons. Service members who were prior enlisted have acquired knowledge about military life and might prefer to stay in the military as a career officer. Secondly, they are more likely to stay in the military for retirement versus their younger colleagues.

(2) Military occupational specialty/designator (MOS): For the Navy, officers were grouped into the following categories: surface warfare, supply and other. Of the 6,894 officers, 2,109 did not have any MOS information and were placed into the "other MOS" category. Officers who had neither a designator nor a specific billet code were classified into "other MOS" as well. The Marine Corps had two categories for MOS: combat and combat support. A few missing values were ignored. We expect different effects for officers who fight in the front lines versus those who support them or who are in support jobs.

c. *Deployment Variables*

Officers commissioned after 9/11 might be expected to have different views on deployments and military life, taking into account effects such as patriotism, nationalism, and the threat to the U.S. The terror attacks on the World Trade Center might have caused every officer to volunteer for deployments to defeat terrorists, even though they joined the military before 9/11 and were unaware of this threat. The different aspect of officers commissioned after 9/11 is that their expectation from deployments might have changed drastically after the attack. It would be more interesting to analyze the data of officers who joined the USNA after 2001. It is reasonable to think hostile deployments will have positive effects on the retention decision of these officers. This might be a possible new research topic. All deployment information in this study covered a period of six years for every officer. Having already made his or her decision to stay in the military or leave, deployments after six years were not included, in order not to overestimate the effect of deployments.

(1) Deployment status (GENDEP, HOSDEP): These were binary variables. The deployed variable (GENDEP) took the value of 1 for officers who experienced a general deployment, and the hostile deployment (HOSDEP) variable took the value of 1 for officers who experienced a hostile deployment at least once. The expected sign of the deployment status depends on the expectation of each individual. Every officer's expected utility differs from all the others in terms of deployment duration and frequency as they are first commissioned. If the actual figures exceed

expectations in a negative manner (longer for officers who prefer none or shorter deployments and shorter or no deployment for those who prefer longer and more deployments), they may tend to leave the military at a higher rate than their peers do. Deployment will have a positive effect on retention as expected utility gets closer to the actual. Nondeployed service members, and only those deployed only to nonhostile regions, form the base case.

(2) Deployment frequency (GENDEPCOUNT, HOSDEPCOUNT): These were continuous variables ranging from 0 to 3 for the Navy, and 0 to 4 for the Marines. These indicated the total number of general deployments (GENDEPCOUNT) and total number of hostile deployments (HOSDEPCOUNT) separately. These variables were divided into subgroups as ONEGENDEP for service members with one deployment and TWOMOREGENDEP for those with two or more deployments. The base case is again nondeployed or nonhostile-deployed officers. The expected sign of this variable depends on the expected utility, as explained above. We expect a positive correlation between the dependent variable (RETAINED) and frequency variables if an officer experiences what he or she expected in terms of the deployment frequency of either type of deployment.

(3) Deployment duration (GENDEPDUR, HOSDEPDUR): In this study, three variables were generated to capture the effect of general deployment duration and two variables for hostile deployments. We believe deployment durations have some threshold values for service members. Therefore, for general deployments, we defined a "short tour" as one less than six months (DEPLESS_6), a "medium tour" as one between six and twelve months (DEP6_12), and a "long tour" as one lasting more than a year (DEPMORE_12). For hostile deployments, categories were created for less than six months (HOSDEPLESS_6) and for more than six months (HOSDEPMORE_6). The base case was nondeployed and nonhostile-deployed officers. The general belief is that the longer the deployment, the greater the negative effect on service members' retention decisions. In the light of Fricker's study regarding all services (2002) and LeFrere's study

on Navy junior officers (2001), deployments had a positive or neutral effect on retention despite the general belief. Nevertheless, fighting in the front lines might decrease the positive effect of deployments for USMC junior officers.

(4)   Being deployed in the last twelve months prior to stay/leave decision (LAST12): This was a binary variable. If the service member was deployed in the last twelve months prior to his or her retention decision, either hostile or nonhostile, the variable took the value of 1, and 0 otherwise. We assumed that most officers make their decision one year prior to the end of their MSO. We believe this deployment might have the largest effect among the deployments. The opposite is also possible. Being in the continental U.S. (being nondeployed) might have a major effect on service members' decision as well.

(5)   Treatment effect (GWOT): In this study, we used the GWOT variable to capture the effect of the Global War on Terror on retention. It was a binary variable and extracted from the date of commissioning variable. It took the value of 1 for officers who graduated between 1996 and 2001, and who thus made retention decisions after the declaration of the GWOT, and the value of 0 for those who graduated between 1990 and 1995, with their decisions made prior to the attacks.

