

The Relationship Between Colocation and Reenlistment in the Marine Corps: Technical Background (Vol. 2)

Lauren Malone, Cathy Hiatt, and Ann Parcell

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Molly McIntosh, Director
Navy Compensation and Personnel Policy
Resources and Force Readiness Division

Abstract

This document provides the technical background for the analysis presented in the CNA annotated briefing, *The Relationship Between Colocation and Reenlistment in the Marine Corps (Vol. 1)*. We describe our data-cleaning procedures, including the observations that were excluded from our analysis. We describe how we created the reenlistment and colocation/marital status variables. We outline our choice of model and estimation technique and identify the control variables included in our model. We present the summary statistics of all variables included in our estimates as well as our estimation results. The annotated briefing contains the summary results and provides conclusions and recommendations for our sponsor, the Assistant Secretary of the Navy for Financial Management and Comptroller (ASN(FM&C)).

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Executive Summary

This document provides the technical background for the analysis presented in the CNA annotated briefing, *The Relationship Between Colocation and Reenlistment in the Marine Corps (Vol. 1)*. Specifically, it contains the following information:

- Our data-cleaning procedures, including the observations that were excluded from our analysis
- A description of the reenlistment and colocation/marital status variables used in the analysis
- Our choice of model and estimation technique
- A description of the control variables included in our model
- Summary statistics of all variables included in our estimates as well as our estimation results

The annotated briefing contains the summary results and provides conclusions and recommendations for our sponsor, the Assistant Secretary of the Navy for Financial Management and Comptroller (ASN(FM&C)).

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Introduction

In this document, we describe the technical details of the analysis and results in the CNA annotated briefing (DAB-2018-U-017653-Final), *The Relationship Between Colocation and Reenlistment in the Marine Corps (Vol. 1)*. For context, the two documents were prepared as part of a larger CNA project, “The Effects of Personnel Policy Changes on Budgets and Manpower Inventories,” intended to identify and explore ways to reduce personnel costs while maintaining or even improving retention. The project is sponsored by the Office of the Assistant Secretary of the Navy (Financial Management and Comptroller) (ASN(FM&C)).

The fact that more women are entering the Navy and the Marine Corps is likely to affect overall personnel retention. In many Navy and Marine Corps occupations, female retention is substantially lower than male retention. As the services develop and evaluate policies to improve retention, they must consider the increasing female share of uniformed personnel in their ranks.¹ One area of consideration is that, as the share of women in the services increases, so does the possibility of dual-military marriages and the potential for an increase in the demand for colocation. The ability of the services to colocate spouses in dual-military marriages may affect the decision to reenlist. In this part of the study, we examine the statistical relationship between colocation and reenlistment for enlisted Marine-Marine marriages.

The accompanying annotated briefing summarizes our analytical results; this document describes the data, methodology, and results in more detail. In the first part of the Technical Details section that follows, we discuss our data-cleaning procedures and describe the observations that were excluded from our analysis. Second, we describe how we created the reenlistment and colocation/marital status variables. Third, we describe our choice of model and estimation technique and describe the control variables in our model. In the fourth part, we describe several other modeling decisions that we made and the corresponding justifications. Finally, we present the summary statistics of all variables included in our estimates as well as our estimation results.

¹ We do not have evidence one way or the other regarding retention of women entering the Marine Corps today or in the future relative to that of the women who entered the Marine Corps in past years. Without additional information, these are our best estimates of how women will behave in the future. Empirically investigating how predictive past behavior is of future behavior was outside the scope of this study, but could be a focus of a future effort.

Technical Details

Data cleaning and dropped observations

Our analytical process began with a reenlistment decision data file compiled from the Marine Corps' Total Force Data Warehouse transaction and snapshot records. Every observation in this dataset represents a decision made by an enlisted Marine to reenlist at the end of his or her contract. Note that the file does not include those who attrite from the Marine Corps before reaching their end of active service (EAS). For purposes of this analysis, we do not view attrition as comparable to having completed a contract and deciding whether to stay in the Marine Corps. We also exclude those who transition to the officer corps since this is a different type of decision to stay in the Marine Corps—one that involves applying for and being accepted into a specific program. In short, we restrict our analysis to those enlisted Marines who have made it to their EAS and are deciding whether to stay in or leave the enlisted Marine Corps. These restrictions result in a sample of 257,491 Zone A (0-6 years of service) decisions, 62,805 Zone B (6-10 years of service) decisions, and 31,799 Zone C (10-14 years of service) decisions.

