The Relationship Between Collocation and Reenlistment in the Navy : Technical Background (Vol. 2)

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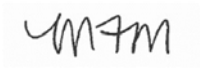

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Abstract

This document provides the technical background for the analysis presented in the CNA annotated briefing, *The Relationship Between Colocation and Reenlistment in the Navy (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 Navy.* 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-016844-Final), *The Relationship Between Colocation and Reenlistment in the Navy (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 Navy-Navy 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 that women entering the Navy today or in the future will have retention behavior similar to that of the women who entered the Navy in past years. Therefore, inference from analyses of historical female retention behavior may have limited applicability to women who join the Navy in the future.

Technical Details

Data cleaning and dropped observations

Our analytical process began with CNA's reenlistment decision data file. Every observation in this dataset represents a decision made by an enlisted sailor to reenlist (or to take a long-term extension, which we treat as equivalent to reenlisting) at the end of his or her contract. Note that the file does not include those who attrite from the Navy before reaching their end of obligated service (EAOS). For purposes of this analysis, we do not view attrition as comparable to having completed a contract and deciding whether to stay in the Navy. We also exclude those who transition to the officer corps since this is a different type of decision to stay in the Navy—one that involves applying for and being accepted into a specific program. In short, we restrict our analysis to those enlisted sailors who have made it to their EAOS and are deciding whether to stay in or leave the enlisted Navy. The steps in our exclusion process follow:

- We start with a database containing enlisted decisions that were made between FY05 and FY15 that resulted in either a reenlistment (or long-term extension) or a loss. We then exclude 72,050 sailors with paygrades of E1 or E2; they were likely demoted and so are unlikely to be allowed to reenlist.

- We exclude 64,211 sailors with a paygrade of E3 who do *not* have a prospective paygrade of E4. Navy policy states that a sailor must be an E4 or above or have a *prospective* paygrade of E4 or above to reenlist. Therefore, no E1, E2, or E3 sailor without a prospective E4 paygrade is eligible to reenlist.

- We also exclude 26,946 sailors who are in a nuclear Enlisted Management Community (EMC) or are in training to become a "nuke." This is because sailors in this community may receive very high reenlistment bonuses to counter their economic opportunities in the civilian labor market, and sailors can maximize their bonus by reenlisting at two years of service. The overall reenlistment process for nukes is therefore different from that of other sailors, and including them in our sample could potentially skew our results.

These restrictions result in a sample of 236,857 Zone A decisions (i.e., decisions made when the sailor has 0 to 6 years of service), 128,668 Zone B decisions (i.e., decisions made with 6 to 10 years of service), and 67,621 Zone C decisions (i.e., decisions made with 10 to 14 years of service).

Defining reenlistment and colocation variables

Our primary analytical question is whether spousal colocation has a positive correlation with sailors' decisions to reenlist. If it does, expanding colocation efforts could potentially be used to increase enlisted retention (or the retention of particular groups, such as women, or sailors in a particular reenlistment Zone). Therefore, how we define *reenlistment* and *colocation* is critical to the analysis. We consider reenlistment to include the decision to reenlist or to take a long-term extension. The reenlist variable takes a value of 1 if the sailor chooses to reenlist and a value of 0 if he or she chooses to leave the Navy at his or her EAOS.

Currently, the Navy considers two sailors to be colocated if the units to which they are assigned are within 90 driving miles of each other. The closest we came to the Navy policy was to determine whether the geographic location of two married sailors' assigned units are within *90 miles* of each other (but not 90 *driving* miles). Note that 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 sailor in our sample, *one* of the following five variables equals 1, and all others equal 0:

- Married to another sailor and colocated with that sailor (units within 90 miles).
- Married to another sailor but not colocated (units outside a 90-mile radius).
- Married to a military spouse but colocation status is unknown. (Most of these sailors are married to servicemembers in other services; a few are married to another sailor but are missing location information.)
- Married to a civilian spouse.
- Single.

We also tested whether colocated sailors whose units were within 50 miles had a different likelihood of reenlisting than those whose units were within 90 miles. We found no substantive difference in the relationship between the 50- and 90-mile colocation variables and reenlistment rates, so we present only the results using the 90-mile colocation definition.

The model and control variables

We estimate the probability that a sailor 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.