(6)   Interaction terms: We assumed that various type, duration, and frequency categories of deployment used in this study would have different effects on retention. For instance, being deployed more than a year, before or after the GWOT, is expected to have different effects on retention. These interaction terms enabled us to differentiate predicted effects of deployment and interpret them easily. Table 8 displays an explanation of each of the interaction terms used in the models.

The GENDEP_GWOT variable was used as a difference-in-difference estimator. It was utilized to measure the difference between the effect of deployments in pre- and post-GWOT for the control group and the effect of deployments in pre- and post-GWOT for the treatment group, as explained in the following table. The GWOT variable captured the effect of increasing operational tempo due to the GWOT. GENDEP captured the effect of deployments on behavioral attitudes of junior officers.

The interaction term between these two variables captured the effect of being deployed, compared to being not deployed, in the post-GWOT period, compared to the pre-GWOT period.

	Control Group (1990-1995 cohorts)	Treatment Group (1996-2001 cohorts)	Difference
Pre-GWOT	β_0	$\beta_{0} + \beta_{13}\text{GENDEP}$	$\beta_{13}\text{GENDEP}$
Post-GWOT	$\beta_{0} + \beta_{14}\text{GWOT}$	$\beta_{0} + \beta_{13}\text{GENDEP} + \beta_{14}\text{GWOT} + \beta_{15}\text{GENDEP\_GWOT}$	$\beta_{13}\text{GENDEP} + \beta_{15}\text{GENDEP\_GWOT}$
Difference	$\beta_{14}\text{GWOT}$	$\beta_{14}\text{GWOT} + \beta_{15}\text{GENDEP\_GWOT}$	$\beta_{15}\text{GENDEP\_GWOT}$

Table 7.   Difference-in-difference Estimator

Likewise, all interaction terms behaved like a difference-in-difference estimator for the category in which they were used.

Interaction Term	Definition
GENDEP_GWOT	=1 if deployed and experienced GWOT, 0 otherwise
ONEGENDEP_GWOT	=1 if deployed only once and experienced GWOT, 0 otherwise
TWOMOREGENDEP_GWOT	=1 if deployed more than once and experienced GWOT, 0 otherwise
DEPLESS_6_ GWOT	=1 if deployed less than 6 months in total and experienced GWOT, 0 otherwise
DEP6_12_ GWOT	=1 if deployed between 6 months and 12 months in total and experienced GWOT, 0 otherwise
DEPMORE_12_ GWOT	=1 if deployed more than 12 months in total and experienced GWOT, 0 otherwise

Table 8.   Explanation of Interaction Terms Used in the Models

Table 9 presents a summary of the variables that were used in our models and their expected signs.

Variable Name	Variable Type	Expected Sign
Demographic Variables		
Gender		
MALE	Binary	Base Case
FEMALE	Binary	-
Race/Ethnicity		
WHITE	Binary	Base Case
BLACK	Binary	+
HISPANIC	Binary	+
OTHERRACE	Binary	+
Marital Status		
JOINTMARRIAGE	Binary	+
MARRIED	Binary	Base Case
SINGLEWITHFAM	Binary	+
SINGLEWOFAM	Binary	-
Age		
AGE	Continuous	+
Service Variables		
PRIORENLISTED	Binary	+
Designator/Military Occupational Specialty		
SWO (NAVY)	Binary	+

Variable Name	Variable Type	Expected Sign
SUPPLY (NAVY)	Binary	+
OTHERMOS (NAVY)	Binary	Base Case
COMBAT (MARINE CORPS)	Binary	+
COMBATSUPPORT (MARINE CORPS)	Binary	Base Case
Deployment Variables		
General Deployment Indicators		
GENDEP	Binary	+
NODEP	Binary	Base Case
Hostile Deployment Indicators		
HOSDEP	Binary	+
NOHOSDEP	Binary	Base Case
Being Deployed in Last 12 Months Prior to Stay/Leave Decision		
LAST12	Binary	+
Deployment Frequency Indicators		
ONEGENDEP	Binary	+
TWOMOREGENDEP	Binary	+
NODEP	Binary	Base Case
Deployment Duration Indicators		
DEPLESS_6	Binary	+
DEP6_12	Binary	+
DEPMORE_12	Binary	-
NODEP	Binary	Base Case

Variable Name	Variable Type	Expected Sign
Hostile Deployment Frequency Indicators		
ONEHOSDEP	Binary	+
TWOMOREHOSDEP	Binary	-
Hostile Deployment Duration Indicators		
HOSDEPLESS_6	Binary	+
HOSDEPMORE_6	Binary	-
NODEP	Binary	Base Case

Table 9.   Summary of Variables

V. ANALYSIS RESULTS

A. DEPLOYMENT MODELS

Three separate models were estimated to capture different aspects of deployments, namely being deployed, the number of deployments, and the duration of deployment. These are regarded as significant factors that affect the retention decisions of junior officers. Beside model-specific deployment variables, all three models included demographic and military background variables. Officers who graduated from the Naval Academy between 1990 and 1995 will be referred to as the control group and those who graduated between 1996 and 2001 as the treatment group in the following part of the study.