Defining reenlistment and colocation variables

Our primary analytical question is whether spousal colocation is correlated with Marines' decisions to reenlist. If we find that it is positively correlated with reenlistment, expanding colocation efforts could potentially be used to increase enlisted retention (or the retention of particular groups, such as women, or Marines in a particular reenlistment Zone). Therefore, how we define *reenlistment* and *colocation* is critical to the analysis. The reenlist variable takes a value of 1 if the Marine reenlists and a value of 0 if he or she leaves the enlisted Marine Corps at his or her EAS.

Currently, the Marine Corps considers two Marines to be colocated if the units to which they are assigned are within 50 miles of each other. Thus, our colocation variable must reflect this. We measure geographic distance using geodesic miles.² Note that

² Note that geodesic miles are *not* driving miles and are also distinct from simply drawing a straight line between two locations, as they take the curvature of the earth into account. Also note that these are *not* the official driving distances considered by the Marine Corps since we did not have access to them.

colocation depends solely on the location of *assignments*, not the location of residences.

Our colocation/marital status variable is a combination of marital and colocation status measured in the quarter of the reenlistment decision. For each Marine in our sample, *one* of the following five variables equals 1, and all others equal 0:

- Married to another Marine and colocated with that Marine (units within a 50-mile radius)
- Married to another Marine but not colocated (units outside a 50-mile radius)
- Married to a military spouse but colocation status is unknown (we suspect that most of these Marines are married to an active-duty servicemember in another service, and that a smaller share are married to a Marine officer, married to a Marine who only recently left the service, or married to a Marine with an SSN we were unable to find)
- Married to a civilian spouse
- Single

We considered testing whether colocated Marines whose units were within 90 miles had a different likelihood of reenlisting than those whose units were within 50 miles, since the Navy uses a 90-mile definition for its colocation policy. This proved infeasible, however. There were too few Marines who would have been colocated per the 90-mile definition but were *not* colocated per the 50-mile definition (i.e., their assigned units were between 51 and 90 miles apart) from whom we could draw inference.

The model and control variables

We estimate the probability that a Marine reenlists as a function of many factors that may affect that decision, such as his or her personal characteristics, military career characteristics, economic conditions, and his or her colocation/marital status.

We follow the traditional practice of using a nonlinear estimation method to estimate models where the dependent variable—that is, the probability of an event occurring—can only be observed as taking the value of 0 or 1 (e.g., Marines reenlist or not). The nonlinear procedure estimates the probability that an event will occur, such as a

Marine reenlisting, as a function of a set of factors specified in the model.³ We run three separate regressions, one each for Zone A, Zone B, and Zone C reenlistment decisions. The same covariates are included in each model and, unless otherwise noted, are measured at the time of the Zone A, B, or C decision. The full list of factors (covariates) included on the right-hand side of our model includes:

- An index summarizing the strength of the U.S. economy in the quarter of decision⁴
- Fiscal year of decision
- Occupational field (occfld)⁵
- Education, characterized by the following mutually exclusive groups:
 - No high school diploma or equivalent (dropout)
 - GED or other credentials
 - 1 semester of college or adult diploma (no HSDG)
 - Homeschool diploma
 - High school diploma graduate (HSDG) or high school senior
 - Some college (HSDG and more than 12 years of education, but no degree attained beyond high school)
 - Associate's degree
 - Bachelor's degree
 - Master's, post-master's, or doctorate degree
 - Other education

³ As we note in Malone, Gregory, and Parcell (2018), Vol. 2, we used references [1-6] to inform our model choice. In the case of our Navy colocation analysis, we found that a linear model was a better fit than a nonlinear model (DRM-2018-U-016843-Final). We ran the same tests to determine whether the linear or nonlinear model provided the better fit for the Marine Corps data and found that the nonlinear approach was more appropriate.

⁴ This index includes nine variables, with the three most heavily weighted being the US unemployment rate, the 3-month Treasury bill, and the 10-year Treasury note. For a detailed discussion of the economic index, see Pinelis and Huff (2014) [7].

⁵ We also tested a version of the model with interactions between the economic index and a Marine's occfield at decision. There were no meaningful changes to our parameters of interest (i.e., those we report and discuss in the document), and the inclusion of this interaction would have significantly complicated our model. We therefore decided to leave this interaction term out of the model since the only notable changes were to the parameters on the economic index, the occfields, and the SRB variables, as we would expect.

