CRM D0006179.A2/Final
July 2002

# Hard-to-Fill Billets, Individual Assignment Preferences, and Continuation

Eric W. Christensen • Heidi L. W. Golding
with
Lynda G. Houck

CNA
4825 Mark Center Drive • Alexandria, Virginia 22311-1850

Approved for distribution: July 2002

Donald J. Cymrot, Director
Workforce, Education and Training Team
Resource Analysis Division

# Contents

# Summary

To man the force, the Navy relies on ordering sailors into billets where they are most needed. Involuntary assignments may keep billets filled in the short run, but in the long run they may hurt recruiting, readiness, and retention. Because the Navy has difficulty keeping certain billets filled, it is considering several new incentives (primarily compensation related) designed to encourage sailors to take, and stay in, hard-to-fill billets. Before the Navy can determine whether the incentives are cost-effective, however, it must know the costs of today's involuntary assignment system.

This paper investigates the relationship between retention and sailors' assignments. We identify the Navy's hard-to-fill billets based on location and job characteristics and then estimate the impact of being ordered into a hard-to-fill billet on sailors' retention. By definition, most sailors do not desire Navy hard-to-fill billets; however, some sailors might. Therefore, we also analyze the effect on continuation of sailors serving in billets of their choosing using individual sailor preference data from the Job Advertising and Selection System (JASS). Finally, we estimate the costs to the Navy of sailors serving in billets not of their choosing.

## Findings

Using a location-based definition of a hard-to-fill billet, we find that career sailors receiving orders for less preferred locations are less likely to remain (or continue) in the Navy 10 months after their projected rotation date (PRD). Specifically, the continuation rate for careerists receiving orders to "good" locations is 1.2 percentage points higher than for those receiving orders to "bad" locations.

Our statistical analysis of individuals' preferences shows that linking sailors' preferences to their job assignments does affect continuation. Specifically, we find that:

- Sailors matched, or assigned, to their preferred billets have higher continuation rates. For example, first-term sailors who are at the end of their detailing window—6 months to projected rotation date (PRD) and consequently likely to be involuntarily assigned a billet if they do not accept a JASS-advertised billet shortly—have continuation rates between 2.1 and 3.2 percentage points lower than sailors who accept an assignment early in their detailing window. In comparision, careerists at about 6 months before PRD have continuation rates 0.8 to 1.3 percentage points lower than careerists early in the detailing window.
- Homebasing increases continuation rates by about 1.4 percentage points for career sailors with dependents. There is, however, no significant impact for first-term sailors with dependents.

## Implications and recommendations

As we show in this paper, the Navy's reliance on a distribution system of involuntary assignments has unintended, adverse consequences on retention. What is the cost of the lower retention? Because our measures do not capture preferences perfectly, we provide two sets of costs based on alternative measures of job preferences. We calculate that to alleviate the effect on retention could require about $39 million in Selective Reenlistment Bonuses (SRBs), and this estimate may still understate the full cost of the lower retention.

Although this cost is clearly substantial, we cannot yet judge the relative cost-effectiveness of a voluntary system of assignments. A voluntary system would encourage and reward sailors for taking priority duty and would increase retention. We don't know, however, how expensive the additional compensation would be. Theoretically, those who volunteer for duty will have a less than average dislike for the hard-to-fill billets, which should reduce the programmatic costs relative to the alternatives. Ultimately, however, experimentation and analysis will answer the question. We recommend that the Navy conduct small-scale experiments to determine the willingness of sailors to fill certain billets given additional pay. The Navy's plan to begin paying Assignment Incentive Pay (AIP) to sailors accepting selected billets should provide valuable information. From there, the Navy will be able to assess the cost-effectiveness of a more flexible, voluntary assignment system.

# Introduction

## Background

The Navy has long faced difficulties in manning certain billets and locations. To alleviate these shortages, the Navy has used several, primarily nonmonetary, incentives to encourage sailors to fill and to stay at those billets. Nonmonetary incentives, however, are not without cost. And, because some incentives are not large enough to encourage sailors to voluntarily fill those billets, gapped billets and chronic shortages at some units would result if not for the Navy ordering sailors into these hard-to-fill billets.

The problem with this solution to manning difficulties is that involuntary assignments may have unintended adverse consequences. Ordering sailors to billets where they have little inclination to go may influence their satisfaction with Navy life and subsequent retention decisions. Some sailors may never arrive at assignments they don't want or may not stay in those billets for their entire prescribed tour—instead choosing to leave the Navy. Previous CNA research shows that manning shortfalls and higher turnover affect readiness in the areas of personnel, training, equipment, and supply on ships [1]. In addition, personnel costs rise. Permanent-change-of-station (PCS) moves increase with turnover; the recruiting or retention mission and associated costs may also grow.

Because the Navy continues to have difficulty keeping certain billets filled, it is considering several new incentive options (primarily related to compensation) to encourage sailors to take and stay in hard-to-fill billets. Of course, before it can determine the cost-effectiveness of the incentives, the Navy must know the cost of an involuntary system of assignments. That information is not readily available. This paper details our efforts to quantify the costs of not aligning sailors' orders or assignments to their preferences.

# Approach

We attempt to look at how much poor assignment matches cost the Navy in retention; however, we are hampered by the lack of a definition of a hard-to-fill billet. As our first step, therefore, we identify hard-to-fill jobs. We group billets by location and then use manning information and sailors' stated preferences to determine whether those groups of billets are hard to fill. Given this definition of hard-to-fill billets, we use regression analysis to estimate the effect on subsequent continuation of serving in one of these jobs.

By definition, most sailors do not desire Navy-wide, hard-to-fill billets; however, for every hard-to-fill billet, there are sailors who have less of a dislike than other sailors for that billet. In fact, some billets we considered as hard to fill will be preferred billets for some sailors. Therefore, we also need to look at sailors' individual preferences for different billets.

Using data on sailors' preferences from JASS, we construct measures of preferences for an assignment and correlate sailors' preferences for their assignments with their continuation behavior. We also estimate the impact of a sailor's preference to homebase on continuation rates. Finally, we discuss the costs and implications of ordering sailors into less preferred billets.

# JASS data

Before we focus on identifying hard-to-fill billets and analyzing the impact of hard-to-fill billets on continuation, we discuss in detail the Job Advertising Selection System (JASS) data. Most of our empirical work in this paper relies on JASS data.

## Overview

The Navy, with assistance from CNA, developed JASS in the mid-1990s. The objective was to improve the functioning of the Navy's detailing system and to give sailors more choices in their assignments.

Through JASS, sailors can view job listings for their paygrades, ratings, and preferred locations. JASS operates in 2-week cycles. In each cycle, job titles—along with job characteristics/requirements—are posted. Sailors can submit applications for about 1 week of the cycle, after which detailers make selections and then make the results available. Those sailors not selected may apply in subsequent cycles for other available billets. In any given cycle, sailors may submit up to five applications.

## Benefits

For the purposes of our analysis, the principal benefit of JASS is the information it reveals about individual assignment preferences. For the Navy, JASS offers such benefits as the following:

- Batch versus on-the-spot detailing
- Viewing of most available jobs—not a select subset presented to the sailor by the detailer
- Detailing support for underway ships

- Ability to better match the needs of the Navy and the qualifications and preferences of the sailor
- Fewer calls to detailers.

In general, JASS makes detailers more efficient while giving sailors more information about the opportunities for their next assignment.

## Limitations

Despite the advantages of JASS, it has limitations. Chief among these limitations is that JASS is not universally used by sailors. The perception in the Navy is that only 25 percent of sailors use it.

Most assignments still take place over the telephone between detailers and sailors—mainly because sailors can find JASS frustrating to use. Sailors wait up to 2 weeks to find out if they were selected. If not selected, they get no immediate feedback as to why. One reason some sailors are not selected is that they submit applications for jobs they are not qualified to fill. To avoid further frustration in these cases, detailers often negotiate with sailors over the telephone.

Another reason sailors continue to rely on detailers is that not all assignments are made available through JASS. Of the 368,063 jobs[1] listed between 2 October 1999 and 3 March 2000, 60 percent were on hold (i.e., not offered through JASS in a given cycle).[2] The assignments the Navy allows sailors to apply to through JASS are "priority" jobs. Priority billets are determined by Manning Control Authority algorithms. Unit manning and deployment schedule for sea activities

1. In actuality, fewer than 368,063 jobs were available during this period, but we can't determine the exact number because each job is given a unique job sequence number in every cycle. If a specific job appears in multiple cycles, it has a different job sequence number in each cycle.

2. Some of the jobs on hold include recruiting or security duty and special programs. Others are on hold for various administrative reasons in a given cycle. A job that was on hold in one cycle may have been offered in an earlier cycle or may be offered later. Again, 60 percent of job *listings* being on hold does not mean that 60 percent of *jobs* were never listed.

are two key factors in determining priority. Some sailors, however, depending on their circumstances and through negotiation with their detailers, can circumvent JASS and obtain non-priority, non-JASS available billets (i.e., billets on hold in the system).

Finally, some sailors may not use JASS simply because it is a fairly new system. They may not be experienced with JASS or, perhaps, with the computer systems supporting the system. Recent enhancements to JASS should improve the ease of use.

## Period of JASS data

The JASS data we used for this study cover 10 JASS cycles between October 1999 and March 2000. A total of 12,006 sailors submitted 28,920 applications, for an average of about 2.4 applications per sailor. Eighty percent of sailors participated in just one cycle; 57 percent of these submitted only one application (see table 1).

Table 1. Number of JASS cycles and number of applications per cycle (October 1999 - March 2000)

| JASS cycles participated in | | | Applications for sailors who participated in 1 cycle | | |
|---|---|---|---|---|---|
| Number of cycles | Number of sailors | Percentage of total[a] | Number of applications | Number of sailors | Percentage of total |
| 1 | 9,608 | 80 | 1 | 5,512 | 57 |
| 2 | 1,860 | 15 | 2 | 1,755 | 18 |
| 3 | 399 | 3 | 3 | 1,080 | 11 |
| 4 | 108 | 1 | 4 | 533 | 6 |
| 5 or more | 31 | 0 | 5 | 727 | 8 |
| Total | 12,006 | 100 | Total | 9,607 | 100 |

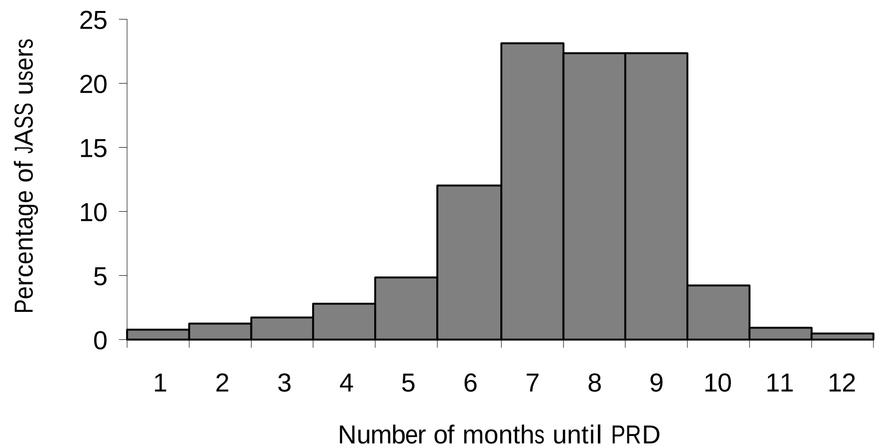
a. Sum may not equal 100 percent because of rounding.