Table 10 presents the results of deployment models for Navy junior officers. It demonstrates the effect of deployment, frequency, and duration on the continuation behavior at the initial decision point. Gender, marital status, experiencing a deployment in the past twelve months prior to the decision point, and the GWOT influence the decisions of naval officers in all models.

	General Deployment (1)	General Deployment Frequency (2)	General Deployment Duration (3)
	Retained	Retained	Retained
female	-0.592	-0.595	-0.591
	(0.082)***	(0.082)***	(0.082)***
black	0.176	0.178	0.179
	(0.124)	(0.124)	(0.124)
hispanic	0.112	0.114	0.109
	(0.108)	(0.108)	(0.109)
otherrace	0.027	0.026	0.019
	(0.107)	(0.107)	(0.107)
jointmarriage	0.862	0.865	0.867
	(0.277)***	(0.277)**	(0.277)***
singlewithfam	-0.253	-0.254	-0.246
	(0.200)	(0.200)	(0.201)

	General Deployment (1)	General Deployment Frequency (2)	General Deployment Duration (3)
singlewofam	-1.323	-1.324	-1.323
	(0.060)***	(0.060)***	(0.060)***
age	-0.041	-0.042	-0.041
	(0.029)	(0.029)	(0.029)
priorenlisted	1.243	1.273	1.233
	(1.183)	(1.186)	(1.182)
swo	-0.454	-0.455	-0.456
	(0.067)***	(0.067)***	(0.067)***
supply	-1.062	-1.062	-1.060
	(0.093)***	(0.093)***	(0.093)***
last12	1.289	1.245	1.290
	(0.164)***	(0.165)***	(0.165)***
gendep	0.097		
	(0.119)		
gwot	0.830	0.831	0.831
	(0.068)***	(0.068)***	(0.068)***
gendep_gwot	0.242		
	(0.169)		
onegendep		0.048	
		(0.122)	
twomoregendep		0.686	
		(0.337)**	
onegendep_gwot		0.254	
		(0.177)	
twomoregendep_gwot		0.009	
		(0.499)	
depless_6			0.482
			(0.291)*
dep6_12			-0.193
			(0.222)
depmore_12			0.114
			(0.137)
depless_6_gwot			0.259
			(0.575)
dep6_12_gwot			0.359
			(0.416)
depmore_12_gwot			0.216
			(0.192)
Constant	2.499	2.537	2.497
	(0.823)**	(0.824)***	(0.824)***

	General Deployment (1)	General Deployment Frequency (2)	General Deployment Duration (3)
Observations	6817	6817	6817
LR chi2	1033.14	1037.9	1037.92
Prob > chi2	0.000	0.000	0.000

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 10.   Logit Retention Model Results for Navy Officers

1.   Navy Results

a.   General Deployment Model

The model in Table 10, column 1, predicted the effect of being deployed, regardless of the region, and the frequency, or duration, of deployment. The results show that female officers have 45% lower odds of retention at the end of their MSO than male officers, controlling other variables. All the minority variables have positive effects on retention; minority officers are more likely to retain than white officers are. Marital status can be regarded as an important predictor of retention. Being single, either with or without dependents, has a negative effect on retention. Single officers without dependents have 74% lower odds of staying, and single officers with dependents 23% lower odds of staying, compared to married officers with everything else the same. However, being single with family is not statistically significant, meaning that marital status does not affect retention. Our results indicate a higher attrition rate for single officers, which complies with the findings of Fricker (2002). Age was expected to have a positive effect on retention, but our results yielded a negative effect. Nevertheless, the effect is not statistically significant. Prior enlistment was found to be an insignificant factor in the retention decision. For occupational specialty, we found that surface warfare officers have 35% lower and supply officers have 65% lower odds of retention compared to other specialties (both are statistically significant at the 1% significance level).