- Education unknown
- The maximum Selective Reenlistment Bonus (SRB) for which a Marine qualifies at decision (a Marine may qualify for more than one SRB, so we control for the one with the highest value)
- Length of service (in months)
- Whether the Marine was on a Global War on Terror (GWOT)⁶ combat deployment at the time of decision
- Whether the Marine was on a GWOT noncombat deployment at the time of decision
- Age
- Gender
- Whether the Marine has children
- Whether the Marine was promoted in the 12 months prior to decision
- Whether the Marine was demoted in the 12 months prior to decision
- Whether the Marine was ever nondeployable for medical reasons in the 12 months prior to decision
- Whether the Marine was ever nondeployable for other reasons in the 12 months prior to decision
- Hispanic ethnicity
- Race (black, Asian Pacific Islander, other, unknown race, or white)
- Armed Forces Qualification Test (AFQT) score⁷
- Paygrade
- Time in grade

⁶ We are restricted to controlling for GWOT deployments (and no other deployment types) because this is the only type of deployment data CNA has ever received from the Marine Corps.

⁷ We use the AFQT score at decision, unless this score is missing or invalid (e.g., "A2"). In those cases, if the AFQT at accession is a nonmissing, valid score, we use that instead of the decision score. For most Marines, the decision and accession scores are equal; the only reason for a difference would be if the Marine wanted to make a lateral move or qualify for a special duty assignment and needed higher ASVAB composite scores to qualify. In those cases, the Marine would retake the AFQT.

- US citizenship
- Total number of GWOT combat deployments the Marine has been on at time of decision
- Total number of GWOT noncombat deployments the Marine has been on at time of decision
- Marital/colocation status: colocated, not colocated, single, colocation status unknown, or civilian spouse⁸
- Interactions between gender and each of the marital/colocation statuses (these interaction terms allow the impact of marital/colocation status on reenlistment to vary by gender)

Summary statistics and results

In the accompanying annotated briefing, we summarize the results for marital/colocation status by gender. Here, in the remainder of this memorandum, we provide tables of summary statistics for those variables and observations included in each of our three models (Zone A, Zone B, and Zone C statistics are presented in Table 1, Table 2, and Table 3, respectively) as well as the complete tables of regression results for these three models (see Table 4). We note one exception: because of the large number of occfields and the fact that our models include an indicator variable for *each* occfield, we are not presenting occfield-specific marginal effects, standard errors, levels of significance, or summary statistics. These are available from the authors on request.

Table 1. Summary statistics for the Zone A reenlistment regression

| Variable | Mean | Standard Deviation | Minimum | Maximum | Median |
|-----------------------|-------|--------------------|---------|---------|--------|
| Reenlistment Decision | 0.321 | 0.467 | 0 | 1 | N/A |
| Economic Index | 0.888 | 0.856 | -0.76 | 2.2 | 0.95 |
| FY2005 | 0.075 | 0.264 | 0 | 1 | N/A |
| FY2006 | 0.079 | 0.270 | 0 | 1 | N/A |
| FY2007 | 0.098 | 0.297 | 0 | 1 | N/A |
| FY2008 | 0.076 | 0.266 | 0 | 1 | N/A |

⁸ In this model, our colocation measure focuses on whether a Marine and his/her spouse were colocated *at the time of* the Marine's reenlistment decision. Although it was outside the scope of this effort, an interesting extension to this work might be to consider the *duration* of spousal colocation or *expectations* regarding future colocation.