Traditionally, nonlinear estimation methods are used 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., sailors reenlist or not). The nonlinear procedure estimates the probability that an event will occur, such as a sailor reenlisting, as a function of a set of factors specified in the model. The challenge with this estimation method is in calculating the marginal effect of each factor on the estimated probability of reenlisting. For example, how much does a sailor's estimated probability of reenlisting change due to colocation, all else equal? It is possible to calculate the marginal effects in a nonlinear model, but it requires a transformation of the estimated coefficients for each factor. In addition, nonlinear or probabilistic models can yield nonconstant marginal effects, meaning that the marginal effects change with different values of the parameters. This renders the interpretation of the marginal effects less intuitive.

By contrast, we can use a standard linear regression model to estimate the probability of reenlisting as a function of many factors, and the marginal effect of each factor is constant for each parameter. The effects are straightforward to interpret and explain.

A number of studies have shown that the marginal effects computed from nonlinear estimation of a binary choice model (i.e., one where the outcome takes only values of 0 or 1) are similar if not equal to those obtained via a linear regression model. Angrist and Pischke (2009) emphasize that as long as the model is being used to generate marginal effects—and differences in the overall fit of the model are less important—the linear and nonlinear models are indistinguishable ([1], pp. 105-107). Similarly, Hellevik (2007) compared the results from many linear and nonlinear models and found that they were highly correlated [2]. Angrist (2001) likewise compares nonlinear models to linear ordinary least squares (OLS) regressions in his evaluation of the impact that employment and other covariates have on the probability that a woman has additional children [3]. In this study and other analytical comparisons, he finds that "in practice, the treatment effects generated by nonlinear models are likely to be indistinguishable from OLS regression coefficients" ([4], p. 36). Finally, Wooldridge (2002) shows that the estimated coefficients from an OLS regression of a binary model are consistent and unbiased if heteroscedastic robust standard errors are used [5].

We note, however, that the use of nonlinear versus linear estimation techniques when the outcome variable is binary (takes values only of 0 or 1) is a contentious issue among econometricians. Horrace and Oaxaca (2006) provide arguments for *not* using a linear approach [6]. The primary argument is that linear probability models can result in

estimated probabilities that are outside the range of [0, 1], and, when this occurs, OLS is a biased and inconsistent estimator. We therefore ran a few tests to evaluate whether our use of a linear model is sufficient. Namely, we checked (1) the share of predicted probabilities that fall within the [0, 1] range and even more precisely, in the [0.25, 0.75] range, (2) whether the signs and significance on estimated parameters were the same regardless of which model is used, (3) whether the models resulted in different marginal effects for the colocation variables (our variables of interest), and (4) whether errors in the prediction are noticeably greater in one model than the another.

First, we find that the predominant majority of our predicted probabilities fall within the [0, 1] range—97, 94, and 86 percent of predictions for the Zone A, B, and C regressions, respectively. For Zones A and B, the majority of predictions are also within [0.25, 0.75], while less than the majority of Zone C predictions are in that range. Second, we find that, in terms of parameter signs and significance, the linear probability and probabilistic models are identical for Zones A and B, and only one variable (promotion within the last 12 months) has a different sign in the linear and nonlinear Zone C models (we do not find this to be of great concern since it is not a primary variable of interest). Third, the sign and significance of the colocation marginal effects that result from the different models are identical. Finally, the prediction errors are worse in the probabilistic models than the linear model.

Despite some concerns about using linear estimation techniques to estimate a discrete-choice model (of which binary models, in which the left-hand-side variable only takes values of 0 or 1, are a subset), we find there to be considerable evidence that our choice of functional form is largely irrelevant. Therefore, we estimate the relationship between colocation and the probability of reenlisting using OLS with heteroscedastic robust standard errors, so that we are able to calculate constant marginal effects (as opposed to marginal effects that vary with the values of other covariates).