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It would be reasonable to say that any kind of deployment that occurred during the last year of service prior to the end of a MSO would be a crucial factor that affects officers' decisions. Our results support this assumption. According to the model, naval officers experiencing a deployment in their last year of obligated service have 263% higher odds of retention. It is surprising to find that general deployment does not have a statistically significant effect on retention at the usual significance levels. On the other hand, being a member of cohorts who made their retention decision after 9/11 had a significant effect on retention. The treatment variable (GWOT) has a log odds of 0.83, an odds ratio of 2.29 (exp(0.83)=2.29), and is statistically significant. If an officer graduated from the Naval Academy between 1996 and 2001 and experienced a deployment, the odds of retention is 192% (exp(0.83+0.242)) higher than for officers who graduated earlier and were not deployed, after controlling for other variables.

b.   General Deployment Frequency Model

The frequency model, shown in Table 10, column 2, predicted the effect of the number of deployments regardless of their duration. All the demographics have the same effect as in the general deployment model, except that joint marriage is no longer significant and single with family is now significant. Being a surface warfare and supply officer had the same lower retention effect. While having two or more deployments has a 1.98 odds ratio, one deployment has only a 1.04 odds ratio in the pre-GWOT period. For officers who decided to stay or leave the military after 9/11, the odds ratio increased to 2.002 for two or more deployments and to 1.35 for one deployment. Whereas the effect of one deployment was not significant, two or more deployments had a significant effect in the pre-GWOT period. Both deployment categories were insignificant in the post-GWOT period, which means that the number of general deployments did not influence the retention behavior of junior officers after the GWOT.

c.   General Deployment Duration Model

As another important aspect of deployment, duration was analyzed as shown in column 3 of Table 10. The variables used in the previous models maintain the

same effects. The odds ratios for the deployment length categories are 1.612, 0.824, and 1.12 for deployments less than six months, six to twelve months, and more than twelve months, respectively. The effect of six to twelve months deployments and deployments of more than twelve months are insignificant, and deployments shorter than six months are significant only at the 10% level. One can infer that duration of the deployment was not a crucial factor for the retention decision for the Navy officers analyzed in this study.

d.   *Results without the 1990, 1991, and 1992 Cohorts*

Table 11 shows the regression results. Due to the error in the coding of designators, we re-estimated the models in Table 10 after omitting data on the 1990-1992 cohorts.

	General Deployment (1)	General Deployment Frequency (2)	General Deployment Duration (3)
	Retained	Retained	Retained
female	-0.734	-0.734	-0.734
	(0.097)***	(0.097)***	(0.097)***
black	0.190	0.193	0.193
	(0.152)	(0.152)	(0.152)
hispanic	0.193	0.191	0.188
	(0.126)	(0.126)	(0.125)
otherrace	0.161	0.158	0.155
	(0.132)	(0.132)	(0.132)
jointmarriage	0.490	0.490	0.494
	(0.292)*	(0.292)*	(0.292)*
singlewithfam	-0.498	-0.500	-0.292
	(0.212)**	(0.212)**	(0.212)**
singlewofam	-1.452	-1.451	-1.454
	(0.082)***	(0.082)***	(0.082)***
age	-0.092	-0.092	-0.092
	(0.037)**	(0.037)**	(0.037)**
swo	-0.085	-0.085	-0.087
	(0.081)	(0.081)	(0.081)
supply	-0.825	-0.825	-0.825
	(0.104)***	(0.104)***	(0.104)***
last12	2.04	2.011	2.066
	(0.266)***	(0.267)***	(0.268)***

	General Deployment (1)	General Deployment Frequency (2)	General Deployment Duration (3)
gendep	0.004		
	(0.162)		
gwot	0.468	0.468	0.468
	(0.082)***	(0.082)***	(0.082)***
gendep_gwot	0.219		
	(0.206)		
onegendep		-0.025	
		(0.168)	
twomoregendep		0.310	
		(0.470)	
onegendep_gwot		0.220	
		(0.215)	
twomoregendep_gwot		0.174	
		(0.605)	
depless_6			0.376
			(0.399)
dep6_12			-0.310
			(0.354)
depmore_12			-0.001
			(0.187)
depless_6_gwot			0.198
			(0.647)
dep6_12_gwot			0.226
			(0.509)
depmore_12_gwot			0.233
			(0.233)
Constant	4.254	4.273	4.258
	(1.064)***	(0.605)***	(1.064)***
Observations	4405	4405	4405
LR chi2	676.60	677.62	679.52
Prob > chi2	0.000	0.000	0.000

Standard errors in parentheses

- significant at 10%; ** significant at 5%; *** significant at 1%

Table 11.   Logit Retention Model Results for Navy Officers Without the 1990-1992 Cohorts

Major changes appeared in the joint marriage, GWOT, and last12 variables in all three models in Table 10. Service members who were married to another service member (jointmarriage) had 74% lower odds ratio than in Table 10. Another prominent change was observed in the effect of the GWOT. On average, officers who made their retention decision after the 9/11 attacks (GWOT) had 70% lower odds ratios of retention than officers in the pre-GWOT cohorts. The effect of experiencing a deployment in the past twelve months (last12) prior to the retention decision doubled compared to the original model results, as the log odds increased from 3.58 to 7.66. All the variables mentioned above still had a positive impact on continuation behavior, although their coefficients were smaller in magnitude. SWO still had a negative effect on retention, but the effect was much smaller than the original model. The supply variable had almost the same effect as in Table 10.