| Variable | Mean | Standard Deviation | Minimum | Maximum | Median |
|---|-------------|---------------------------|----------------|----------------|---------------|
| FY2009 | 0.078 | 0.269 | 0 | 1 | N/A |
| FY2010 | 0.083 | 0.275 | 0 | 1 | N/A |
| FY2011 | 0.069 | 0.253 | 0 | 1 | N/A |
| FY2012 | 0.072 | 0.258 | 0 | 1 | N/A |
| FY2013 | 0.075 | 0.264 | 0 | 1 | N/A |
| FY2014 | 0.064 | 0.244 | 0 | 1 | N/A |
| FY2015 | 0.068 | 0.252 | 0 | 1 | N/A |
| FY2016 | 0.071 | 0.257 | 0 | 1 | N/A |
| FY2017 | 0.092 | 0.289 | 0 | 1 | N/A |
| No High School Diploma or Equivalent (Dropout) | 0.001 | 0.027 | 0 | 1 | N/A |
| GED or Other Credentials | 0.013 | 0.113 | 0 | 1 | N/A |
| 1 Semester College or Adult Diploma (non-HSDGs) | 0.023 | 0.149 | 0 | 1 | N/A |
| Home School Diploma | 0.006 | 0.077 | 0 | 1 | N/A |
| High School Diploma or High School Senior | 0.915 | 0.278 | 0 | 1 | N/A |
| Some College but no Degree (HSDGs) | 0.018 | 0.134 | 0 | 1 | N/A |
| Associate's Degree | 0.010 | 0.098 | 0 | 1 | N/A |
| Bachelor's Degree | 0.009 | 0.094 | 0 | 1 | N/A |
| Master's, post-Master's, or Doctorate | 0.000 | 0.021 | 0 | 1 | N/A |
| Other Education | 0.002 | 0.040 | 0 | 1 | N/A |
| Unknown Education | 0.003 | 0.059 | 0 | 1 | N/A |
| Maximum SRB | \$11,065.02 | \$14,471.26 | \$0 | \$90,000 | \$4,750 |
| Months of Service | 49.913 | 6.867 | 17 | 72 | 48 |
| Combat Deployed at Decision | 0.060 | 0.237 | 0 | 1 | N/A |
| Non-Combat Deployed at Decision | 0.029 | 0.168 | 0 | 1 | N/A |
| Age | 23.316 | 2.041 | 18 | 41 | 23 |
| Female | 0.067 | 0.250 | 0 | 1 | N/A |
| Have Children | 0.159 | 0.366 | 0 | 1 | N/A |
| Promoted in Last 12 Months | 0.414 | 0.493 | 0 | 1 | N/A |
| Demoted in Last 12 Months | 0.022 | 0.147 | 0 | 1 | N/A |

| Variable | Mean | Standard Deviation | Minimum | Maximum | Median |
|---|-------------|---------------------------|----------------|----------------|---------------|
| Medically Nondeployable in Last 12 Months | 0.022 | 0.148 | 0 | 1 | N/A |
| Nondeployable for Other Reasons in Last 12 Months | 0.021 | 0.143 | 0 | 1 | N/A |
| Hispanic | 0.158 | 0.365 | 0 | 1 | N/A |
| Black | 0.094 | 0.292 | 0 | 1 | N/A |
| Asian Pacific Islander | 0.036 | 0.187 | 0 | 1 | N/A |
| Other Race | 0.013 | 0.111 | 0 | 1 | N/A |
| Unknown Race | 0.059 | 0.236 | 0 | 1 | N/A |
| AFQT score | 61.439 | 18.316 | 3 | 99 | 61 |
| Paygrade | 4.136 | 0.601 | 1 | 7 | 4 |
| Time in Grade | 14.437 | 9.663 | 0 | 92 | 13 |
| US Citizen | 0.972 | 0.165 | 0 | 1 | N/A |
| Total GWOT Combat Deployments | 0.943 | 0.860 | 0 | 14 | 1 |
| Total GWOT Noncombat Deployments | 0.247 | 0.485 | 0 | 4 | 0 |
| Colocated | 0.035 | 0.184 | 0 | 1 | N/A |
| Not Colocated | 0.005 | 0.067 | 0 | 1 | N/A |
| Single | 0.530 | 0.499 | 0 | 1 | N/A |
| Colocation Status Unknown | 0.014 | 0.116 | 0 | 1 | N/A |
| Civilian Spouse | 0.417 | 0.493 | 0 | 1 | N/A |
| Female*Colocated | 0.017 | 0.128 | 0 | 1 | N/A |
| Female*Not Colocated | 0.002 | 0.049 | 0 | 1 | N/A |
| Female*Single | 0.030 | 0.171 | 0 | 1 | N/A |
| Female*Colocation Unknown | 0.004 | 0.067 | 0 | 1 | N/A |
| Female*Civilian Spouse | 0.013 | 0.113 | 0 | 1 | N/A |

Source: CNA analysis of Marine Corps personnel files.