## Who uses JASS?

Ideally, those using JASS have at least 6 months until their projected rotation date (PRD) because orders should be issued 6 months before a sailor's PRD. Sailors are free to use JASS starting 9 months before their PRD.

Do JASS users generally have 6 to 9 months until their PRD? Figure 1 shows that 80 percent of sailors who used JASS in our sample period had between 6 and 9 months until their PRD. This is a relatively high percentage given that PRDs are not set in stone and can be easily changed by a few months to accommodate individual circumstances. If we expand this window to 3 to 10 months until PRD, 94 percent of those using JASS fall into this group. The window of 3 to 10 months until PRD is the window we've used for this analysis.

Figure 1. Months until PRD of sailors who used JASS (October 1999 - March 2000)



# Navy-wide hard-to-fill billets

What makes a billet hard to fill? The difficulty arises if the job's characteristics are dissimilar to most sailors' preferences. Many factors can influence the quality of the job match, including location, worker skills required, job tasks or requirements, coworkers, how career enhancing the assignment is to the sailor, and how critical the job is to the Navy. Although workers may know their preferences for these factors—location, for example—the Navy does not. Similarly, the Navy knows what jobs are most critical to its mission and goals, but individual sailors may not.

## How can you identify hard-to-fill billets?

Ideally, you could identify hard-to-fill billets by looking at the sailors' demand for a billet. We don't know the demand, but we can construct measures for the demand for certain types of billets.

### Manning levels

The first potential measure of the demand for a group of billets is the manning level. Assume for a moment that the assignment system is voluntary. If the average manning for a group of billets is high, we presume that underlying this manning level is high demand. Sailors like the characteristics of the jobs. If the average manning is low, the implication is that demand for the billet is low and that this billet is hard to fill. The critical assumption here is the voluntary nature of the assignment, which implies that sailors are not being forced into billets they don't care for.

The assignment system, however, is not completely voluntary. Often the Navy must order sailors into "priority" assignments to fill a role that is critical to the Navy's mission. Hence, a billet may be filled not because it is a desirable billet but because it is a priority billet. Because of the sometimes involuntary nature of assignments, manning levels may be linked only tenuously, if at all, to sailors' desire for the billets.

## Average time in station

Another potential measure for sailors' demand for certain billets is the turnover rate, or average time sailors spend in those billets. If the demand for a certain billet is high, average time in station should be high. Why? Sailors in the billet may extend their tours to remain in the job or, at least, they don't leave the billet early to go to a better assignment or to leave the Navy entirely.

As with manning levels, however, using average time in station is problematic. Not all sailors have the same prescribed tour length. When aggregating billets into groups (e.g., by location), differences in average time in station reflect to a large degree the sailors' obligated tour length, and not the sailors' preferences for the billet.

## JASS applications data

Another way to determine Navy-wide hard-to-fill billets (and the method we have used in this study) relies on the information sailors reveal about their preferences through JASS. The benefit of JASS data is that they provide information on which jobs sailors actually wanted, and applied for, whereas we can only infer which jobs sailors demanded from manning levels and average time in station. Hence, even without the previously mentioned problems in measuring demand through manning levels and average time in station, JASS application data provide superior information. They reveal the preferences of individual sailors, whereas the other measures provide only aggregate-level information.

In addition to providing individual preference data, we can aggregate JASS data to determine the demand for certain types of billets. We do this by comparing the number of applications that were received for each job. This allows us to generate a relative ranking of which billets were preferred and which were hard to fill.

## Why are certain billets hard to fill?

There may be several reasons why the underlying demand for certain billets may be low—making them hard to fill. One obvious factor in what makes a billet hard to fill is location. We recognize that location preferences vary across individuals. What is a highly preferred location to one may be undesirable to another. However, to the extent that a location is preferred overall, using a measure of its desirability is a reasonable measure of the relative difficulty in filling certain billets.

In addition to location, other job characteristics, such as shore job versus sea job, factor into how hard it is to fill a billet. Another characteristic affecting the difficulty of filling billets is whether the job is career enhancing to the sailor. If sailors find it career enhancing to work in jobs that require them to use their rating-specific skills, we expect that it's harder to fill billets that are out of rating.

# Navy-wide hard-to-fill billets and continuation

We now turn to analyzing whether assignment to Navy-wide hard-to-fill jobs affects retention. We look at hard-to-fill billets principally in terms of location. Because individual preferences vary, we recognize that jobs may be desirable to some sailors and undesirable to others. To the extent, however, that certain assignments are perceived as undesirable, there should be a negative relationship between receiving orders for one of these jobs and continuation.

## Method for ranking locations

Obviously, which locations may be desirable varies across sailors, but, based on conversations with sailors and detailing experts, we believe that, overall, some locations are easier or harder to fill than others. Population density, climate, and other considerations factor into which locations are hard to fill. In addition, any incentives the Navy currently offers to certain locations (e.g., giving sea duty rotational credit for overseas shore duty or shortened tour lengths) affect the overall desirability of a location. To obtain measures of desirability based on the location itself, we restricted the sample to billets without these incentives—CONUS shore duty.

After limiting the sample in this way, we aggregated all CONUS shore duty billets into 18 locations (see table 2). Because we based our ranking on JASS applications data that cover a relatively short time period (October 1999 through March 2000), the data are insufficient to judge the relative desirability of narrowly defined locations.

Using JASS data, we ranked the 18 CONUS locations defined in table 2 by summing the number of applications submitted to each shore job.[3] We then added the number of applications and, separately, the jobs in each geographic location and computed the average number

3. Our criteria were geographic proximity and having sufficient billets so that small sample sizes would not affect our location ranking.

of applications per job in each location. Based on this, we ordered the locations from most to least preferred as shown in figure 2.

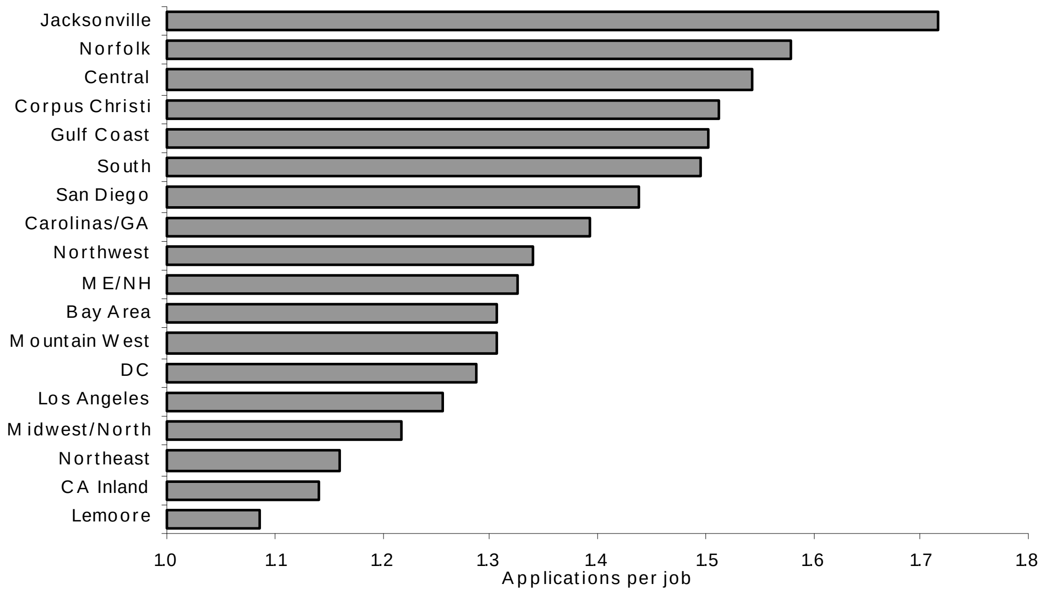
Table 2. Definitions of geographic areas

| Geographic area | Locations in the geographic area |
|---|---|
| Northwest | WA and OR |
| Bay area | San Francisco metropolitan area |
| Los Angeles | Los Angeles metropolitan area, Camp Pendleton, Port Hueneme, Point Mugu, and Santa Barbara |
| San Diego | San Diego metropolitan area |
| Lemoore | Lemoore and Fresno |
| Inland California | Barstow, Bridgeport, China Lake, El Centro, Twentynine Palms, and Victorville |
| Mountain West | AZ, CO, ID, NM, NV, UT, Spokane, and El Paso |
| Corpus Christi | Corpus Christi, Ingleside, and Kingsville |
| Central | KS, NE, OK, and TX (excluding Corpus Christi and El Paso) |
| Midwest/North | IL, IN, MI, MN, MO, OH, WI, PA (excluding Philadelphia), Buffalo, and Rochester |
| South | KY, TN, WV, and VA (excluding DC and Norfolk) |
| Gulf coast | AL, LA, MS, Florida Panhandle, and Tampa |
| Jacksonville | Florida (excluding Panhandle and Tampa) and Kings Bay |
| Carolinas/GA | NC, SC, and GA (excluding Kings Bay) |
| Norfolk | Norfolk metropolitan area |
| DC | Washington, DC, metropolitan area and Patuxent River |
| Northeast | Philadelphia metropolitan area, NJ, NY (excluding Buffalo and Rochester), CT, RI, and MA |
| ME/NH | ME and NH |

We found that the most preferred locations are Jacksonville and Norfolk, whereas the least preferred are Lemoore and inland California. These findings mesh with the homebasing survey from 1996 [2]. The homebasing survey found that Jacksonville / Mayport / Kings Bay, Gulfport / Pascagoula / New Orleans, and Corpus Christi / Ingleside / Kingsville were among the locations sailors preferred. Similarly, it found that Earle, New London / Groton, and Lemoore were among the least preferred locations.[4]

4. In addition, this location rank is similar to what we get when we use percent manning as the measure of location preferences. Specifically, the correlation coefficient between the two location rankings is 0.76.

Figure 2. Applications per job by CONUS location (shore jobs only)




## How strong are sailors' location preferences?

Because we based our definition of location preferences on applications per job, we want to verify that our ranking of locations isn't driven by purely random differences in applications per job across locations. Hence, we need to look at how strong location preferences are. If preferences are strong, we can be confident that location is a consistently important and determining factor in what billets are hard to fill.

To determine whether location matters to sailors, we examined the intensity of location preferences within JASS cycles. We did this by analyzing the CONUS shore jobs in four of our JASS cycles.[5] In each cycle, sailors can submit up to five applications. These might all be to

5. The cycles we used were the first, fourth, seventh, and tenth. We didn't use all cycles because jobs that are not filled are held over to the next JASS cycle. Consequently, to avoid the potential bias that may result from holding over jobs, we only used four cycles.

jobs in different locations or all in the same location. We determined what percentage of total applications we would expect for each of our 18 locations if applications were purely random. Based on this, we calculated the probability that some or all of the applications submitted by a given sailor were to the same location. Then we compared this random probability to the actual percentage of sailors who submitted applications to the same location.