2. Marine Corps Results

Table 12 shows the results when the models used for the Navy are applied to Marine Corps data. Marine Corps and Army units are the main combatant forces of the United States military on the ground. They have taken the priority in dictating plans, specifically in the Global War on Terror. Since the declaration of the GWOT, they have experienced more hostile tours than their colleagues in the Navy and Air Force have. Therefore, we initially anticipated that the type, duration and frequency of deployments would be significant predictors on Marine Corps officers' retention. However, Table 12 shows that most of the deployment-related variables are statistically insignificant.

a. General Deployment Models

	General Deployment (1)	General Deployment Frequency (2)	General Deployment Duration (3)
	Retained	Retained	Retained
Female	0.049	0.045	0.067
	(0.257)	(0.259)	(0.259)
Black	0.717	0.755	0.765

	General Deployment (1)	General Deployment Frequency (2)	General Deployment Duration (3)
	(0.288)**	(0.290)***	(0.290)***
Hispanic	0.140	0.162	0.145
	(0.323)	(0.322)	(0.323)
Otherrace	-0.199	-0.166	-0.209
	(0.355)	(0.357)	(0.359)
Jointmarriage	-0.171	-0.158	-0.207
	(0.382)	(0.383)	(0.382)
Singlewithfam	-1.317	-1.244	-1.196
	(0.823)	(0.821)	(0.831)
Singlewofam	-1.572	-1.61	-1.605
	(0.166)***	(0.168)***	(0.168)***
Age	-0.124	-0.114	-0.112
	(0.064)*	(0.064)*	(0.065)*
Priorenlisted	0.894	0.829	0.896
	(0.531)*	(0.536)	(0.534)*
Combatsupport	-1.056	-1.047	-1.079
	(0.157)***	(0.158)***	(0.159)***
last12	2.086	1.968	2.083
	(0.362)***	(0.366)***	(0.369)***
gendep	0.335		
	(0.252)		
Gwot	0.744	0.759	0.763
	(0.258)***	(0.259)***	(0.259)***
gendep_gwot	0.090		
	(0.319)		
onegendep		0.185	
		(0.271)	
twomoregendep		0.613	
		(0.310)**	
onegendep_gwot		0.069	
		(0.347)	
twomoregendep_gwot		0.251	
		(0.429)	
depless_6			0.064
			(0.288)
dep6_12			0.369
			(0.330)
depmore_12			0.855
			(0.352)**
depless_6_gwot			0.464

	General Deployment (1)	General Deployment Frequency (2)	General Deployment Duration (3)
			(0.382)
dep6_12_gwot			0.143
			(0.461)
depmore_12_gwot			-0.636
			(0.454)
Constant	4.676	4.399	4.348
	(1.913)**	(1.928)**	(1.930)**
Observations	999	999	999
LR chi2	241.63	247.80	248.13
Prob > chi2	0.000	0.000	0.000

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 12.   Logit Retention Regression Model Results For The Marine Corps for General Deployments

(1) General Deployment Model. In column 1 of Table 12, of fourteen independent variables, only seven were statistically significant. The female variable has a positive but insignificant effect on retention. Contrary to the general perception about gender as a retention barrier, it does not appear to influence retention behavior in the Marine Corps, at least among USNA graduates. Female officers made up 10% of the Marine Corps sample used in this study. They are generally assigned to support MOS, rather than to active combatant military occupational specialties. This assignment might be another reason for the insignificant effect of gender on retention. There is a slight inconsistency for race variables. African-American officers have higher log odds to retain compared to white officers, and it was statistically significant in the general deployment model. The Hispanic variable has a positive effect and the other race variable has a negative coefficient. The model yielded inconsistent effects for race, and two of the categories were not significant.

Marital status plays a big role in predicting service members' retention decisions. Compared to being married, all other marital status categories are less likely to stay in the military. However, among these groups the single without family

variable is the only significant one. Age was expected to have a positive effect on retention, but the model produced negative and insignificant effects. Prior enlistment positively influenced retention (significant at level of 10%). Combat support officers have 65% (1-exp(-1.056)) lower odds of retention than combat officers who have the same characteristics. The sign of the "last12" variable signifies that deployments in the last year before deciding to stay or resign have a positive effect on retention. As Fricker (2002) noted, another explanation for this positive effect might be that the nondeployed officers' separation rate is so high that it makes the retention rate of deployed officers seem high. The "Gendep" variable captures the effect of deployment regardless of the operational tempo caused by the GWOT. It has a positive sign, but it is statistically insignificant. The treatment group officers have 110% (1 − exp(0.743)) higher odds of retention as opposed to the control group. The 'Gendep_GWOT' variable predicts the impact of the deployment environment dictated by the GWOT on retention. It turns out to be insignificant, which means deployments do not influence the retention of officers who graduated from the Naval Academy between 1996 and 2001 in our model.