Table 2. Summary statistics for the Zone B reenlistment regression

| Variable | Mean | Standard Deviation | Minimum | Maximum | Median |
|-----------------------|-------------|---------------------------|----------------|----------------|---------------|
| Reenlistment Decision | 0.680 | 0.467 | 0 | 1 | N/A |
| Economic Index | 0.855 | 0.854 | -0.76 | 2.2 | 0.95 |

| Variable | Mean | Standard Deviation | Minimum | Maximum | Median |
|---|-------------|---------------------------|----------------|----------------|---------------|
| FY2005 | 0.080 | 0.272 | 0 | 1 | N/A |
| FY2006 | 0.084 | 0.277 | 0 | 1 | N/A |
| FY2007 | 0.097 | 0.297 | 0 | 1 | N/A |
| FY2008 | 0.084 | 0.278 | 0 | 1 | N/A |
| FY2009 | 0.083 | 0.276 | 0 | 1 | N/A |
| FY2010 | 0.066 | 0.248 | 0 | 1 | N/A |
| FY2011 | 0.076 | 0.265 | 0 | 1 | N/A |
| FY2012 | 0.080 | 0.271 | 0 | 1 | N/A |
| FY2013 | 0.073 | 0.260 | 0 | 1 | N/A |
| FY2014 | 0.072 | 0.259 | 0 | 1 | N/A |
| FY2015 | 0.062 | 0.242 | 0 | 1 | N/A |
| FY2016 | 0.071 | 0.257 | 0 | 1 | N/A |
| FY2017 | 0.071 | 0.257 | 0 | 1 | N/A |
| No High School Diploma or Equivalent (Dropout) | 0.001 | 0.033 | 0 | 1 | N/A |
| GED or Other Credentials | 0.019 | 0.136 | 0 | 1 | N/A |
| 1 Semester College or Adult Diploma (non-HSDGs) | 0.020 | 0.140 | 0 | 1 | N/A |
| Home School Diploma | 0.003 | 0.056 | 0 | 1 | N/A |
| High School Diploma or High School Senior | 0.886 | 0.318 | 0 | 1 | N/A |
| Some College but no Degree (HSDGs) | 0.017 | 0.130 | 0 | 1 | N/A |
| Associate's Degree | 0.032 | 0.175 | 0 | 1 | N/A |
| Bachelor's Degree | 0.019 | 0.136 | 0 | 1 | N/A |
| Master's, post-Master's, or Doctorate | 0.002 | 0.047 | 0 | 1 | N/A |
| Other Education | 0.001 | 0.026 | 0 | 1 | N/A |
| Unknown Education | 0.000 | 0.021 | 0 | 1 | N/A |
| Maximum SRB | \$10,435.04 | \$15,241.230 | \$0 | \$89,000 | \$0 |
| Months of Service | 96.716 | 11.063 | 73 | 120 | 96 |
| Combat Deployed at Decision | 0.070 | 0.256 | 0 | 1 | N/A |
| Non-Combat Deployed at Decision | 0.040 | 0.195 | 0 | 1 | N/A |
| Age | 27.405 | 2.422 | 22 | 43 | 27 |
| Female | 0.073 | 0.260 | 0 | 1 | N/A |
| Have Children | 0.511 | 0.500 | 0 | 1 | N/A |

| Variable | Mean | Standard Deviation | Minimum | Maximum | Median |
|---|-------------|---------------------------|----------------|----------------|---------------|
| Promoted in Last 12 Months | 0.238 | 0.426 | 0 | 1 | N/A |
| Demoted in Last 12 Months | 0.008 | 0.090 | 0 | 1 | N/A |
| Medically Nondeployable in Last 12 Months | 0.025 | 0.157 | 0 | 1 | N/A |
| Nondeployable for Other Reasons in Last 12 Months | 0.057 | 0.231 | 0 | 1 | N/A |
| Hispanic | 0.183 | 0.387 | 0 | 1 | N/A |
| Black | 0.143 | 0.350 | 0 | 1 | N/A |
| Asian Pacific Islander | 0.035 | 0.183 | 0 | 1 | N/A |
| Other Race | 0.013 | 0.115 | 0 | 1 | N/A |
| Unknown Race | 0.096 | 0.295 | 0 | 1 | N/A |
| AFQT score | 60.814 | 17.968 | 3 | 99 | 61 |
| Paygrade | 5.308 | 0.538 | 1 | 8 | 5 |
| Time in Grade | 27.285 | 17.513 | 0 | 118 | 27 |
| US Citizen | 0.975 | 0.157 | 0 | 1 | N/A |
| Total GWOT Combat Deployments | 1.482 | 1.138 | 0 | 14 | 1 |
| Total GWOT Noncombat Deployments | 0.339 | 0.593 | 0 | 5 | 0 |
| Colocated | 0.038 | 0.192 | 0 | 1 | N/A |
| Not Colocated | | | 0 | 1 | N/A |
| Single | 0.260 | 0.438 | 0 | 1 | N/A |
| Colocation Status Unknown | 0.018 | 0.132 | 0 | 1 | N/A |
| Civilian Spouse | 0.677 | 0.468 | 0 | 1 | N/A |
| Female*Colocated | 0.019 | 0.136 | 0 | 1 | N/A |
| Female*Not Colocated | 0.004 | 0.060 | 0 | 1 | N/A |
| Female*Single | 0.031 | 0.173 | 0 | 1 | N/A |
| Female*Colocation Unknown | 0.003 | 0.054 | 0 | 1 | N/A |
| Female*Civilian Spouse | 0.016 | 0.127 | 0 | 1 | N/A |