Table 3 shows the percentage of sailors we expect (on a random basis) to submit some or all of their applications to the same location. For example, if location were not a factor when sailors applied for jobs, we would expect that, 84 percent of the time, those who submit five applications in a given cycle would have at least two applications to the same location. The reason this percentage is so high is that a very high percentage of billets are in San Diego, Norfolk, or Jacksonville.

Table 3. Expected percentage (if purely random) of applicants with JASS applications to the same location (within a cycle)

| Number of applications | Number of locations matched (percentage) | | | | |
|---|---|---|---|---|---|
| | None | At least 2 | At least 3 | At least 4 | All |
| 2 | 91 | 9 | | | |
| 3 | 73 | 27 | 1 | | |
| 4 | 48 | 52 | 5 | 0 | |
| 5 | 16 | 84 | 11 | 1 | 0 |

Given the purely random case as a comparison, we show in table 4 the actual percentage of sailors who submitted applications to the same location. For sailors who submit five applications, we observe that 97 percent of applicants applied to at least two billets in the same location as compared to the expected 84 percent. Particularly striking is the percentage of applicants who submit all of their applications to the same location. Forty-two percent of sailors submitting five applications, for example, submitted all five applications to the same location. This is substantially different from the expectation that less than 1 percent of sailors would submit all of the applications to the same location if it were purely random. Overall, the actual and expected percentages are statistically different (using a chi-square test). Given that location preferences are strong, we are confident that location is a critical determinant in whether a billet is hard to fill.

Table 4. Actual percentage of applicants with JASS applications to the same location (within a cycle)

| Number of applications | Number of locations matched (percentage) | | | | |
|---|---|---|---|---|---|
| | None | At least 2 | At least 3 | At least 4 | All |
| 2 | 40 | 60 | | | |
| 3 | 21 | 79 | 49 | | |
| 4 | 16 | 84 | 58 | 41 | |
| 5 | 3 | 97 | 74 | 54 | 42 |

# Impact of location on continuation

## Statistical methods

We use a probit regression model to estimate the effect of location on continuation where location preferences are measured by applications per job. A probit model uses a dichotomous dependent variable and estimates the probability of an event occurring (such as remaining in the Navy). Because we believe that the continuation behavior of careerists and first-term sailors is systematically different, we perform separate analyses for each group. Our sample includes all sailors receiving orders whose PRDs were such that they could have participated in JASS during the data window (October 1999 through March 2000). In both samples, we exclude the following:

- Training and Administration of Reserves (TARs) and Temporary Active Reserves (TEMACs)
- Those in accounting codes 380 through 393 (pending separation, discharge, release, retirement, or administrative board review; disciplinary status; or confinement)
- Those whose initial enlistment was before age 17 or after age 35
- Those with 20 or more years of service
- Those with less than 3 or more than 10 months until PRD.

We wish to point out that there are factors that we cannot control for in our model. For example, sailors are sometimes promised that, if they take a certain billet now, their next assignment will be a preferred one. This assignment incentive will bias downward any effect on continuation that we find from being ordered to a hard-to-fill billet. In other words, our measured impact on continuation will be lower than the actual effect.

Another factor that may influence our results is that higher quality sailors are likely given the best, or most preferred billets. We believe we can control for sailor quality adequately, but, to the degree we cannot do so perfectly, the preferred locations will reflect, in part, the higher continuation behavior of the high-quality sailors. The measured effect of hard-to-fill locations on continuation would then be overstated.

## Continuation and control variables

The measure of continuation that we used is continuation in the Navy through 10 months after the sailor's PRD.[6]

Obviously, many factors affect continuation other than a location preference. We have controlled for those other determinants by including the following variables in this and all our subsequent estimations (unless otherwise noted):

- *At EAOS:* This variable indicates whether the sailor faced a reenlistment decision by 10 months after PRD. All else constant, sailors who are not at EAOS must have Navy approval to leave and should, consequently, have more difficulty leaving the Navy than sailors at EAOS.

---

6. We used continuation 10 months after PRD because the most recent source of data available for our analysis was the December 2001 Enlisted Master Record. Sailors with 10 months until PRD in March 2000 (end of the JASS data window) wouldn't reach PRD until January 2001 and, consequently, wouldn't reach 10 months following PRD until November 2001. In addition, we believe this measure adequately captures continuation behavior because the vast majority of those who leave the Navy do so by 10 months after PRD.

- *Pay:* A ratio of civilian to military pay.[7] We include this because the better sailors' outside job opportunities are, the less likely they are to remain in the Navy. Civilian pay is computed as detailed in appendix A. Military pay is estimated as regular military compensation (RMC) by paygrade and years of services as shown in [8].[8]
- *Unemployment rate:* This is a state-level unemployment rate (as reported by the Bureau of Labor Statistics) for the state from which each sailor was accessed. These data control for the relative strength of civilian labor markets, which may be an important factor for sailors considering leaving the Navy.
- *Demographics:* These variables control for gender, marital status, number of children, and race.
- *Sailor quality:* We control for the quality of sailors by whether they are high school diploma graduates, their Armed Forces Qualification Test (AFQT) score, and whether they were promoted to E-5 by 48 months.[9]
- *Billet characteristics:* These variables indicate whether the billet is a CONUS billet or a shore billet, and whether the billet requires sailor screening.

---

7. Even though using a civilian-military pay ratio is a common approach in previous studies [3 through 6], it may not produce the best results for pay elasticities [7]. Reference [7] shows that Annualized-Cost-of-Leaving (ACOL) models produce the best estimates of pay elasticities. However, because ACOL models are costly to develop and because we aren't concerned with estimating pay elasticities, we model the effects of pay on continuation with a civilian-military pay ratio. Note that the coefficients on the other explanatory variables were not different when we changed the pay variable from a pay ratio to a civilian and military pay difference.

8. We don't include SRBs as part of military compensation because our dependent variable is continuation, not reenlistment. However, because SRBs are driven by ratings, we do effectively proxy for SRBs by controlling for the sailors' ratings and whether they are at EAOS.

9. In some sense, pay is also a control for sailor quality.

- *Rating groups:* We control for other factors associated with the individual ratings by including rating group variables. We have partitioned ratings into 14 different rating groups (see appendix A).

## Results

Table 5 shows the impact of hard-to-fill locations, as measured by applications per job, on continuation.[10] For sailors who received orders to CONUS shore billets, the location desirability had a significant impact on the continuation rate of careerists, but not on first-term sailors.

Table 5. Marginal effect of location preference on continuation

| Group | Average continuation rate | Marginal effect |
|---|---|---|
| First-term sailors | 0.827 | 0 |
| Careerists | 0.938 | 0.031[a] |

a. Zero lies outside the 90-percent confidence interval for the underlying coefficient.

Specifically, we estimate that marginal effect of location preference (as measured by applications per job) on continuation for careerists is 0.031. This means that if location A has an average of one more application per job than location B, the continuation rate will be 3.1 percentage points higher in location A than location B. This is a relatively large effect given that the average continuation rate is 93.8 percent for careerists.

To put this effect in perspective of the most versus least preferred locations, the applications per job in Jacksonville are 1.72 compared to 1.09 in Lemoore for a difference of 0.63 applications per job. Given our marginal effect of 0.031, the continuation rate for sailors going to Jacksonville is about 1.9 percentage points higher than for sailors going to Lemoore.

10. For details of the regression output, see appendix B.

Because the location preference measure probably does not perfectly order the spectrum of locations, we also partitioned the locations more broadly into "good," "mediocre," and "bad" locations. We based the categories again on applications per job and aggregated the distribution of locations into thirds. Consistent with our previous results, we see that the difference in careerists' continuation rates ordered to the "best" versus the "worst" locations (or between the top and bottom thirds) is 1.2 percentage points (see table 6).

Table 6. Predicted continuation of career sailors by location

| Locations | Applications per job | Predicted continuation | Difference from best |
|---|---|---|---|
| **Best:** Jacksonville, Norfolk, Central, Corpus Christi, Gulf Coast, and South | 1.60 | 0.954 | -- |
| **Middle:** San Diego, Carolinas/GA, Northwest, ME/NH, Bay Area, and Mt. West | 1.40 | 0.948 | 0.006 |
| **Worst:** DC, Los Angeles, Midwest/North, Northeast, Inland CA, and Lemoore | 1.21 | 0.942 | 0.012 |

In contrast to the continuation differences we find with careerists, we find no significant impact on continuation for first-term sailors. This result is not unexpected. First-term sailors are still sampling Navy jobs and gaining information as to which are good and bad locations. In addition, sailors early in their careers repeatedly say they want to "see the world." Location may not reflect first-term sailors' assignment preferences well. It does not mean that they don't have assignment preferences or that their preferences don't affect continuation. That is why we investigate the effects of other preference measures.

## Other hard-to-fill factors

Although we believe that location is a principal driver in determining a hard-to-fill billet, it is an imprecise measure. Other factors certainly play a role. An obvious one is whether the billet is a sea or a shore billet. The Navy recognizes this fact as is evident by the additional pay sailors receive for sea duty.

Another factor that potentially makes a billet hard to fill is whether a job is career enhancing. By working in rating, sailors can improve their skills and increase the likelihood of passing advancement tests. Consequently, working in rating should be career enhancing; billets that are unlikely to use a sailor's skills should be harder to fill.

Based on this assumption, we studied the relationship between continuation and working in-rating. To do this, we looked at the relationship between continuation and working in a Required Functional Category (RFC) that is related to a sailor's skills.[11] The difficulty of this approach is the fact that the Enlisted Master Record (EMR) does not track sailors' RFC. To overcome this, we constructed a proxy variable showing the probability that a sailor is working in an RFC that is in-rating. To develop this variable, we classified all billets by RFC and rating for each Unit Identification Code (UIC). Then we simply computed for each rating in each UIC the percentage of billets that had in-rating RFCs.

Using this proxy, we did not find any significant relationship between working in-rating and continuation. It may be that the precision of this variable was insufficient to pick up any correlations because we don't know the sailors' specific RFCs. Previous CNA research [9], which focused on more senior sailors (those in E-5 and E-6 billets), found that working in rating-specific NECs while on shore duty was associated with faster advancement from E-5 to E-6. And, it found that working in rating-specific NECs while on shore duty increased the probability of continuing from 73 months to 109 months by 3.7 percentage points.

11. Earlier CNA research by Arkes and Golding [9] defined sailors working in-skill as those whose Navy Enlisted Classification (NEC) matched the billets' Distribution NEC (DNEC).

# Sailors' assignment preferences and retention

Recognizing that sailors' assignment preferences will differ, we need to examine not only the relationship between continuation and generally accepted hard-to-fill billets but also the relationship between continuation and serving in a billet of *the sailor's choice*. We do this by constructing various measures of individual sailors' preferences and estimating the relationship these measures have with continuation. In addition, we created a indicator of each sailor's desire to homebase to determine the effect of homebasing on continuation. We begin by studying a sailor's billet preferences.

## Preferred billets and continuation

JASS applications contain a direct indicator of sailors' preferences. Sailors rank the applications they submit by preference order (with 1 being most preferred). A ranking of 1, however, doesn't necessarily mean that the billet is their *ideal* or *most* preferred billet given the entire universe of billets. It is, however, their most preferred, and an acceptable one, given their alternatives in that JASS cycle.