(2) General Deployment Frequency Model. The results in column 3 of Table 12 indicate that demographics have almost the same impact as in the general Marine Corps model. As expected, prior enlisted officers are more inclined to remain and be career officers. Members of combat military occupational specialties who experience positive aspects of deployment, such as increased job satisfaction and applying theory to real situations, are more likely to stay in the military than members who have other occupational specialties. The "GWOT" variable has a positive and significant effect. Being a member of the 1996-2001 cohorts appears to be a key factor of the decision to stay. For the effect of deployment frequencies, in column 3 of Table 12 we observed that one deployment causes lower retention rate, while two or more deployments does the opposite. That is, if an officer experiences two or more deployments, he or she has 84% higher odds of retention compared to nondeployed officers. Deployments experienced, no matter how many times, do not appear to affect the continuation decision of treatment group members.

(3) General Deployment Duration Model. In column 3 of Table 12, there are nine significant variables out of eighteen variables in the model. Demographic and service variables have the same effect as in the previous two models. The key variables in this model were the deployment duration categories. For the control group, having a total deployment duration less than a year does not influence the stay or leave decision. Among the duration variables, total deployment duration longer than a year affects service members' decisions to stay in the military in a positive manner.

b.   Hostile Deployment Models

Theoretically, a hostile deployment variable should have a negative retention effect, but previous studies revealed a positive effect on retention behavior. This effect was generally attributed to occupational and personal satisfaction benefits, as well as other deployment benefits.

	Hostile Deployment Model (4)	Hostile Deployment Frequency Model (5)	Hostile Deployment Duration Model (6)
	Retained	Retained	Retained
female	0.061	0.067	0.061
	(0.258)	(0.258)	(0.258)
black	0.714	0.717	0.715
	(0.286)**	(0.286)**	(0.286)**
hispanic	0.140	0.145	0.140
	(0.322)	(0.322)	(0.322)
otherrace	-0.174	-0.170	-0.172
	(0.354)	(0.354)	(0.354)
jointmarriage	-0.128	-0.123	-0.128
	(0.381)	(0.381)	(0.381)
singlewithfam	-1.297	-1.297	-1.295
	(0.819)	(0.819)	(0.819)
singlewofam	-1.533	-1.532	-1.533
	(0.164)***	(0.164)***	(0.164)***
age	-0.130	-0.130	-0.130
	(0.063)**	(0.063)**	(0.063)**
priorenlisted	0.910	0.917	0.908
	(0.532)*	(0.532)*	(0.532)*
combatsupport	-1.104	-1.102	-1.104
	(0.155)***	(0.155)***	(0.155)***

	Hostile Deployment Model (4)	Hostile Deployment Frequency Model (5)	Hostile Deployment Duration Model (6)
Last12	2.252	2.242	2.257
	(0.360)***	(0.361)***	(0.364)***
hosdep	-0.070		
	(0.265)		
gwot	0.730	0.729	0.730
	(0.163)***	(0.163)***	(0.163)***
onehosdep		-0.117	
		(0.278)	
twomorehosdep		0.289	
		(0.732)	
hosdepless_6			-0.058
			(0.296)
hosdepmore_6			-0.109
			(0.498)
Constant	5.094	5.103	5.085
	(1.858)***	(1.859)***	(1.860)***
Observations	999	999	999
LR chi2	235.55	235.84	235.55
Prob > chi2	0.000	0.000	0.000

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 13.   Logit Retention Regression Model Results For The Marine Corps for Hostile Deployments

(1) Hostile Deployment Model. The positive sign of the female variable indicates female officers retain at a higher rate than their male peers, holding everything else the same. However, the female variable is not statistically significant. For the race and ethnicity variables, all categories proved insignificant except the one for African-American officers, who have 104% higher odds ratio of retention than white officers. Compared to married officers, all others preferred not to retain, but only the single without dependents variable was statistically significant. Contrary to general beliefs, age turned out to have a negative impact on the continuation of junior Marine Corps officers in our model. Prior enlistment had a positive effect as expected. If a service member was in a combat support unit, he or she had lower log odds of retention

than an officer in a combat unit. Experiencing a deployment prior to making a retention decision in the final year is a key factor that affects the decision of service members in a positive manner.