Source: CNA analysis of Marine Corps personnel files.

Table 3. Summary statistics for the Zone C reenlistment regression

| Variable | Mean | Standard Deviation | Minimum | Maximum | Median |
|---|-------------|---------------------------|----------------|----------------|---------------|
| Reenlistment Decision | 0.848 | 0.359 | 0 | 1 | N/A |
| Economic Index | 0.904 | 0.808 | -0.76 | 2.2 | 1.11 |
| FY2005 | 0.061 | 0.239 | 0 | 1 | N/A |
| FY2006 | 0.071 | 0.256 | 0 | 1 | N/A |
| FY2007 | 0.091 | 0.288 | 0 | 1 | N/A |
| FY2008 | 0.078 | 0.268 | 0 | 1 | N/A |
| FY2009 | 0.069 | 0.254 | 0 | 1 | N/A |
| FY2010 | 0.054 | 0.227 | 0 | 1 | N/A |
| FY2011 | 0.064 | 0.245 | 0 | 1 | N/A |
| FY2012 | 0.084 | 0.278 | 0 | 1 | N/A |
| FY2013 | 0.084 | 0.277 | 0 | 1 | N/A |
| FY2014 | 0.097 | 0.296 | 0 | 1 | N/A |
| FY2015 | 0.093 | 0.291 | 0 | 1 | N/A |
| FY2016 | 0.086 | 0.281 | 0 | 1 | N/A |
| FY2017 | 0.067 | 0.250 | 0 | 1 | N/A |
| No High School Diploma or Equivalent (Dropout) | 0.002 | 0.045 | 0 | 1 | N/A |
| GED or Other Credentials | 0.018 | 0.133 | 0 | 1 | N/A |
| 1 Semester College or Adult Diploma (non-HSDGs) | 0.017 | 0.130 | 0 | 1 | N/A |
| Home School Diploma | 0.001 | 0.037 | 0 | 1 | N/A |
| High School Diploma or High School Senior | 0.847 | 0.360 | 0 | 1 | N/A |
| Some College but no Degree (HSDGs) | 0.022 | 0.146 | 0 | 1 | N/A |
| Associate's Degree | 0.052 | 0.222 | 0 | 1 | N/A |
| Bachelor's Degree | 0.033 | 0.178 | 0 | 1 | N/A |
| Master's, post-Master's, or Doctorate | 0.004 | 0.063 | 0 | 1 | N/A |
| Other Education | 0.001 | 0.024 | 0 | 1 | N/A |
| Unknown Education | 0.003 | 0.058 | 0 | 1 | N/A |
| Maximum SRB | \$5,781.24 | \$11,483.12 | \$0 | \$83,000 | \$0 |
| Months of Service | 142.129 | 12.570 | 121 | 168 | 141 |
| Combat Deployed at Decision | 0 | 0 | 0 | 1 | N/A |
| Non-Combat Deployed at Decision | 0.003 | 0.052 | 0 | 1 | N/A |