In this section, we present information on the preference rankings of sailors selected through JASS and their preference rankings. Then, we discuss some of the problems with the JASS data that we need to account for in our analysis and alternative preference measures we use to alleviate those problems. Finally, we discuss our modeling technique and results.

### JASS selection and preferences

A logical assumption is that more experienced sailors get their first choice more often than less experienced sailors because they are more likely to know which billets are realistic goals. An understanding of what is realistic comes with experience. In table 7, we show by paygrade the percentage of sailors who got their first choice. Notice that those in higher paygrades get their first choice more often than those in lower paygrades. Specifically, E-7s who were selected for billets advertised on JASS received their first choice 87 percent of the time compared with 68 percent for E-3s.

Although we find that more senior sailors tend to get their first choice, we don't find that they are selected through JASS at a higher percentage than junior sailors. As table 7 shows, having a higher paygrade doesn't mean you are more likely to be selected. Specifically, we observe that 57 percent of E-3s who used JASS were selected, whereas 55 percent of E-7s who used JASS were selected.[12]

Table 7. Percentage of sailors selected through JASS who got their first choice and percentage of sailors selected[a]

| Paygrade | Percentage getting first choice | Percentage selected |
|---|---|---|
| E-2 | 61 | 56 |
| E-3 | 68 | 57 |
| E-4 | 71 | 54 |
| E-5 | 76 | 56 |
| E-6 | 82 | 52 |
| E-7 | 87 | 55 |
| E-8 | 96 | 48 |

a. We excluded paygrades E-1 and E-9 because of small sample sizes.

## Problems with the data

When we used JASS applications data to classify locations by most to least preferred, we didn't need to concern ourselves with two potential problems in the data because we used the information in aggregate and not on the individual level. Specifically, our data may not contain all the cycles in which sailors submitted applications. In addition, the sailors who use JASS might not be representative in terms of continuation of those who don't use it. To obtain reliable estimates on the effect of sailors' individual billet preferences on continuation, we must understand the magnitude of these problems and resolve them.

12. When we state they were selected, we simply mean selected through JASS and not the percentage selected in a given cycle.

### Incomplete application data

As stated previously, our data cover 10 JASS cycles. The first of these cycles began on 2 October 1999 and the last ended on 3 March 2000. We were able to count the number of cycles each sailor participated in during this period, but we have no information about sailors' JASS activity outside the data window. Essentially, the data are left censored because we don't know how many cycles each sailor participated in before October 2000. And, the data are right censored for those sailors who were not selected by March 2000 because we do not know how many cycles they participated in after this time or which sailors eventually were selected through JASS.

The data in table 8 show the average number of cycles a sailor participated in and the percentage of sailors selected in their first cycle or subsequent cycle. If left censoring weren't a problem, we would expect that the average number of times sailors participated in JASS or were selected in their first cycle would be similar throughout the data period. However, that is clearly not true for the first cycle in our sample. Based on our data, left censoring appears to be a problem in the first and possibly the second cycles.

Table 8. Average number of cycles participated in and the percentage eventually selected through JASS by JASS cycle

| | | First-time JASS users | | |
|---|---|---|---|---|
| | | Percentage selected in | | |
| Cycle | Average number of times in JASS for those participating in this cycle | Their first cycle | This or future cycles | Percentage-point difference |
| 10/02/99 - 10/22/99 | 1.00 | 30 | 45 | 15 |
| 10/23/99 - 11/05/99 | 1.20 | 50 | 61 | 11 |
| 11/06/99 - 11/19/99 | 1.24 | 54 | 63 | 9 |
| 11/20/99 - 12/03/99 | 1.38 | 55 | 64 | 8 |
| 12/04/99 - 12/23/99 | 1.27 | 2 | 16 | 14 |
| 12/24/99 - 01/07/00 | 1.40 | 51 | 65 | 14 |
| 01/08/00 - 01/21/00 | 1.30 | 50 | 60 | 11 |
| 01/22/00 - 02/04/00 | 1.36 | 52 | 62 | 10 |
| 02/05/00 - 02/18/00 | 1.29 | 53 | 59 | 6 |
| 02/19/00 - 03/03/00 | 1.37 | 49 | 49 | 0 |

Right censoring is a issue for those sailors who weren't selected during our data window. Some were undoubtedly successful in later cycles. To get a feel for the magnitude of this problem, we compared (as shown in table 8) the percentage of sailors who were selected in their first JASS attempt to the percentage of first-time users who were selected in their first or subsequent cycles. In the second cycle for which we have data, for example, 1,093 sailors were in JASS for the first time. Fifty percent of these were selected immediately. An additional 11 percent were selected in subsequent cycles. In the first eight cycles, the percentage of sailors not selected in the first attempt but selected in later cycles ranges between 8 and 15 percent. For the last two cycles, this percentage is 0 and 6 percent. Right censoring appears to be a problem in the last two cycles.

### Do JASS users look like nonusers?

Because one of the principal limitations of JASS is that not all sailors use it, there is the potential for bias—that the results will not reflect the entire enlisted force. Bias may occur if the group that uses JASS is statistically different from the group that doesn't. Our estimate is that 30 percent of sailors used JASS.[13] This is similar to the perception in the Navy that 25 percent of sailors use it.

As a first check for statistical differences between JASS users and nonusers, we see whether the percentage of users who are first-term sailors is statistically different from the nonuser population. It is not. Specifically, 22.6 percent of JASS users are first-term sailors compared to 23.3 percent of nonusers.

We also compare the means of several demographic variables between the JASS and non-JASS groups, as shown in table 9. For first-term sailors, we find statistical differences between the groups in:

- Years of service
- Percentage male
- Percentage married

13. Thirty percent is the percentage of sailors (with 3 to 10 months until PRD who received orders during or close to the period for which we have JASS data) who used JASS.

- Percentage high school educated
- Average AFQT scores.

For careerists, there are significant differences in:

- Years of service
- Percentage male
- Percentage white.

There are no differences for careerists in percentage married. This is important because sailors with special circumstances (who consequently negotiate with their detailers) had been thought to be disproportionately married.[14]

Table 9. Demographic variable means for the JASS and non-JASS groups

| Comparison variables | First-term sailors | | | Careerists | | |
|---|---|---|---|---|---|---|
| | JASS group | Non-JASS group | Diff. | JASS group | Non-JASS group | Diff. |
| Years of service | 2.95 | 3.01 | -0.05[a] | 11.5 | 11.7 | -0.2[b] |
| Percent male | 74.8 | 69.7 | 5.1[b] | 90.3 | 89.2 | 1.2[b] |
| Percent married | 25.4 | 27.6 | -2.2[c] | 73.1 | 73.5 | -0.4 |
| Percent white | 66.1 | 67.5 | -1.4 | 64.6 | 68.0 | -3.5[b] |
| Percent with high school education | 95.9 | 96.7 | -0.8[a] | 95.6 | 95.3 | 0.3 |
| AFQT score | 63.3 | 61.4 | 1.9[b] | 58.0 | 58.5 | -0.5 |

a. The means are statistically different at the 10-percent level.
b. The means are statistically different at the 1-percent level.
c. The means are statistically different at the 5-percent level.

There are obviously many other factors—some of which may be unobservable—that may cause JASS users and nonusers to be statistically different. The method we used to see if there are differences between

14. Although we find statistically significant differences between JASS users and nonusers, the magnitudes are small for some of the variables. Years of service, for example, differ by 0.05 and 0.2 year for first-term sailors and careerists, respectively.

the JASS and non-JASS groups in unobservable characteristics is to perform a probit regression analysis of continuation (continuing versus not continuing in the Navy). In this analysis, we used the same control variables and sample exclusions that we had in the location analysis. In addition, we included a variable indicating whether each sailor participated in JASS to determine whether JASS users are different from nonusers in unobservable ways that affect their continuation behavior. Results of our analysis are shown in table 10.

Table 10. Marginal effect of participating in JASS on continuation

| Group | Continuation rate | Marginal effect |
|---|---|---|
| First-term sailors | 0.868 | 0.034[a] |
| Careerists | 0.945 | 0.026[a] |

a. Zero lies outside the 99-percent confidence interval for the underlying coefficient.

For first-term sailors, the continuation rate for those who participated in JASS was 3.4 percentage points higher than for those who did not. Similarly, the continuation rate for careerists was 2.6 percentage points higher for those participating in JASS. Clearly, there is a substantial difference in continuation behavior between the JASS and non-JASS groups. Given that a difference exists, we have to adopt an estimation strategy to control for the potential bias associated with the differences between the JASS and non-JASS groups. We outline our approach in the next section.

## How do we deal with sample bias?

We have constructed several different measures of billet preferences and data samples to estimate the impact of getting a preferred billet on continuation. We designed all of these preference measures and data samples to alleviate the problems inherent in our JASS data.

### Measures of billet preference

Our first measure of whether sailors receive their preferred billets centers on how long sailors take to find new assignments. The number of JASS cycles that sailors could have participated in before being selected for a billet reveals information about sailors' likely satisfaction with their ultimate assignments. We hypothesize that sailors using JASS one month into the detailing window will be more discriminating about the billet they apply for than those sailors close to PRD. Sailors who are close to receiving orders may apply for billets that are not their ideal rather than take a chance on being ordered into a billet that they see as undesirable. In other words, sailors with shorter time to selection (i.e., the time from when sailors can begin looking for a new assignment until they receive orders for a new assignment) are more likely to have received their preferred billet. Shorter time to selection should then translate into higher continuation.

Because the application data are incomplete for some sailors, our data understate how many JASS cycles some sailors participated in. And, there is always the possibility that sailors searched JASS in one or several cycles but didn't submit an application. To correct for this incomplete information, we used, as our first measure of sailors' preferences for their next assignment, the sailors' *potential* time to selection. This is measured as the number of JASS cycles each sailor could have participated in from the time they were able to go into JASS until they were actually selected for an assignment. Given the pattern of JASS use (see figure 1), we use 10 months until PRD as the time sailors can start using JASS.

The second and third measures of assignment preferences we used take advantage of our knowing the sailors' stated preference rankings (1 to 5) for the job for which each sailor was selected. We haven't used this information in isolation because the strength of preferences is likely to change depending on how close sailors are to the time that orders need to be issued. A preference ranking of 2, for example, may or may not be preferred to a preference ranking of 1 in a subsequent cycle.

To account for this variability, we have combined the number of potential cycles and the preference ranking by creating the following two measures:

1. Time to selection x billet preference ranking—this variable multiples the sailor's potential number of cycles to selection by the preference ranking for the JASS billet the sailor received.

The higher the value, the lower the preference. Hence, a job with a preference ranking of 5 in the first cycle would be less preferred than a job with a ranking of 2 in the second cycle.

2. Ordinal time to selection and billet preference ranking—this variable is computed as *preference ranking* + (*number of cycles* - 1) x 5. This construct means that jobs applied for in the current cycle are always preferred to jobs applied for in subsequent cycles. The higher the value, the lower the billet preference.

**Samples**

Table 11 summarizes the data samples and preference measures we used. The first sample simply consists of all sailors receiving orders (both JASS users and nonusers) between October 1999 and March 2000 (the JASS data window). By using this sample, we remove the possibility that the results are being driven by population differences between JASS users and nonusers.