We had anticipated finding a positive effect of hostile deployment, in accordance with their preliminary analysis (Figures 10 and 15). However, the hostile deployment variable had a very small negative coefficient, which was practically negligible. The sign of the GWOT variable signifies that living through 9/11 is strongly and positively associated with the retention decision.

(2) Hostile Deployment Frequency Model. As mentioned in the general Navy and general Marine Corps deployment models, the effect of demographic and service variables did not change throughout the models. The results showed higher retention propensities for officers who experienced deployment in the last twelve months and a different effect for the two-tour duration categories. While deploying to hostile regions once decreased the likelihood of continuation, two or more tours positively contributed to the retention decision for Marine Corps members, though both proved insignificant. Besides, the result for two or more hostile deployments can be neglected due to a very small number of observations, namely seventeen.

(3) Hostile Deployment Duration Model. For the duration model, as in previous models, the odds of retention for African-American officers were significantly higher than for their white colleagues, while other minority officers did not show the same attitude statistically according to the model. Moreover, the duration category results also exhibited a negative impact for Marine Corps officers. Both duration categories yielded a negative but statistically insignificant reaction of service members to deployment duration categories, indicating that members did not necessarily regard the length of duration as a critical aspect while making their continuation decision. It might be rationalized that they see the dangerous deployments as a part of a military career. Nevertheless, saying that time spent under imminent threat would not have any influence on the continuation decision does not seem sensible, and one explanation for this result could be self-selection.

B.   TEST OF MODELS

A likelihood ratio test was conducted to determine if deployment and period variables were jointly significant in the models. The null hypothesis was that deployment, GWOT, and the interaction of these two variables were not jointly significant and had no effect on explaining the retention behavior of service members. The alternative hypothesis was that at least one of the variables was associated with the retention decision. The likelihood ratio test is based on the same concept as the F-test in a linear model (Wooldridge, 2006). The results can be evaluated in a way similar to that of the OLS regression F-test.

According to the results of the likelihood ratio test, as shown in Table 14, the null hypothesis was rejected for all models. That is, the deployment, GWOT, and interaction variables were jointly significant and at least one of them was associated with the retention decision of service members in each model.

Model	LR Chi2	DF	Pr>Chisq
Navy General Deployment (1)	209.3	15	0.000
Navy General Deployment Frequency (2)	214.07	17	0.000
Navy General Deployment Duration (3)	214.08	19	0.000
Marine Corps General Deployment (1)	27.67	14	0.000
Marine General Deployment Frequency (2)	33.83	16	0.000
Marine General Deployment Duration (3)	34.17	18	0.000
Marine Corps Hostile Deployment (4)	21.58	13	0.000
Marine Hostile Deployment Frequency (5)	21.87	14	0.000
Marine Hostile Deployment Duration (6)	21.59	14	0.000

Table 14.   Likelihood Ratio Test Results

VI.   CONCLUSION AND RECOMMENDATIONS

A.   CONCLUSION

The Navy and Marine Corps spend a lot of money on recruiting, training and developing their officer corps. Retaining these trained personnel is a key issue for military manpower planners. As the main focus of this thesis, the authors believe that an understanding of the features of deployments (type, length, and frequency) as crucial factors in junior officer retention is a key component of manning issues for the future of the Navy and the Marine Corps.

Naval Academy students who graduated between 1990 and 1995 were taken as the control group. These officers made their retention decisions before the 9/11 attacks. The 9/11 attacks are taken to be the treatment effect in this study. Officers who graduated between 1996 and 2001 are taken as treatment group; they experienced more frequent deployments, with less rest time between them. Although this thesis is limited, some factors affecting the retention behavior of USNA-graduate junior officers were identified here. The DMDC data used in this study is the biggest handicap of the study. Because of the errors mentioned in Chapter 3, it may be misleading to draw firm conclusions based on this data. Nonetheless, some clear patterns emerge in the data.

1.   Naval Officers

The retention rate of junior officers follows a horizontal pattern between 60% and 70% until 2001. The Navy enjoyed a ten-percentage point jump in the retention rate, presumably as a result of 9/11, until 2005. Then, the data revealed a declining trend in retention starting from 2005. Single officers without dependents preferred to leave the military at a higher rate than their married peers did. The proportion of married officers decreased by eight percentage points in the post-GWOT period in comparison with the

pre-GWOT period.[9] Deployment appeared to contribute to higher retention rates. An increasing number of deployments were associated with higher retention rates. Nevertheless, the effect of deployment duration was not so clear in either the pre- or post-GWOT period. When the 1990, 1991, and 1992 cohorts were excluded, the results of the two models were very similar.