| Variable | Mean | Standard Deviation | Minimum | Maximum | Median |
|---|-------------|---------------------------|----------------|----------------|---------------|
| Age | 31.294 | 2.516 | 26 | 47 | 31 |
| Female | 0.062 | 0.241 | 0 | 1 | N/A |
| Have Children | 0.704 | 0.457 | 0 | 1 | N/A |
| Promoted in Last 12 Months | 0.219 | 0.414 | 0 | 1 | N/A |
| Demoted in Last 12 Months | 0.002 | 0.043 | 0 | 1 | N/A |
| Medically Nondeployable in Last 12 Months | 0.021 | 0.142 | 0 | 1 | N/A |
| Nondeployable for Other Reasons in Last 12 Months | 0.061 | 0.240 | 0 | 1 | N/A |
| Hispanic | 0.200 | 0.400 | 0 | 1 | N/A |
| Black | 0.171 | 0.377 | 0 | 1 | N/A |
| Asian Pacific Islander | 0.034 | 0.182 | 0 | 1 | N/A |
| Other Race | 0.015 | 0.121 | 0 | 1 | N/A |
| Unknown Race | 0.105 | 0.307 | 0 | 1 | N/A |
| AFQT score | 60.709 | 17.587 | 11 | 99 | 61 |
| Paygrade | 6.096 | 0.560 | 1 | 8 | 6 |
| Time in Grade | 33.556 | 23.200 | 0 | 139 | 32 |
| US Citizen | 0.979 | 0.144 | 0 | 1 | N/A |
| Total GWOT Combat Deployments | 1.804 | 1.378 | 0 | 13 | 2 |
| Total GWOT Noncombat Deployments | 0.398 | 0.671 | 0 | 6 | 0 |
| Colocated | 0.038 | 0.191 | 0 | 1 | N/A |
| Not Colocated | 0.006 | 0.077 | 0 | 1 | N/A |
| Single | 0.181 | 0.385 | 0 | 1 | N/A |
| Colocation Status Unknown | 0.014 | 0.118 | 0 | 1 | N/A |
| Civilian Spouse | 0.761 | 0.426 | 0 | 1 | N/A |
| Female*Colocated | 0.018 | 0.135 | 0 | 1 | N/A |
| Female*Not Colocated | 0.003 | 0.050 | 0 | 1 | N/A |
| Female*Single | 0.025 | 0.157 | 0 | 1 | N/A |
| Female*Colocation Unknown | 0.002 | 0.046 | 0 | 1 | N/A |
| Female*Civilian Spouse | 0.013 | 0.114 | 0 | 1 | N/A |

Source: CNA analysis of Marine Corps personnel files.

Table 4. Zone A, B, and C reenlistment regression results

| Variable | Zone A^a | Zone B^a | Zone C^a |
|---|---------------------------|---------------------------|---------------------------|
| Economic Index | 0.197*** (0.011) | 0.257*** (0.023) | 0.210*** (0.046) |
| No High School Diploma or Equivalent (Dropout) | 0.033 (0.134) | -0.255 (0.176) | -0.101 (0.224) |
| GED or Other Credentials | 0.038 (0.028) | 0.042 (0.042) | 0.008 (0.077) |
| 1 Semester College or Adult Diploma (non-HSDGs) | -0.053** (0.021) | -0.028 (0.042) | -0.047 (0.077) |
| Home School Diploma | 0.013 (0.041) | 0.040 (0.103) | -0.152 (0.265) |
| Some College but no Degree (HSDGs) | -0.075*** (0.023) | -0.070 (0.047) | 0.094 (0.083) |
| Associate's Degree | 0.070** (0.033) | 0.050 (0.037) | 0.029 (0.053) |
| Bachelor's Degree | -0.257*** (0.036) | -0.369*** (0.045) | -0.254*** (0.064) |
| Master's, post-Master's, or Doctorate | 0.152 (0.174) | -0.189 (0.137) | -0.500*** (0.190) |
| Other Education | -0.074 (0.081) | -0.229 (0.204) | 0.031 (0.228) |
| Unknown Education | 0.047 (0.044) | -0.069 (0.252) | 0.191 (0.270) |
| Maximum SRB | 0.000** (0.000) | 0.000*** (0.000) | -0.000** (0.000) |
| Length of Service | -0.125*** (0.001) | -0.034*** (0.001) | -0.003** (0.001) |
| Combat Deployed at Decision | 3.506*** (0.095) | 2.601*** (0.183) | dropped |
| Non-Combat Deployed at Decision | 1.538*** (0.089) | 0.835*** (0.159) | 0.947*** (0.298) |
| Age | 0.007*** (0.002) | 0.025*** (0.003) | 0.009* (0.005) |
| Female | -0.402*** (0.083) | -0.306** (0.145) | -0.716*** (0.238) |