Table 11. Combination of preference variables and samples used

| Preference variable | Sample |
|---|---|
| Time to selection (potential number of JASS cycles to selection) | Sailors with orders |
| Time to selection (potential number of JASS cycles to selection) | JASS selectees |
| Time to selection x billet preference ranking | JASS selectees |
| Ordinal time preference x billet preference ranking | JASS selectees |

The second sample consists of all sailors selected through JASS. This sample allows us examine specifically the behavior of those who used JASS and were selected through it. Comparing the impact of the time to selection on continuation from both of these samples allows us to estimate an upper bound on any bias that results from using only the sample of JASS selectees.

We also use the sample of those selected through JASS for the preference ranking variables. We don't include JASS users who weren't selected because we have no information about how they value the jobs for which they finally received orders. Just because a sailor isn't selected through JASS doesn't mean that he or she didn't get a good job match, but we have no way of telling if the job was a preferred one.

## Continuation effects of receiving preferred billet

As with the previous analyses, we use a probit regression model to estimate the effect of job preferences or the quality of job match on continuation. The continuation measure, control variables, and sample exclusions are the same as we previously made. Again, we performed separate analyses for careerists and first-term sailors.

Table 12 reports the impact of the preference measures on the continuation rate. Appendix C shows the effect of the other variables on continuation.[15] Overall, we find that receiving a preferred billet does increase continuation for both first-term sailors and careerists. When using the sample of all sailors with orders, we estimate that, if time to selection is 2 weeks longer (1 additional JASS cycle), the continuation rate falls by 0.35 percentage point for first-term sailors. For careerists, there is a 0.14-percentage-point reduction in continuation if time to selection is 2 weeks longer.

Table 12. Marginal effect of preference variables on continuation

| | | First-term sailors | | Careerists | |
|---|---|---|---|---|---|
| Preference variable | Sample | Continuation rate | Marginal effect | Continuation rate | Marginal effect |
| Time to selection | Sailors with orders | 0.860 | -0.0035[a] | 0.942 | -0.0014[a] |
| Time to selection | JASS selectees | 0.926 | -0.0053[a] | 0.971 | -0.0021[b] |
| Time to selection x billet preference ranking | JASS selectees | 0.926 | 0 | 0.971 | -0.0008[b] |
| Ordinal time to selection and preference ranking | JASS selectees | 0.926 | -0.0010[a] | 0.971 | -0.0004[b] |

a. Zero lies outside the 95-percent confidence interval for this coefficient.
b. Zero lies outside the 99-percent confidence interval for this coefficient.

15. One of our control variables is whether a sailor is at EAOS. Because it is easier to leave the Navy at EAOS, continuation is less for the group at EAOS than for those who are not. We note, however, that sailors at EAOS may have some bargaining power to get their preferred billet. This bargaining power effect may bias toward zero the impact of the potential number of cycles on continuation.

Another way to interpret our results is to think about the difference between sailors selected 9 months before PRD versus those selected 6 months from PRD. We believe that those sailors who are selected early in their detailing window are likely to get a job that they prefer. Similarly, those who aren't selected until 6 months before their PRD are less likely to get a billet they prefer because orders are supposed to be issued by this juncture. In other words, they might take almost any billet so that they are not "slammed" into an assignment. Comparing first-term sailors selected at 9 months versus 6 months, the continuation rate of those selected early is 2.1 (0.35 x 6) percentage points higher. For careerists, the continuation rate difference would be 0.84 (0.14 x 6) percentage point. These differences should approximate the continuation impact of being involuntarily assigned.[16]

The lower effect for careerists is understandable for two reasons. First, careerist continuation rates are much higher—94 percent versus 86 percent for first-term sailors. With continuation rates for careerists so high, it would be difficult to believe that any one factor could explain much more of why senior sailors leave. Second, it may be the case that the detailing system works somewhat differently for more experienced sailors. They know the system and billet options and may be more able to work with their detailer until closer to PRD to get a preferred billet.

Restricting the sample to JASS selectees, we find that time to selection has a larger effect on continuation than when we use the sample of all sailors with orders—decreasing it 0.53 and 0.21 percentage points for each additional of JASS cycle for first-term sailors and careerists, respectively. Comparing sailors selected at 9 months and 6 months before PRD, first-term sailors and careerists experience higher continuation (3.2 and 1.3 percentage points, respectively). Note that these estimates are about 50 percent (0.0053/0.0035 or 0.0021/0.0014) higher when we restrict the sample (JASS selectees) than when we use all sailors receiving orders. This difference may result from the bias between the sample of JASS selectees and the sample of

16. These estimates will understate the continuation effect of being involuntary assigned because the sailors may or may not have been slammed into a billet.

all sailors receiving orders. However, the difference in rates may also reflect, in part, the fact that sailors who use detailers are getting slammed into billets throughout their detailing window.

When we incorporate sailors' stated billet preference rankings into the time-to-selection measure, we find that the estimated effects on continuation are smaller. This is largely a function of the preference ranking measures being on a finer scale than the time-to-selection measure. For example, increasing the time to selection by 1 is equivalent to increasing the ordinal time to selection and preference rankings measure by 5. Thus, the marginal effect on continuation for first-term sailors of the ordinal measure given a 5-unit increase is 0.0050 (0.0010 x 5). This is essentially the same effect on continuation as the time-to-selection measure (0.0053).[17] This result implies that stated preference ordering within a sample doesn't have much impact on continuation; time to selection drives the effect on continuation.

## Homebasing and continuation

Some sailors prefer to avoid frequent moves. To the extent that the Navy can accommodate these sailors by allowing them to serve consecutive tours in one geographic area (i.e., homebasing), it should increase continuation. Previous CNA research [10] looked into opportunities for homebasing and found that, in general, length of stay in a geographic area increased with paygrade and varied by gender, family composition, occupation, and location.

### Measuring the desire to homebase

To determine the impact of the desire to homebase on continuation, we rely on the information revealed about sailors' preferences through JASS. We limit our analysis to those sailors selected through JASS. Those who used JASS but were not selected through it also revealed information about their job preferences; however, we don't know their preference for the job for which they received orders.

---

17. The same 5 to 1 relationship between these two preference variables holds for careerists.

We created a homebasing variable equaling 1 if the sailor's new job is in the same geographic location as his/her old job; otherwise, the variable equals 0. We believe this variable is a reasonable representation of whether sailors have tastes for homebasing because all JASS selectees got jobs they found acceptable enough to have applied for.

If the coefficient on the homebasing variable is positive, we interpret it as homebasing having a positive effect on continuation. But if sailors who took jobs elsewhere (different locations) got the jobs they wanted, why would they have lower continuation than those who stayed in the same location? The answer depends on the relative strength of preferences for or against homebasing.

To understand what our homebasing variable may measure, consider the three hypothetical types of sailors shown in table 13. If sailors who *prefer to homebase* stay in the same location, their continuation rate is 95 percent compared to 90 percent when they go elsewhere. Those who are *indifferent to homebasing* don't care whether they stay in the same location. Their continuation is 95 percent regardless of staying or leaving. The third type, sailors who are *averse to homebasing*, prefer to move rather than remain in the same location. These sailors might be the type who want to "see the world" or they might simply be unsatisfied with their current location, so staying in the same location is less preferred. Their continuation rate is higher if they move (95 percent) than if they stay (90 percent).

Table 13. Hypothetical continuation rates by homebasing preference

| | Hypothetical continuation rate if: | |
|---|---|---|
| Homebasing preference | Stay in same location | Go to a different location |
| Prefer to homebase | 95% | 90% |
| Indifferent to homebasing | 95% | 95% |
| Averse to homebasing | 90% | 95% |

Obviously, if the Navy only has sailors who prefer homebasing, our homebasing variable would indicate a positive effect on continuation. Similarly, if the Navy only has sailors who are averse to homebasing, our homebasing variable would indicate a negative effect on continuation.

If the Navy is equally composed of those who prefer and are averse to homebasing, our homebasing variable won't pick up any effect on continuation. Why? Our homebasing variable assumes that those who stay in one location have preferences for homebasing (or at least thought they wanted to stay, or are indifferent to staying or moving), whereas those who move locations don't.[18] In this case, the average continuation rate of those who stay is between 90 and 95 percent, as is the continuation rate of those who leave.

If the Navy is composed of those who prefer homebasing, and those who are indifferent to it, the homebasing variable does pick up a positive effect on continuation. Why? The continuation rate of those who stay is 95 percent compared with 90 to 95 percent for those who leave.[19]

In reality, the Navy has some of each of these three types of sailors. Obviously, many sailors do want to homebase. They are probably married, in school, and/or have children. They are looking for a more stable life. Certainly, some are averse to homebasing. They joined the Navy to "see the world" and are likely young, single, and without children. And, there are some sailors who clearly don't care whether they stay in the same location or move.

## What areas are considered for homebasing?

Given that the Navy has personnel in hundreds of locations throughout the United States and the world, it is necessary to aggregate these locations into a manageable number of geographic areas to consider for homebasing. Specifically, the locations we use for homebasing are the 18 CONUS locations detailed in table 2.

18. Those who move may also be indifferent or may have at least thought they wanted to move.

19. Similarly, if the Navy is composed of those who are either averse to or indifferent to homebasing, the continuation rate of those stay in the same location is between 90 and 95 percent compared with 95 percent for those who leave.

Again, the criteria we used to determine the geographic areas were the number and proximity of billets. The number of billets is important here because homebasing is obviously not possible in a given geographic area if the number of jobs a sailor could serve in is severely limited. Similarly, the importance of job proximity within a geographic area to a homebasing decision is obvious.

Review of the geographic areas listed in table 2 shows that a few, such as the Mountain West area (which comprises cities in eight states), cover a large area. These states were grouped because the number of billets in each is usually small, but the proximity of billets isn't close enough to consider the area a reasonable site for homebasing. Consequently, for us to consider a sailor as homebasing, we further restrict the proximity of the past and future billet to the same state. Although states are still large geographic areas, we realize that in most states, such as the Mountain West states, the Navy has personnel in only one or two cities. Hence, the proximity issue largely goes away.

Even though we believe the proximity issues generally go away in these large states, we conducted our homebasing analysis with and without these states to show that the results aren't affected by including them. Specifically, the samples are: (a) all 18 CONUS locations listed in table 2 and (b) the remaining 14 CONUS locations after excluding Mountain West, Central, Midwest, and South.

## Impact of the desire to homebase on continuation

As with the individual and aggregate preference models, we use a probit regression model to estimate the effect of homebasing on continuation. Specifically, we use the following three variables as measures of homebasing preferences:

1. Same location as previous assignment (1 if true, 0 otherwise)
2. Same location and married (1 if true, 0 otherwise)
3. Same location, married, and children (1 if true, 0 otherwise).

We applied the same controls (including marital status and number of children) and restrictions as in the previous regressions and performed separate analyses for careerists and first-term sailors.

Table 14 presents the impact of homebasing on continuation.[20] The results show that, for those in their initial enlistment, homebasing or serving consecutive tours in one location *reduces* continuation by 3.8 percentage points. This is a logical result for two reasons. First, it's possible that many first-term sailors are unhappy with the location of their first assignment (over which they exercised no control), and they want to move to one of their preferred locations before homebasing. Second, it's possible that sailors in their first enlistment are generally averse to homebasing; they want to "see the world" or at least experience one or two more locations before settling on a single, preferred one. This seems reasonable because first-term sailors are typically younger, single, and without children.[21]

We do not find this negative effect among certain groups of first-term sailors—those who are married and/or have children. For these groups, it seems that the aversion to homebasing is muted.