The full list of factors (covariates) included on the right-hand side of our model includes those from a previously established enlisted Navy reenlistment model. Specifically, the fundamentals of our model were adapted from those used by Golfin and her coauthors [7-8]. 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:

- Age
- Gender
- Race (black, Asian Pacific Islander, other, unknown race, or white)
- Ethnicity (Hispanic or non-Hispanic)
- A 0/1 indicator for whether the sailor has children
- A 0/1 indicator for whether the sailor is a US citizen

- A 0/1 indicator for each education group (only one of these will equal 1 for each sailor), the groups are:
  - No high school diploma or equivalent (dropout)
  - GED or other credentials
  - 1 semester of college or adult diploma
  - Homeschool diploma
  - High school diploma graduate or high school senior
  - Associate's degree; bachelor's degree or nursing degree
  - Master's degree, post-master's degree, or doctorate degree
  - Other education
  - Education unknown
- A 0/1 indicator for whether the sailor was on sea duty at the time of decision
- A 0/1 indicator for whether the sailor was promoted in the 12 months before decision
- A 0/1 indicator for whether the sailor was demoted in the 12 months before decision
- A 0/1 indicator for whether the sailor was ever demoted
- A 0/1 indicator for whether the sailor had a medical accounting code (indicating that he/she was hurt or hospitalized) in the 12 months prior to decision
- Length of service (in months)
- Paygrade
- Time in grade
- Fiscal year of decision
- An index summarizing the strength of the U.S. economy in the quarter of decision[2]
- Sailor's Enlisted Management Community, or EMC[3]

[2] 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) [9].

[3] We also tested a version of the model with interactions between the economic index and a sailor's EMC at decision. There were no meaningful changes to our parameters of interest (i.e.,

- The maximum Selective Reenlistment Bonus (SRB) for which a sailor qualifies at decision (a sailor may qualify for more than one SRB, so we control for the one with the highest value)
- Armed Forces Qualification Test (AFQT) score[4]
- Total number of months sailor has been on sea duty up to point of decision
- Total number of months sailor has been on arduous shore duty up to point of decision
- Number of months spent in the Delayed Entry Program prior to accession
- Marital/colocation status, as captured by five variables (only one of these will equal 1 for each sailor: colocated, not colocated, colocation status unknown, civilian spouse, or single)
- 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)

Other analytical decisions/considerations

In this subsection, we highlight a few other analytical decisions we made. The reasons for these decisions follow:

1. To present results on our entire sample period (FY05 through FY15 reenlistment decisions), even though the Career Waypoints (C-WAY) system supplanted the Perform to Serve (PTS) system in July 2013 and could change reenlistment behavior
2. To *not* control for the proximity of a spouse's reenlistment decision to the sailor's decision
3. To "correct" the data so that no sailor is married to more than one *other* sailor at any point in time

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 EMCs, and the SRB variables, as we would expect.

[4] We use the AFQT score at accession, unless this score is missing or invalid (e.g., "A2"). In those cases, if the AFQT at decision is a nonmissing, valid score, we use that instead of the accession score.

The Perform to Serve (PTS) program, which was applied in our sample years of FY05 through mid-FY13, sought to reallocate sailors toward undermanned ratings and away from overmanned ratings at reenlistment. In fact, the PTS program allowed the Navy to prohibit reenlistment for some sailors who wanted to reenlist in overmanned ratings. The C-WAY system, introduced in July 2013, requires sailors to *apply* to reenlist in the Navy. Like PTS, it is an effort by the Navy to encourage reenlistment in undermanned ratings and discourage reenlistment in overmanned ones. Some sailors applying for reenlistment who are in overmanned ratings are denied reenlistment entirely, while others are approved to reenlist *if* they convert to another, undermanned rating.

Both the PTS and C-WAY policies changed what we can surmise from an observed sailor decision. Specifically, it is not entirely clear whether and how an observed decision reflects sailors' preferences. To attempt to control for some of the C-WAY and PTS effects on reenlistment decisions, we control for the fiscal year of a sailor's decision as well as his or her rating. Some of the sample variation explained by those variables should be the average impact of C-WAY (or PTS) on reenlistment decisions for sailors in different ratings and different years.

In addition, C-WAY and PTS are different programs (albeit with similar goals) with potentially different implications for sailor decisions. Therefore, we also ran our models two ways: first including the entire FY05-FY15 sample and then including only those decisions made *prior* to the implementation of C-WAY. There were no meaningful differences in our results. Thus, to maintain as much statistical power as possible, we include all years and make no restriction for the C-WAY implementation.