In accordance with the literature and preliminary findings of this study, female officers and single service members, regardless of the number of dependents, were less likely to remain in the military, and married officers together with members of minority categories had a higher propensity to stay in the military. Contrary to previous findings, age turned out to have a negative effect on the continuation behavior of service members in these models. SWO and supply officers leave the military at higher rates than their peers in other designators do. Prior enlisted service members had a notably higher probability of staying, as expected. The effect of being deployed in the last year of an officer's MSO considerably increased the odds of continuation. If an officer made his or her retention decision after 2001, he or she was more likely to continue military service. All aspects of deployment had a positive influence on retention, except for deployments with duration of between six and twelve months. Increasing operational tempo, in terms of the number of deployments and the associated duration, caused retention rates to increase among naval junior officers.

2. Marine Corps Officers

Female officers tended to join the Marine Corps at higher rates after 9/11, as their proportion of the force increased by ten percentage points in the post-GWOT period. A decrease in the number of married officers was seen in the Marine Corps as in the Navy. Although the results in Table 4 alone seem to indicate a decrease in the percentage of deployed officers, this would be deceptive. As the number of observations in the sample is taken into consideration, it becomes obvious that more officers experienced

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[9] When single officers leave the military at higher rates, the proportion of married officers is expected to rise. On the other hand, as Karney and Crown (2007) described in their study, marital dissolution rates were very high in the late 1990s, which makes up the post-GWOT period in the thesis.

deployments in the post-GWOT period. The positive effect of deployment frequency and the mixed effect of deployment duration are observed in the Marine Corps, too. The only exception is that longer hostile deployments resulted in higher retention rates.

Regression analyses of Marine Corps retention models indicate that gender, race, marital status, being in a combat MOS, and deployment aspects significantly affected the retention decisions of Marine Corps service members. Being female, white, African-American, Hispanic, single, in combat military occupational specialties, and all types of general deployments positively contributed to higher retention. However, hostile deployments, regardless of frequency and the length of deployment, decreased the likelihood of retaining, except for two or more deployments.

B.   RECOMMENDATIONS AND FURTHER RESEARCH

Despite the fact that challenges may be regarded as a part and reality of military life for career officers, the appeal of higher income and a risk-free and stable environment in civilian life may negatively affect an officer's way of looking at upcoming deployments. Experiencing family separations and life-threatening situations have been the natural consequences of the war on terrorism. Therefore, understanding the actual situation, the viewpoint of officers, their worries and expectations, and coming up with a better understanding of issues about the effect of increasing operational tempo on continuation decisions will become a critical issue.

It should always be kept in mind that these results are produced from a data file with some data errors. In particular, the first three cohorts covered in this study have no information about designator/MOS, which made them difficult to analyze.

Moreover, the variables included in the models are not the only ones that explain retention behavior. Variables such as military pay, the civilian/military pay ratio, job satisfaction, expectation from military such as deployment time, time spent with family, and quality of leadership also explain retention. This study looked at the number of officers, not quality. A proxy for officer quality may reveal different results that will be in the interest of both services.

Both services should seek ways to compensate for the negative effects of deployments with monetary incentives, because monetary issues make up the top reason for leaving the military.[10]

Hostile deployment is inevitable in the future of the Marine Corps. However, Marine Corps headquarters can examine aspects of deployments thoroughly to detect and minimize the negative effect as well as maximize the benefits of deployment. The finding that any length and number of hostile deployments causes lower retention, although general deployments cause increased retention, points to a future research topic.

Current data allowed the authors to analyze cohorts up to the 2001 cohort, which is the beginning of the GWOT. Increased operational tempo might have different effects on cohorts after 2001. Thus, a contemporary study could be performed with much more up-to-date data to get a better grip on the retention behavior of service members in the light of previous changes in deployment and hostility issues like perstempo and threat levels.

Only USNA graduates, who are known to have higher retention rates, were analyzed in this thesis. A broader study that encompasses all accession sources would give a more in-depth understanding of the effect of deployments.

Actual data were analyzed in this study. A comparison of a survey of service members' intentions to stay in the military based on their expectations and actual outcomes could be another interesting topic for further research.

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[10] It was the first reason for leaving the military, with 28% among the top five reasons, according to 1999 survey results (Other reasons accounted for 30% in total). (GAO report, 2000).

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5.   Kara Harp Okulu Enstitusu
        Kara Harp Okulu
        Bakanlıklar, Ankara, Türkiye

6.   Havacılık ve Uzay Teknolojileri Enstitüsü
        Hava Harp Okulu
        Yeşilyurt, Istanbul, Türkiye

7.   M. Murat Alankaya
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8.   Hızır Kılıç
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