For careerists overall, we do not find a significant relationship (at conventional significance levels) between homebasing and continuation.[22] Similarly, married career sailors who homebase do not have higher or lower continuation rates than other careerists. We

20. For those interested in looking at the impact of the control variables, appendix D shows the complete regression results.

21. More specifically, the relative strength of preferences may drive the negative homebasing effect for first-term sailors for two reasons. First, if the proportion of sailors who are indifferent to homebasing is relative large among those who stayed in the same location compared with those who moved, homebasing would have a negative continuation effect because the average preference against homebasing would be stronger in the group that moved than in the group that stayed. Second, if preferences against homebasing for those who are averse to it are stronger than the preferences for homebasing for those who prefer it, homebasing would have a negative effect on continuation because one effect dominates the other even if the proportion of sailors who are indifferent to homebasing is the same in the two groups.

22. For careerists, the coefficient on the homebasing variable is 0.010, indicating that homebasing increases continuation by 1.0 percentage point. This estimate, however, is not significant at the 90-percent level, but it is at the 88-percent level.

do find, however, that those careerists with children who homebase have a continuation rate that is 1.4 percentage points higher than other career sailors. Indeed, married sailors with children who homebase also have a continuation rate that is 1.4 percentage points higher than other career sailors. These results are consistent with the belief that sailors with families prefer geographic stability. Relatively fewer career sailors are averse to homebasing.

Table 14. Marginal effect of homebasing on continuation[a]

| Sample and homebasing variable | First-term sailors: Continuation rate | First-term sailors: Marginal effect | Careerists: Continuation rate | Careerists: Marginal effect |
|---|---|---|---|---|
| All 18 CONUS locations | | | | |
| Same location as previous assignment | 0.923 | -0.038[b] | 0.964 | 0 |
| Same location and married | 0.923 | 0 | 0.964 | 0 |
| Same location and children | 0.923 | 0 | 0.964 | 0.014[b] |
| Same location, married, and children | 0.923 | 0 | 0.964 | 0.014[b] |
| CONUS locations (excluding the Mountain West, Central, Midwest, and South regions) | | | | |
| Same location as previous assignment | 0.922 | -0.038[b] | 0.964 | 0 |
| Same location and married | 0.922 | 0 | 0.964 | 0 |
| Same location and children | 0.922 | 0 | 0.964 | 0.015[b] |
| Same location, married, and children | 0.922 | 0 | 0.964 | 0.014[b] |

a. The marginal effect of homebasing on continuation is the percentage-point difference in continuation between not homebasing and homebasing.

b. Zero lies outside the 90-percent confidence interval for the underlying coefficient.

These results imply that assigning sailors who prefer to homebase to billets located elsewhere will entail lower continuation. We would anticipate that reassigning such sailors to hard-to-fill locations elsewhere would be particularly costly in retention.

# Cost of an involuntary assignment system

We've measured substantial effects for billet preferences on sailors' continuation. In this section, we consider the cost implications of the lower continuation for the Navy. Our approach was to count the number of sailors receiving orders to less preferred billets and calculate how many extra reenlistments would be required to offset their lower continuation. From there, we estimated the Selective Reenlistment Bonus (SRB) cost required to generate the additional retention. In this exercise, because our measures do not reflect preferences perfectly, we use two indicators of sailors' receiving less preferred assignments to derive a range of cost estimates.

- The location is hard-to-fill
- The billets were filled within JASS, but just before being involuntarily assigned (i.e., at 6 months before PRD).

## Hard-to-fill locations

In our first cost scenario, we calculate the retention cost of sailors ordered to the least preferred CONUS locations. As shown in table 6, sailors' least preferred areas included Washington, DC, Los Angeles, inland California, Lemoore, and portions of the Midwest and Northeast.[23] In FY01, total full duty *shore* manning in these locations was about 23,850, whereas 3,100 careerists—zone B and zone C sailors—in these locations had PRD changes. To offset the 1.2-percentage-point decrease in their continuation[24] and keep endstrength

23. Our location list is not exhaustive. The criteria we used define and rank locations was geographic proximity and having a sufficient number of billets advertised on JASS. Some less preferred locations may not be included in the analysis. This does not impact our estimated continuation effects; however, it does mean our cost estimates are understated.

24. We did not find a continuation effect for first-term sailors.

constant, the Navy would need to increase careerist reenlistments overall by about 0.15 percentage points.[25] To do so using SRBs would cost about $7.7 million per year.[26] Table 15 summarizes the costs of this scenario as well as the three others that we describe below.

Table 15. Retention cost of the involuntary assignment system

| Cost scenario | SRB cost to alleviate retention effect (in millions of dollars) Initial enlistee | Careerist | Total |
|---|---|---|---|
| 1: Least preferred locations (CONUS shore duty) | 0 | 7.7 | 7.7 |
| 2: Least preferred locations (CONUS shore plus type 3 duty) | 3.6 | 10.7 | 14.3 |
| 3: Involuntary assignment (CONUS shore duty) | 13.6 | 8.2 | 21.8 |
| 4: Involuntary assignment (all duty types) | 24.6 | 14.5 | 39.1 |

Because all overseas shore duty (type 3 duty) receives sea duty credit for rotational purposes as an assignment incentive, we include another cost scenario based on a broader definition of least preferred locations. In cost scenario 2, we calculate the retention cost of sailors being ordered into the existing least preferred CONUS locations plus all type 3 overseas shore duty locations. In FY01, approximately 5,650 sailors with under 14 years of service were stationed in type 3 overseas locations; 45 percent (or 2,500 sailors) had PRD changes. Because all sailors in type 3 duty receive sea duty credit, we assume a negative continuation effect for all these sailors were they to be ordered into these billets without an incentive. SRB costs to offset the continuation effects of the sailors ordered to less preferred shore duty (CONUS and type 3) would total $14.3 million per year.

25. We used a CNA recruiting/retention tradeoff model to calculate the reenlistments required. Reference [11] describes the model in detail.

26. Costs per SRB level were obtained from [11] and [12].

## Involuntary assignment

For cost scenarios 3 and 4, we obtain a lower bound cost estimate for sailors involuntarily assigned. For the purposes of this estimate, we assume that all sailors selected for billets at 6 months are getting assignments they do not prefer to have. We know that is not true. Sailors within JASS are choosing billets; they could do worse if they were involuntarily assigned. However, because these sailors are at the end of their detailing windows, they are accepting whatever is available to avoid being involuntarily assigned. Consequently, the costs we calculate still understate those for sailors involuntarily assigned.

Within JASS, 23 percent of sailors are selected at 6 months or less before PRD. Based on the sailors rotating in FY01, we estimate that approximately 1,950 and 2,950 of first-term sailors and careerists on CONUS shore duty, respectively, are selected at the end of their detailing window. First-term sailors at the end of their window have 3.2 percentage points lower continuation, whereas careerists have a continuation rate 1.3 percentage points lower than sailors selected at 9 months. The Navy would need to increase initial reenlistments by 0.19 percent and careerist reenlistments by 0.15 percent to offset these losses in continuation. The total cost in SRBs would be approximately $21.8 million. Using the same approach but expanding the analysis to cover both sea and shore duty billets, the cost rises to $39.1 million.

## Reconciling the estimates

Based on these cost comparisons, the cost of sailors ordered into less preferred billets is modest to substantial. One of the main determinants of the cost is the magnitude of the continuation effect among first-term sailors. For example, if assignment preferences do not affect first-term sailors' continuation (as our location preference indicator shows), the retention costs to hard-to-fill billets are not large. However, location is not the only characteristic of a billet that matters to sailors. There are many ways to measure billet preferences, none of which will reflect sailors' preferences perfectly. For first-term sailors, location may not enter into an assignment's desirability. That does not mean that first-term sailors do not have assignment preferences or that those preferences do not matter for retention. It is just that the location measure is not an accurate indicator for them. Based on our other measures, assignment preferences do matter to first-term sailors. If we focus on those cost scenarios, it appears that the cost of being assigned a less preferred billet is substantial for the Navy.

We believe that even the higher estimates understate the costs of the involuntary system. To the extent we are not capturing preferences perfectly in our measures and cannot control for the effects of existing assignment incentives, our estimated continuation effects are too low. Consequently, the costs we've estimated should be considered lower bounds.

# Conclusions

Historically, the Navy has relied on a system of involuntary assignments to keep priority billets manned and readiness high. As we have shown, however, this system has unintended consequences. Continuation rates are lower for sailors who serve in hard-to-fill billets and for sailors who do not receive their preferred billets.

What is the retention cost of the involuntary system? We calculated a range in costs based on various preferences measures and duty types. To make up for the decreases in continuation from sailors being assigned to less preferred shore billets, the Navy would need to spend between $8 and $22 million in SRBs. Including the continuation cost of involuntarily assigning sailors to hard-to-fill sea billets, SRBs of up to $39 million would be necessary. These are conservative estimates as our estimates of continuation effects, we believe, are understated.

This is a substantial cost, but we cannot yet say whether moving to a voluntary system of assignments is cost-effective. We don't know how expensive a system that rewards sailors for volunteering for priority duty will be. Theoretically, those who volunteer for duty will have a less than average dislike for the hard-to-fill billets, which would reduce the programmatic costs relative to other alternatives. Ultimately, however, experimentation and analysis will answer the question. We recommend that the Navy conduct experimental research—creating a hypothetical, small-scale distribution system—to determine the willingness of sailors to fill certain billets given additional pay. In addition, the Navy's plan to begin paying Assignment Incentive Pay to sailors accepting selected overseas shore billets over the next year will provide valuable information. From there, the Navy will be able to assess the cost-effectiveness of a more flexible, voluntary assignment system.

# Appendix A: Civilian earnings estimates

To estimate potential civilian earnings, we group personnel into rating groups. The ratings groups we used is similar to [7]. Specifically, these ratings groups are the following:

1. Construction battalion

   — Builder (BU), construction electrician (CE), construction mechanic (CM), constructionman (CN, CU), engineering aid (EA), equipment operator (EO), equipmentman (EQ), steelworker (SW), utilities constructionman (UC), and utilitiesman (UT).

2. Surface engineer

   — Boiler repairer (BR), boiler technician (BT), engineman (EN), gas turbine systems technician (GS, GSE, GSM), and machinist's mate (MM).

3. Hull, mechanical, electrical

   — Damage controlman (DC), electrician's mate (EM), hull maintenance technician (HT), instrumentman (IM), interior communications electrician (IC), machinery repairman (MR), molder (ML), opticalman (OM), pattern maker (PM), and precision instrumentman (PI).

4. Aviation maintenance

   — Aviation antisubmarine warfare technician (AX), aviation avionics technician (AV), aviation electrician's mate (AE), aviation electronics technician (AT), aviation fire control technician (AQ), aviation machinist's mate (AD, ADJ, ADR), aviation maintenance technician (AF), aviation structural mechanic (AM, AME, AMH, AMS), aviation support equipment technician (AS, ASE, ASH, ASM), and training devices man (TD).