We also considered adding a covariate to our model that controls for whether a sailor's spouse in a dual-enlisted-Navy marriage made a reenlistment decision within a year of the sailor's decision *and* what that decision was. We suspected, in fact, that those sailor pairs whose decisions were within a year might treat their decisions as a joint household decision, perhaps more so than is the case in households where the decisions are many years apart. However, after settling on the definition of the colocation/marital status variable, which includes a "civilian spouse" option, we could no longer simultaneously control for the spouse's decision. This is because these two variables are highly correlated. Any time the "first decider" in a sailor-sailor couple decides to leave the Navy, the "second decider" will, by definition, have a civilian spouse at the time of his or her decision. Due to the high percentage of sailors in this situation (in which the spouse's previous decision was to leave the Navy, thus making the sailor a "civilian spouse" by the time of his or her decision), it became econometrically infeasible to capture both whether the sailor is married to a civilian spouse and the spouse's reenlistment decision. Given our analytic objective, we found it more important to fully capture the range of colocation/marital statuses than to control for the spouse's reenlistment decision.

Finally, a small number of records indicated that a sailor was simultaneously married to *two* other sailors (most likely the result of either a lag in recording an update to the spousal Social Security Number (SSN) on the sailor's record or an error in entering the spousal SSN). In these cases, we kept the most recent spouse as the sailor's spouse, assuming that what likely happened is that the Navy personnel records had not yet been updated to reflect a change in spouse.

Sample descriptive statistics and results

In the remainder of this memorandum, we provide tables of summary statistics for those variables and observations included in each of our three estimations (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 estimations (see Table 4). We note one exception: because of the large number of EMCs and the fact that our estimations include an indicator variable for *each* EMC, we are not presenting EMC-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	0.577	0.494	0	1	N/A
Economic Index	0.905	0.907	-0.76	2.2	1.15
FY2005	0.100	0.300	0	1	N/A
FY2006	0.096	0.294	0	1	N/A
FY2007	0.089	0.285	0	1	N/A
FY2008	0.088	0.283	0	1	N/A
FY2009	0.084	0.277	0	1	N/A
FY2010	0.084	0.278	0	1	N/A
FY2011	0.093	0.290	0	1	N/A
FY2012	0.093	0.290	0	1	N/A
FY2013	0.092	0.289	0	1	N/A
FY2014	0.093	0.290	0	1	N/A
FY2015	0.089	0.285	0	1	N/A
No High School Diploma or Equivalent (Dropout)	0.013	0.115	0	1	N/A
GED or Other Credentials	0.028	0.165	0	1	N/A
1 Semester College or Adult Diploma	0.034	0.182	0	1	N/A

Variable	Mean	Standard Deviation	Minimum	Maximum	Median
Home School Diploma	0.003	0.056	0	1	N/A
High School Diploma or High School Senior	0.858	0.348	0	1	N/A
Associate's Degree	0.020	0.139	0	1	N/A
Bachelor's Degree	0.025	0.157	0	1	N/A
Master's, post-Master's, or Doctorate	0.002	0.040	0	1	N/A
Other Education	0.002	0.048	0	1	N/A
Unknown Education	0.014	0.116	0	1	N/A
Maximum SRB	0.788	1.287	0	11.5	0
Length of Service	53.807	9.666	3	73	50
On Sea Duty at Decision	0.685	0.465	0	1	N/A
Age	24.784	3.078	19	47	24
Female	0.185	0.388	0	1	N/A
Have Children	0.242	0.428	0	1	N/A
Promoted in Last 12 Months	0.482	0.500	0	1	N/A
Demoted in Last 12 Months	0.007	0.081	0	1	N/A
Medical Accounting Code in Last 12 Months	0.031	0.174	0	1	N/A
Ever Demoted	0.042	0.201	0	1	N/A
Hispanic	0.187	0.390	0	1	N/A
Black	0.179	0.383	0	1	N/A
Asian Pacific Islander	0.063	0.243	0	1	N/A
Other Race	0.138	0.345	0	1	N/A
Unknown Race	0.007	0.085	0	1	N/A
AFQT score	62.429	17.563	28	99	62
Pay Grade	4.420	0.517	3.5	7	4
Time in Grade	16.902	11.437	0	154	15
Months in DEP	5.534	3.669	0	29	5
US Citizen	0.964	0.187	0	1	N/A
Total Sea Duty Months	34.670	17.122	0	278	39
Total Arduous Shore Duty Months	0.774	4.313	0	68	0
Colocated	0.045	0.207	0	1	N/A
Not Colocated	0.014	0.117	0	1	N/A
Single	0.537	0.499	0	1	N/A