| Variable | Zone A ^a | Zone B ^a | Zone C ^a |
|---|----------------------|----------------------|----------------------|
| Have Children | 0.217*** (0.009) | 0.200*** (0.013) | 0.105*** (0.025) |
| Promoted in Last 12 Months | -0.070*** (0.010) | 0.018 (0.022) | -0.101** (0.046) |
| Demoted in Last 12 Months | -0.209*** (0.034) | -1.118*** (0.124) | -0.799 (0.491) |
| Medically Nondeployable in Last 12 Months | -0.114*** (0.023) | -0.357*** (0.036) | -0.252*** (0.063) |
| Nondeployable for Other Reasons in Last 12 Months | 0.085*** (0.022) | 0.262*** (0.026) | 0.142*** (0.046) |
| Hispanic | 0.081*** (0.009) | 0.082*** (0.017) | 0.089*** (0.030) |
| Black | 0.418*** (0.011) | 0.211*** (0.018) | 0.087*** (0.030) |
| Asian Pacific Islander | 0.097*** (0.016) | 0.065** (0.032) | 0.097* (0.058) |
| Other Race | 0.061** (0.028) | 0.073 (0.051) | -0.294*** (0.076) |
| Unknown Race | 0.075*** (0.014) | -0.018 (0.022) | -0.056 (0.039) |
| AFQT score | 0.000 (0.000) | -0.003*** (0.000) | -0.003*** (0.001) |
| Paygrade | 0.673*** (0.008) | 1.030*** (0.018) | 1.372*** (0.042) |
| Time in Grade | 0.002*** (0.001) | -0.002*** (0.001) | -0.012*** (0.001) |
| US Citizen | -0.001 (0.019) | -0.067* (0.038) | 0.097 (0.065) |
| Total GWOT Combat Deployments | -0.139*** (0.005) | 0.014** (0.007) | 0.008 (0.011) |
| Total GWOT Noncombat Deployments | 0.029*** (0.008) | -0.008 (0.011) | -0.014 (0.018) |
| Colocated | 0.062 (0.067) | 0.204* (0.119) | -0.123 (0.167) |
| Single | -0.509*** | -0.401*** | -0.555*** |

| Variable | Zone A ^a | Zone B ^a | Zone C ^a |
|---------------------------|---------------------|----------------------|----------------------|
| | (0.064) | (0.111) | (0.146) |
| Colocation Status Unknown | -0.139** (0.071) | -0.314*** (0.120) | -0.478*** (0.170) |
| Civilian Spouse | -0.075 (0.064) | -0.079 (0.111) | -0.397*** (0.145) |
| Female*Colocated | 0.065 (0.089) | -0.101 (0.158) | 0.491* (0.268) |
| Female*Single | 0.608*** (0.085) | 0.334** (0.149) | 0.692*** (0.248) |
| Female*Colocation Unknown | -0.114 (0.100) | -0.225 (0.184) | 0.090 (0.312) |
| Female*Civilian Spouse | 0.056 (0.088) | -0.076 (0.151) | 0.230 (0.252) |
| Constant | 2.690*** (0.092) | -1.956*** (0.158) | -5.889*** (0.306) |
| Observations | 257,491 | 62,805 | 31,799 |
| Pseudo R-squared | 0.324 | 0.206 | 0.325 |

Source: CNA analysis of Marine Corps personnel files.

^a. Robust standard errors are in parentheses.

***, **, and * represent statistical significance at the 1-, 5-, and 10-percent levels, respectively.

References

- [1] Angrist, Joshua D. 2001. "Estimation of Limited Dependent Variable Models with Dummy Endogenous Regressors: Simple Strategies for Empirical Practice." *Journal of Business and Economic Statistics* 19 (1): 2-16.
- [2] Angrist, Joshua D. 2006. "Instrumental Variables Methods in Experimental Criminological Research: What, Why and How." *Journal of Experimental Criminology* 2: 23-44.
- [3] Angrist, Joshua D., and Jorn-Steffen Pischke. 2009. *Mostly Harmless Econometrics*. Princeton, NJ: Princeton University Press.
- [4] Hellevik, Ottar. 2007. "Linear Versus Logistic Regression When the Dependent Variable Is a Dichotomy." *Quality and Quantity* 43: 59-74.
- [5] Horrace, William C., and Ronald L. Oaxaca. 2006. "Results on the Bias and Inconsistency of Ordinary Least Squares for the Linear Probability Model." *Economic Letters* 90: 321-327.
- [6] Wooldridge, Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: Massachusetts Institute of Technology.
- [7] Pinelis, Jane K., and Jared M. Huff. 2014. *The Economy and Enlisted Retention in the Navy*. CNA. DRM-2014-U-007301-Final.



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