5. Aviation operations

   — Aerographer's mate (AG), air traffic controller (AC), aviation antisubmarine warfare operator (AW), aviation boatswain's mate (AB, ABE, ABF, ABH), aviation ordnanceman (AO), and photographer's mate (PH).

6. Aviation supply

   — Aviation maintenance administrationman (AZ), aviation storekeeper (AK), and parachute rigger (PR).

7. Administration

   — Data processing technician (DP), draftsman illustrator (DM), journalist (JO), legalman (LN), lithographer (LI), Master-at-Arms (MA), Navy counselor (NC), personnelman (PN), postal clerk (PC), religious program specialist (RP), and yeoman (YN).

8. Supply

   — Distribution clerk (DK), mess management specialist (MS), ship's serviceman (SH), and storekeeper (SK).

9. Medical

   — Dental technician (DT) and hospital corpsman (HM).

10. Cryptology

    — Cryptologic technician - administration, collection, communications, interpreter/linguist, maintenance, technical (CTA, CTR, CTO, CTI, CTM, CTT) and intelligence specialist (IS).

11. Surface operations combat systems

    — Data systems technician (DS), electronics warfare technician (EW), fire control technician (FC, FTM), gunner's mate (GM, GMG, GMM, GMT), ocean systems technician (OT, OTA, OTM), sonar technician (ST, STG), and weapons technician (WT).

12. Surface operations

    — Electronics technician (ET, ETN, ETR), information systems technician (IT), operations specialist (OS), and radioman (RM).

13. Submarine

    — Fire control technician (FT, FTB, FTG), mineman (MN), missile technician (MT), sonar technician (STS), and torpedoman (TM).

14. General detail

    — Airman (AN), boatswain's mate (BM), fireman (FN), seaman (SN), signalman (SM), and quartermaster (QM).

Given these rating groups and using regression analysis, we predicted civilian earnings using the 1992–2001 March CPS data using occupations appropriate for each rating group. Note that the CPS contains earnings information from the previous year, so the data really contain earnings information from 1991 to 2000.

In these regressions, we controlled for age, gender, race, education, marital status, number of dependents, geographic region, year. We conducted a separate regression for each rating group. From these regressions, we predicted each sailor's potential civilian earnings based on his / his individual characteristics.

# Appendix B: Impact of location preference on continuation

Table 16 presents the results of the probit regression analyis for the impact of location preference (as measured by applications per job) on the continuation rate.

Table 16. Probit results: impact of location preference on continuation (sample: all sailors receiving orders to CONUS, shore billets)

| Variables | First-term sailors | Careerists |
|---|---|---|
| Location preference (applications/job) | -0.1339 | 0.2972[a] |
| Percentage of UIC jobs in-rating | -0.0013 | -0.0001 |
| Months to PRD when orders received | 0.1260[b] | 0.0717[b] |
| Completed EAOS | -0.3463[b] | -0.5115[b] |
| Civilian-military pay ratio | -1.3327[b] | -0.6178[b] |
| Unemployment rate | 0.1626[b] | 0.0493 |
| Male | 0.6761[b] | 0.3295[b] |
| Married | 0.2782[b] | 0.0416 |
| Number of children | -0.0211 | 0.0082 |
| Black | 0.2421 | 0.0555 |
| Other race | -0.0722 | 0.0389 |
| High school education | 0.2834 | 0.1819[a] |
| AFQT score | -0.0033 | -0.0021 |
| Billet requires screening | 0.4163[c] | 0.4034[b] |
| Percentage of shore billets (by location) | 0.0059[b] | 0.0051[b] |
| E-5 by 48 months | | -0.1281[c] |
| Construction battalion | 0.8890[b] | -0.0588 |
| Surface engineer | 0.5307[b] | -0.0176 |
| Hull, mechanical, electrical | 0.7412[b] | -0.0554 |
| Aviation maintenance | 0.7947[b] | 0.1510 |
| Aviation operations | 0.9188[b] | 0.2999[c] |
| Aviation supply | 1.0039[b] | 0.3145[a] |
| Administration | 1.3006[b] | 0.2568[a] |
| Supply | 0.8290[b] | -0.1485 |
| Medical | 1.4089[b] | 0.0178 |
| Cryptology | 1.6422[b] | 0.2365 |
| Surface operations combat systems | 0.8033[b] | 0.2900[a] |
| Surface operations | 0.8334[b] | 0.0102 |
| Submarine | 0.7207[c] | 0.2461 |
| Constant | -0.8022 | 0.5619 |
| Number of observations | 2,007 | 8,400 |
| Sample continuation rate | 0.813 | 0.938 |

a. Zero lies outside the 90-percent confidence interval for this coefficient.
b. Zero lies outside the 99-percent confidence interval for this coefficient.
c. Zero lies outside the 95-percent confidence interval for this coefficient.

# Appendix C: Impact of preference measures on continuation

In this appendix, we present the probit results for the impact on continuation of various individual level preference measures. Table 17 presents the probit results when we use time to selection (the potential number of JASS cycles in which a sailor could have participated before receiving orders) as our preference measure.

Table 17. Probit results: impact of time to selection on continuation (sample: all sailors receiving orders between October 1999 and March 2000)

| Variable | First-term sailors | Careerists |
|---|---|---|
| Time to selection (potential number of JASS cycles) | -0.0167[a] | -0.0134[a] |
| Completed EAOS | -0.2483[b] | -0.4062[b] |
| Civilian-military pay ratio | -0.2038 | -0.2329 |
| Unemployment rate | 0.0393 | 0.0754[b] |
| Male | 0.2185[a] | 0.1367[c] |
| Married | 0.1584 | 0.0288 |
| Number of children | -0.0354 | 0.0174 |
| Black | 0.2104[a] | 0.0986[c] |
| Other race | 0.1788[c] | 0.0878 |
| High school education | 0.0931 | 0.2203[a] |
| AFQT score | -0.0000 | -0.0016 |
| Billet requires screening | 0.5041[b] | 0.2761[b] |
| CONUS | 0.0788 | 0.0624 |
| Shore | -0.2398[b] | 0.0098 |
| E-5 by 48 months | | 0.0633 |
| Constant | 0.9521[b] | 1.4002[b] |
| Number of observations | 2,941 | 10,518 |
| Sample continuation rate | 0.860 | 0.942 |

a. Zero lies outside the 95-percent confidence interval for this coefficient.
b. Zero lies outside the 99-percent confidence interval for this coefficient.
c. Zero lies outside the 90-percent confidence interval for this coefficient.

Like table 17, table 18 presents the probit results when we use as our preferences measure the time to selection. The difference between the two tables is that for table 18 we limited the sample to those sailors selected through JASS, whereas table 17 included all sailors receiving orders during the same time period as the JASS data.

Table 18. Probit results: impact of time to selection on continuation (sample: all sailors seclected through JASS)

| Variable | First-term sailors | Careerists |
|---|---|---|
| Time to selection (potential number of JASS cycles) | -0.0426[a] | -0.0356[b] |
| Completed EAOS | -0.4393[b] | -0.2068[a] |
| Civilian-military pay ratio | -0.3450 | 0.2545 |
| Unemployment rate | -0.0934 | -0.0593 |
| Male | 0.0965 | -0.0124 |
| Married | -0.1372 | 0.0995 |
| Number of children | 0.0931 | 0.0686 |
| Black | 0.3177[c] | 0.3728[b] |
| Other race | 0.0480 | 0.3224[c] |
| High school education | 0.0602 | 0.0381 |
| AFQT score | -0.0018 | -0.0014 |
| Billet requires screening | 0.2800 | -0.0473 |
| CONUS | 0.1235 | -0.0434 |
| Shore | 0.3384[a] | 0.1598[c] |
| E-5 by 48 months | | 0.0980 |
| Constant | 2.2905[b] | 2.0530[b] |
| Number of observations | 1,153 | 3,645 |
| Sample continuation rate | 0.926 | 0.971 |

a. Zero lies outside the 95-percent confidence interval for this coefficient.
b. Zero lies outside the 99-percent confidence interval for this coefficient.
c. Zero lies outside the 90-percent confidence interval for this coefficient.

For the results presented in tables 19 and 20, we limited the sample to those sailors selected through JASS. This was necessary because we use each sailor's preference ranking of the job for which they were selected in conjunction with the time to selection to generate a measure for preferences. These preference measures are as follows:

1. Time to selection x billet preference ranking—this variable simply multiples the number of cycles by the preference ranking.

2. Ordinal time to selection and billet preference ranking—this variable is computed as *preference ranking* + (*number of cycles* - 1) x 5.

Table 19. Probit results: impact of time to selection x preference ranking on continuation (sample: all sailors seclected through JASS)

| Variable | First-term sailors | Careerists |
|---|---|---|
| Time to selection x preference ranking | -0.0034 | -0.0127[a] |
| Completed EAOS | -0.4301[a] | -0.1969[b] |
| Civilian-military pay ratio | -0.3162 | 0.2834 |
| Unemployment rate | -0.0892 | -0.0633 |
| Male | 0.0864 | -0.0032 |
| Married | -0.1596 | 0.1101 |
| Number of children | 0.0852 | 0.0654 |
| Black | 0.3252[c] | 0.3801[a] |
| Other race | 0.0397 | 0.3139 |
| High school education | 0.0253 | 0.0473 |
| AFQT score | -0.0018 | -0.0014 |
| Billet requires screening | 0.2866 | -0.0439 |
| CONUS | 0.1316 | -0.0492 |
| Shore | 0.3894[a] | 0.1671[c] |
| E-5 by 48 months | | 0.1050 |
| Constant | 1.9461[a] | 1.8769[a] |
| Number of observations | 1,153 | 3,645 |
| Sample continuation rate | 0.926 | 0.971 |

a. Zero lies outside the 99-percent confidence interval for this coefficient.
b. Zero lies outside the 95-percent confidence interval for this coefficient.
c. Zero lies outside the 90-percent confidence interval for this coefficient.

Table 20. Probit results: impact of ordinal time to selection and preference ranking on continuation (sample: all sailors seclected through JASS)

| Variable | First-term sailors | Careerists |
|---|---|---|
| Ordinal time to selection and preference ranking | -0.0083[a] | -0.0072[b] |
| Completed EAOS | -0.4400[b] | -0.2072[a] |
| Civilian-military pay ratio | -0.3432 | 0.2575 |
| Unemployment rate | -0.0933 | -0.0595 |
| Male | 0.0955 | -0.0123 |
| Married | -0.1385 | 0.0990 |
| Number of children | 0.0928 | 0.0685 |
| Black | 0.3182[c] | 0.3743[b] |
| Other race | 0.0473 | 0.3223 |
| High school education | 0.0581 | 0.0386 |
| AFQT score | -0.0018 | -0.0014 |
| Billet requires screening | 0.2801 | -0.0470 |
| CONUS | 0.1244 | -0.0431 |
| Shore | 0.3381[a] | 0.1593[c] |
| E-5 by 48 months | | 0.0978 |
| Constant | 2.2505[b] | 2.0294[b] |
| Number of observations | 1,153 | 3,645 |
| Sample continuation rate | 0.926 | 0.971 |

a. Zero lies outside the 95-percent confidence interval for this coefficient.
b. Zero lies outside the 99-percent confidence interval for this coefficient.
c. Zero lies outside the 90-percent confidence interval for this coefficient.