Variable	Mean	Standard Deviation	Minimum	Maximum	Median
Colocation Status Unknown	0.013	0.114	0	1	N/A
Civilian Spouse	0.392	0.488	0	1	N/A
Female*Colocated	0.024	0.153	0	1	N/A
Female*Not Colocated	0.008	0.090	0	1	N/A
Female*Single	0.106	0.308	0	1	N/A
Female*Colocation Unknown	0.007	0.085	0	1	N/A
Female*Civilian Spouse	0.039	0.193	0	1	N/A

Source: CNA analysis of Navy's enlisted master records.

Table 2. Summary statistics for the Zone B reenlistment regression

Variable	Mean	Standard Deviation	Minimum	Maximum	Median
Reenlistment Decision	0.655	0.475	0	1	N/A
Economic Index	0.939	0.922	-0.76	2.2	1.26
FY2005	0.074	0.262	0	1	N/A
FY2006	0.091	0.288	0	1	N/A
FY2007	0.096	0.295	0	1	N/A
FY2008	0.095	0.293	0	1	N/A
FY2009	0.104	0.305	0	1	N/A
FY2010	0.105	0.307	0	1	N/A
FY2011	0.097	0.296	0	1	N/A
FY2012	0.098	0.298	0	1	N/A
FY2013	0.087	0.281	0	1	N/A
FY2014	0.078	0.268	0	1	N/A
FY2015	0.074	0.263	0	1	N/A
No High School Diploma or Equivalent (Dropout)	0.015	0.123	0	1	N/A
GED or Other Credentials	0.029	0.167	0	1	N/A
1 Semester College or Adult Diploma	0.041	0.198	0	1	N/A
Home School Diploma	0.003	0.054	0	1	N/A
High School Diploma or High School Senior	0.826	0.38	0	1	N/A
Associate's Degree	0.041	0.198	0	1	N/A
Bachelor's Degree	0.024	0.154	0	1	N/A

Variable	Mean	Standard Deviation	Minimum	Maximum	Median
Master's, post-Master's, or Doctorate	0.003	0.050	0	1	N/A
Other Education	0.002	0.045	0	1	N/A
Unknown Education	0.017	0.129	0	1	N/A
Maximum SRB	0.604	1.268	0	9	0
Length of Service	98.048	12.767	74	121	96
On Sea Duty at Decision	0.312	0.463	0	1	N/A
Age	28.281	3.157	23	48	28
Female	0.175	0.380	0	1	N/A
Have Children	0.489	0.500	0	1	N/A
Promoted in Last 12 Months	0.212	0.409	0	1	N/A
Demoted in Last 12 Months	0.010	0.097	0	1	N/A
Medical Accounting Code in Last 12 Months	0.032	0.177	0	1	N/A
Ever Demoted	0.073	0.260	0	1	N/A
Hispanic	0.169	0.375	0	1	N/A
Black	0.235	0.424	0	1	N/A
Asian Pacific Islander	0.077	0.267	0	1	N/A
Other Race	0.095	0.294	0	1	N/A
Unknown Race	0.007	0.083	0	1	N/A
AFQT score	59.028	17.952	27	99	57
Pay Grade	5.117	0.611	3.5	7.5	5
Time in Grade	33.026	19.412	0	117	32
Months in DEP	4.974	3.804	0	25	4
US Citizen	0.957	0.203	0	1	N/A
Total Sea Duty Months	52.234	20.863	0	119	54
Total Arduous Shore Duty Months	1.917	7.372	0	105	0
Colocated	0.050	0.219	0	1	N/A
Not Colocated	0.014	0.117	0	1	N/A
Single	0.363	0.481	0	1	N/A
Colocation Status Unknown	0.014	0.117	0	1	N/A
Civilian Spouse	0.559	0.497	0	1	N/A
Female*Colocated	0.027	0.162	0	1	N/A
Female*Not Colocated	0.008	0.087	0	1	N/A

Variable	Mean	Standard Deviation	Minimum	Maximum	Median
Female*Single	0.090	0.286	0	1	N/A
Female*Colocation Unknown	0.007	0.082	0	1	N/A
Female*Civilian Spouse	0.044	0.204	0	1	N/A

Source: CNA analysis of Navy's enlisted master records.