# Appendix D: Impact of homebasing on continuation

Tables 21 and 22 show the probit results for the impact of homebasing on continuation for first-term sailors. These samples are (a) the 18 CONUS locations as listed in table 2 and (b) the 14 CONUS locations after excluding the 4 locations listed as Mountain West, Central, South, and Midwest.

Table 21. Probit results: impact of homebasing on continuation for first-term sailors (sample: all sailors selected through JASS receiving orders for CONUS billets)

| | Homebasing measure | | | |
|---|---|---|---|---|
| Variable | Same location | Same location and married | Same location and children | Same location, married, and children |
| Homebase measure | -0.2825[a] | 0.2069 | -0.0086 | 0.0248 |
| Potential number of JASS cycles | -0.0359[a] | -0.0365[a] | -0.0364[a] | -0.0364[a] |
| Completed EAOS | -0.5506[b] | -0.5367[b] | -0.5420[b] | -0.5414[b] |
| Civilian-military pay ratio | -0.3502 | -0.3515 | -0.3457 | -0.3460 |
| Unemployment rate | -0.0496 | -0.0420 | -0.0445 | -0.0445 |
| Male | -0.0858 | -0.1013 | -0.0897 | -0.0909 |
| Married | -0.1213 | -0.1689 | -0.1298 | -0.1315 |
| Number of children | 0.0185 | -0.0167 | -0.0050 | -0.0095 |
| Black | 0.5322[c] | 0.5168[c] | 0.5171[c] | 0.5169[c] |
| Other race | 0.0362 | 0.0381 | 0.0417 | 0.0415 |
| High school education | 0.1895 | 0.2117 | 0.1983 | 0.1998 |
| AFQT score | -0.0045 | -0.0047 | -0.0047 | -0.0047 |
| Billet requires screening | -0.0778 | -0.0420 | -0.0558 | -0.0544 |
| Shore | 0.4860[b] | 0.4763[b] | 0.4785[b] | 0.4783[b] |
| Constant | 2.3981[b] | 2.3273[b] | 2.3388[b] | 2.3376[b] |
| Number of observations | 855 | 855 | 855 | 855 |
| Sample continuation rate | 0.923 | 0.923 | 0.923 | 0.923 |

a. Zero lies outside the 90-percent confidence interval for this coefficient.
b. Zero lies outside the 99-percent confidence interval for this coefficient.
c. Zero lies outside the 95-percent confidence interval for this coefficient.

Table 22. Probit results: homebasing impact on continuation for first-term sailors (sample: all sailors selected through JASS receiving orders for the 14 CONUS locations)

| | Homebasing measure | | | |
|---|---|---|---|---|
| Variable | Same location | Same location and married | Same location and children | Same location, married, and children |
| Homebase measure | -0.2776[a] | 0.1977 | 0.0019 | 0.0243 |
| Potential number of JASS cycles | -0.0355[a] | -0.0360[a] | -0.0359[a] | -0.0359[a] |
| Completed EAOS | -0.5245[b] | -0.5210[b] | -0.5165[b] | -0.5161[b] |
| Civilian-military pay ratio | -0.3365 | -0.3382 | -0.3327 | -0.3328 |
| Unemployment rate | -0.0437 | -0.0362 | -0.0386 | -0.0386 |
| Male | -0.1387 | -0.1519 | -0.1408 | -0.1419 |
| Married | -0.0826 | -0.1296 | -0.0913 | -0.0929 |
| Number of children | -0.0022 | -0.0358 | -0.0268 | -0.0293 |
| Black | 0.5319[c] | 0.5157[c] | 0.5162[c] | 0.5162[c] |
| Other race | 0.0972 | 0.0972 | 0.1012 | 0.1009 |
| High school education | 0.2111 | 0.2340 | 0.2213 | 0.2224 |
| AFQT score | -0.0046 | -0.0049 | -0.0049 | -0.0049 |
| Billet requires screening | -0.0498 | -0.0174 | -0.0297 | -0.0288 |
| Shore | 0.4936[b] | 0.4838[b] | 0.4859[b] | 0.4858[b] |
| Constant | 2.3560[b] | 2.2847[b] | 2.2947[b] | 2.2945[b] |
| Number of observations | 837 | 837 | 837 | 837 |
| Sample continuation rate | 0.922 | 0.922 | 0.922 | 0.922 |

a. Zero lies outside the 90-percent confidence interval for this coefficient.
b. Zero lies outside the 99-percent confidence interval for this coefficient.
c. Zero lies outside the 95-percent confidence interval for this coefficient.

Tables 23 and 24 show the probit results for the impact of homebasing on continuation for career sailors. These samples are (a) the 18 CONUS locations as listed in table 2 and (b) the 14 CONUS locations after excluding the 4 locations listed as Mountain West, Central, South, and Midwest.

Table 23. Probit results: impact of homebasing on continuation for careerists (sample: all sailors selected through JASS receiving orders for CONUS billets)

| | Homebasing measure | | | |
|---|---|---|---|---|
| Variable | Same location | Same location and married | Same location and children | Same location, married, and children |
| Homebase measure | 0.1549 | 0.1339 | 0.2266[a] | 0.2178[a] |
| Potential number of JASS cycles | -0.0409[b] | -0.0407[b] | -0.0406[b] | -0.0406[b] |
| Completed EAOS | -0.1969[c] | -0.1974[c] | -0.2027[c] | -0.2027[c] |
| Civilian-military pay ratio | 0.0998 | 0.1057 | 0.1086 | 0.1122 |
| Unemployment rate | -0.0788 | -0.0792 | -0.0814 | -0.0806 |
| Male | 0.0698 | 0.0753 | 0.0717 | 0.0712 |
| Married | 0.1162 | 0.0833 | 0.1102 | 0.0930 |
| Number of children | 0.0517 | 0.0513 | 0.0302 | 0.0346 |
| Black | 0.3474[b] | 0.3507[b] | 0.3534[b] | 0.3548[b] |
| Other race | 0.3964[a] | 0.3934[a] | 0.3969[a] | 0.3951[a] |
| High school education | 0.1065 | 0.0995 | 0.0980 | 0.0950 |
| AFQT score | -0.0023 | -0.0023 | -0.0025 | -0.0024 |
| Billet requires screening | 0.0978 | 0.0963 | 0.0999 | 0.0974 |
| Shore | 0.1725[a] | 0.1716[a] | 0.1720[a] | 0.1702[a] |
| E-5 by 48 months | -0.0192 | -0.0173 | -0.0136 | -0.0140 |
| Constant | 2.0468[b] | 2.0860[b] | 2.1012[b] | 2.1068[b] |
| Number of observations | 3,137 | 3,137 | 3,137 | 3,137 |
| Sample continuation rate | 0.964 | 0.964 | 0.964 | 0.964 |

a. Zero lies outside the 90-percent confidence interval for this coefficient.
b. Zero lies outside the 99-percent confidence interval for this coefficient.
c. Zero lies outside the 95-percent confidence interval for this coefficient.

Table 24. Probit results: homebasing impact on continuation for careerists (sample: all sailors selected through JASS receiving orders for the 14 CONUS locations)

| Variable | Homebasing measure: Same location | Same location and married | Same location and children | Same location, married, and children |
|---|---|---|---|---|
| Homebase measure | 0.1540 | 0.1360 | 0.2346[a] | 0.2268[a] |
| Potential number of JASS cycles | -0.0403[b] | -0.0401[b] | -0.0400[b] | -0.0400[b] |
| Completed EAOS | -0.1902[c] | -0.1907[c] | -0.1966[c] | -0.1966[c] |
| Civilian-military pay ratio | 0.0599 | 0.0645 | 0.0670 | 0.0706 |
| Unemployment rate | -0.0753 | -0.0751 | -0.0774 | -0.0764 |
| Male | 0.1003 | 0.1067 | 0.1034 | 0.1029 |
| Married | 0.1182 | 0.0834 | 0.1111 | 0.0922 |
| Number of children | 0.0435 | 0.0431 | 0.0210 | 0.0256 |
| Black | 0.3331[b] | 0.3360[b] | 0.3390[b] | 0.3404[b] |
| Other race | 0.3817[a] | 0.3788[a] | 0.3828[a] | 0.3809[a] |
| High school education | 0.1229 | 0.1165 | 0.1150 | 0.1118 |
| AFQT score | -0.0019 | -0.0020 | -0.0022 | -0.0021 |
| Billet requires screening | 0.0386 | 0.0386 | 0.0415 | 0.0393 |
| Shore | 0.1754[a] | 0.1755[a] | 0.1752[a] | 0.1736[a] |
| E-5 by 48 months | -0.0365 | -0.0349 | -0.0311 | -0.0316 |
| Constant | 2.0166[b] | 2.0535[c] | 2.0699[b] | 2.0754[b] |
| Number of observations | 3,043 | 3,043 | 3,043 | 3,043 |
| Sample continuation rate | 0.964 | 0.964 | 0.964 | 0.964 |

a. Zero lies outside the 90-percent confidence interval for this coefficient.
b. Zero lies outside the 99-percent confidence interval for this coefficient.
c. Zero lies outside the 95-percent confidence interval for this coefficient.

# References


[1] Laura J. Junor and Jessica S. Oi. *A New Approach to Modeling Ship Readiness*, Apr 1996 (CNA Research Memorandum 95-239)

[2] Gerry Wilcove. *Results from the Navy Homebasing Survey*, 11 Feb 1997 (Navy Personnel Research and Development Center, San Diego, CA)

[3] James R. Hosek and Christine E. Peterson. *Reenlistment Bonuses and Retention Behavior*, Mar 1985 (RAND Report R-3199-ML)

[4] Timothy W. Cooke, Alan J. Marcus, and Aline O. Quester. *Personnel Tempo of Operations and Navy Enlisted Retention*, Feb 1992 (CNA Research Memorandum 91-150)

[5] Martha E. Shiells and Joyce S. McMahon. *Effects of Sea Duty and Advancement on First-Term Retention*, Jun 1993 (CNA Research Memorandum 92-205)

[6] Michael L. Hansen. *Compensation and Enlisted Manning Shortfalls*, Sep 2000 (CNA Research Memorandum D0001998.A2)

[7] Michael L. Hansen and Jennie W. Wenger. *Why Do Pay Elasticity Estimates Differ?* Mar 2002 (CNA Research Memorandum D0005644.A2)

[8] *2000 Uniformed Services Almanac*, 42nd edition

[9] Jeremy A. Arkes and Heidi L.W. Golding with David Gregory. *Outsourcing In-Skill Shore Billets: Potential Manpower Costs*, Jun 1998 (CNA Research Memorandum 98-38)

[10] Peggy A. Golfin, James L. Gasch, and Henry S. Griffis. *Home-steading/Homebasing: A Current Look and Some Ideas for the Future*, Jun 1996 (CNA Annotated Briefing 96-54)

[11] Carol S. Moore, Heidi L. W. Golding, and Henry S. Griffis. *Manpower and Personnel IWAR 2000: Aging the Force*, Jan 2001 (CNA Annotated Briefing D0003079.A2)

[12] Henry S. Griffis, Heidi L. W. Golding, and Carol S. Moore. *Costs and Benefits of Aging the Navy's Enlisted Force*, Oct 1997 (CNA Annotated Briefing 97-14)

# List of tables