Table 3. Summary statistics for the Zone C reenlistment regression

Variable	Mean	Standard Deviation	Minimum	Maximum	Median
Reenlistment Decision	0.784	0.412	0	1	N/A
Economic Index	1.106	0.872	-0.76	2.2	1.42
FY2005	0.061	0.239	0	1	N/A
FY2006	0.068	0.252	0	1	N/A
FY2007	0.072	0.258	0	1	N/A
FY2008	0.073	0.261	0	1	N/A
FY2009	0.089	0.284	0	1	N/A
FY2010	0.115	0.319	0	1	N/A
FY2011	0.122	0.327	0	1	N/A
FY2012	0.137	0.344	0	1	N/A
FY2013	0.102	0.303	0	1	N/A
FY2014	0.085	0.279	0	1	N/A
FY2015	0.075	0.264	0	1	N/A
No High School Diploma or Equivalent (Dropout)	0.014	0.119	0	1	N/A
GED or Other Credentials	0.026	0.158	0	1	N/A
1 Semester College or Adult Diploma	0.038	0.191	0	1	N/A
Home School Diploma	0.002	0.049	0	1	N/A
High School Diploma or High School Senior	0.783	0.412	0	1	N/A
Associate's Degree	0.073	0.260	0	1	N/A
Bachelor's Degree	0.040	0.196	0	1	N/A
Master's, post-Master's, or Doctorate	0.005	0.068	0	1	N/A
Other Education	0.001	0.031	0	1	N/A
Unknown Education	0.018	0.133	0	1	N/A
Maximum SRB	0.358	1.183	0	9	0

Variable	Mean	Standard Deviation	Minimum	Maximum	Median
Length of Service	146.682	14.913	122	169	146
On Sea Duty at Decision	0.519	0.500	0	1	N/A
Age	32.331	3.273	27	52	32
Female	0.160	0.366	0	1	N/A
Have Children	0.674	0.469	0	1	N/A
Promoted in Last 12 Months	0.188	0.391	0	1	N/A
Demoted in Last 12 Months	0.010	0.098	0	1	N/A
Medical Accounting Code in Last 12 Months	0.035	0.183	0	1	N/A
Ever Demoted	0.082	0.274	0	1	N/A
Hispanic	0.149	0.357	0	1	N/A
Black	0.258	0.438	0	1	N/A
Asian Pacific Islander	0.092	0.289	0	1	N/A
Other Race	0.079	0.270	0	1	N/A
Unknown Race	0.002	0.048	0	1	N/A
AFQT score	57.283	17.988	25	99	55
Pay Grade	5.784	0.634	3.5	8.5	6
Time in Grade	42.855	28.186	0	166	39
Months in DEP	4.453	3.756	0	25	3
US Citizen	0.963	0.188	0	1	N/A
Total Sea Duty Months	78.416	28.982	0	165	83
Total Arduous Shore Duty Months	4.013	11.204	0	147	0
Colocated	0.056	0.231	0	1	N/A
Not Colocated	0.012	0.107	0	1	N/A
Single	0.261	0.439	0	1	N/A
Colocation Status Unknown	0.012	0.109	0	1	N/A
Civilian Spouse	0.659	0.474	0	1	N/A
Female*Colocated	0.029	0.168	0	1	N/A
Female*Not Colocated	0.006	0.078	0	1	N/A
Female*Single	0.074	0.261	0	1	N/A
Female*Colocation Unknown	0.006	0.078	0	1	N/A
Female*Civilian Spouse	0.045	0.207	0	1	N/A

Source: CNA analysis of Navy's enlisted master records.

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

Variable	Zone A[a]	Zone B[a]	Zone C[a]
Economic Index	-0.005	0.017***	-0.002
	(0.003)	(0.004)	(0.005)
1 Semester College or Adult Diploma	0.006	-0.012**	-0.019**
	(0.005)	(0.006)	(0.007)
Associate's Degree	-0.007	0.001	0.011**
	(0.007)	(0.006)	(0.005)
Bachelor's Degree	-0.055***	-0.096***	-0.020***
	(0.006)	(0.008)	(0.007)
Home School Diploma	-0.028*	-0.025	-0.038
	(0.017)	(0.023)	(0.028)
Other Education	0.034*	-0.022	0.031
	(0.019)	(0.027)	(0.041)
Master's, post-Master's, or Doctorate	-0.118***	-0.190***	-0.047**
	(0.024)	(0.026)	(0.021)
GED or Other Credentials	0.005	0.003	-0.010
	(0.006)	(0.007)	(0.009)
No High School Diploma or Equivalent (Dropout)	-0.003	0.011	-0.003
	(0.008)	(0.010)	(0.012)
Unknown Education	-0.049***	-0.044***	-0.036***
	(0.008)	(0.010)	(0.011)
Maximum SRB	0.043***	0.037***	0.005***
	(0.001)	(0.002)	(0.002)
Length of Service	-0.012***	-0.005***	-0.001***
	(0.000)	(0.000)	(0.000)
On Sea Duty at Decision	0.223***	0.096***	0.107***
	(0.002)	(0.003)	(0.003)
Total Sea Duty Months	-0.001***	0.002***	0.000***
	(0.000)	(0.000)	(0.000)
Total Arduous Shore Duty Months	0.001***	0.002***	0.000***
	(0.000)	(0.000)	(0.000)
Promoted in Last 12 Months	0.255***	0.073***	-0.028***
	(0.003)	(0.004)	(0.004)
Demoted in Last 12 Months	0.024**	-0.184***	-0.397***
	(0.012)	(0.011)	(0.016)

Variable	Zone A[a]	Zone B[a]	Zone C[a]
Medical Accounting Code in Last 12 Months	-0.077***	-0.238***	-0.250***
	(0.005)	(0.007)	(0.010)
Ever Demoted	0.032***	0.019***	-0.025***
	(0.005)	(0.005)	(0.006)
AFQT score	-0.003***	-0.003***	-0.001***
	(0.000)	(0.000)	(0.000)
Pay Grade	0.157***	0.323***	0.216***
	(0.003)	(0.003)	(0.003)
Time in Grade	0.010***	0.001***	-0.002***
	(0.000)	(0.000)	(0.000)
Months in DEP	-0.000	0.002***	0.001***
	(0.000)	(0.000)	(0.000)
Age	0.002***	0.002***	-0.000
	(0.000)	(0.000)	(0.000)
Female	-0.160***	-0.147***	-0.059**
	(0.016)	(0.020)	(0.026)
Have Children	0.065***	0.034***	0.012***
	(0.002)	(0.003)	(0.003)
Hispanic	0.013***	0.019***	0.004
	(0.002)	(0.003)	(0.004)
Black	0.149***	0.075***	0.036***
	(0.003)	(0.003)	(0.004)
Asian Pacific Islander	0.087***	0.081***	0.034***
	(0.004)	(0.005)	(0.005)
Other Race	0.024***	0.028***	0.013**
	(0.003)	(0.004)	(0.005)
Unknown Race	0.052***	0.027*	0.113***
	(0.011)	(0.014)	(0.026)
US Citizen	-0.036***	-0.010	-0.003
	(0.005)	(0.006)	(0.007)
Colocated	0.026*	0.020	0.048**
	(0.013)	(0.016)	(0.019)
Single	-0.111***	-0.082***	-0.020
	(0.012)	(0.015)	(0.018)
Colocation Status Unknown	-0.073***	-0.109***	-0.001
	(0.017)	(0.020)	(0.025)

Variable	Zone A[a]	Zone B[a]	Zone C[a]
Civilian Spouse	-0.028**	-0.029**	0.010
	(0.012)	(0.015)	(0.018)
Female*Colocated	0.066***	0.067***	0.028
	(0.018)	(0.022)	(0.028)
Female*Single	0.208***	0.147***	0.056**
	(0.016)	(0.021)	(0.027)
Female*Colocation Unknown	0.078***	0.093***	0.001
	(0.023)	(0.029)	(0.038)
Female*Civilian Spouse	0.119***	0.087***	0.017
	(0.016)	(0.021)	(0.027)
Constant	0.031	-0.692***	-0.164***
	(0.019)	(0.026)	(0.034)
Observations	236,857	128,668	67,621
R-squared	0.201	0.210	0.271

Source: CNA analysis of Navy's enlisted master records.

[a.] Robust standard errors are in parentheses.

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

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