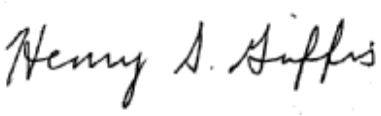
CRM D0013385.A2/Final
April 2006

The Effect of Enlistment and Reenlistment Bonuses on Participation in the Navy Selected Reserve

Diana S. Lien
with
David Gregory • Michael L. Hansen

4825 Mark Center Drive • Alexandria, Virginia 22311-1850

Approved for distribution: April 2006



Henry S. Griffis, Director
Workforce, Education and Training Team
Resource Analysis Division

This document represents the best opinion of CNA at the time of issue.
It does not necessarily represent the opinion of the Department of the Navy.

Contents

Executive summary

Background

In 2005, the Navy implemented a number of changes to the Selected Reserve (SELRES) incentive program, such as increasing bonuses significantly and instituting a tiered eligibility system. Reserve community managers, however, have few tools with which to measure the effect of these changes on SELRES participation. Consequently, the Navy is developing a decision support tool to assist in more effectively managing these communities. As part of this effort, the Navy asked CNA to measure the responsiveness of SELRES members to bonuses; this research memorandum summarizes the results of that analysis.

Approach

We use monthly data from October 1999 through March 2005 to estimate the effect of SELRES bonuses on reenlistment and continuation behavior. In addition to the retention decisions of SELRES participants, these data also provide us with information about economic conditions and the characteristics of reservists at the time they make these decisions. This additional information allows us to separate the effect of bonuses on retention from other factors that might contribute to the retention decision.

The changes to the SELRES incentive program after March 2005 are substantial. In contrast, empirical estimates based on historical data are most reliable for predicting a behavioral response to *marginal* changes in incentives. Therefore, while this research memorandum presents our best estimate of the effect of bonuses on retention (based on the pre-March 2005 data), further analysis will be necessary a year or two from now to assess the dramatic changes in financial incentives that began to take effect in March 2005.

Findings and implications

Reenlistment bonuses can be used to increase reenlistment and encourage longer obligations.

At the end of an existing obligation, a Sailor can leave the Selected Reserve, extend his or her existing contract, or sign a reenlistment contract. We find that bonuses increase the likelihood of reenlistment, through both a decrease in the probability of extension and a decrease in the probability of leaving. In addition, bonuses increase the likelihood that one will sign a longer reenlistment contract.

Enlistment bonuses discourage attrition from the Selected Reserve.

SELRES accessions, both with and without prior service, have higher continuation rates if they are offered a bonus upon enlistment. For prior-service accessions with 3-year enlistment contracts, those who received bonuses are 17 (36) percent less likely to attrite within the first 12 (24) months of their obligation. For prior-service accessions with 6-year enlistment contracts, attrition is 22 (33) percent lower.

Only a very small number of non-prior-service accessions received bonuses during the period examined; nevertheless, the data suggest that they are also responsive to these incentives. However, if the Navy were to drastically increase the number that receive bonuses, it is possible that the effect of financial incentives will be smaller than what we have estimated.

There is no indication that increasing the number of non-prior-service accessions will significantly decrease manning.

Reductions in active-duty endstrength and increases in active-duty reenlistments have reduced the number of qualified Sailors with prior service. If requirements in the Selected Reserve are unchanged, it is likely that the Navy will have to recruit more people without prior active-duty service. We find that the continuation rates of non-prior-service accessions are similar to those with prior service. This suggests that increasing the number of non-prior-service accessions will not significantly decrease SELRES manning.

If the Navy is considering lump-sum bonus payments, a pilot program should focus on reenlistment bonuses.

Lump-sum bonuses are thought to be more cost-effective than bonuses paid in installments since people have a preference for immediate over deferred compensation. The main disadvantage of lump-sum bonuses is the potential for reneging on one's contract. However, we find that reservists who reenlist have similar continuation rates once they sign the reenlistment contract, regardless of whether they received a bonus. Furthermore, these reservists have higher continuation rates than new enlistments. Both these results suggest that lump-sum payments are a better option for reenlistment contracts. Consequently, if lump-sum bonus payments are being considered by the Navy, we recommend that a pilot program should focus on reenlistment bonuses.

Introduction

In 2005, the Navy implemented a number of changes to the Selected Reserve (SELRES) incentive program, including increasing bonus amounts in accordance with the 2005 National Defense Authorization Act (NDAA) and implementing a tiered eligibility system to match manning needs. In the past, community managers had few reliable forecasting tools to measure the effect of changes in bonuses on manning. Thus, the likely effects of recent changes to the incentive program on reenlistment and continuation behavior are not known. To address these issues, N1 asked the SAG Corporation to develop a decision support tool to assist community managers, Navy Reserve Forces Command (NRFC), and Navy Recruiting Command with monitoring the incentive program, determining bonus eligibility, and forecasting the effect of bonuses. To assist in this tasking, N1 asked The CNA Corporation to estimate the initial parameters for the SAG Corporation decision support tool.

Merging data provided by NRFC and the Defense Manpower Data Center (DMDC), we estimate the effect of bonuses on reenlistment and continuation behavior. These estimates will help the Navy determine the most efficient allocation of Navy Selected Reserve bonuses. This paper documents how we estimated those parameters, documents our findings, and presents a brief discussion of policy implications based on our findings.

The outline of the paper is as follows: we first describe the Navy Selected Reserve incentive program and discuss the findings of past research. We then turn to a discussion of the data and methodology used to estimate how bonuses affect retention.[1] Finally, we present

1. In this memorandum, we focus on the Selected Reserve incentive program. Individual Ready Reserve members in a few critical ratings are eligible for bonuses, but bonus data for that population were unavailable for analysis.

some of our main reenlistment and continuation findings and conclude with a section on relevant policy implications. The appendix contains full variable definitions, descriptive statistics, and results.

The Enlisted Reserve Incentive Program

Background on the Navy Reserve[2]

Members of the Ready Reserve and Standby Reserve (Active) are considered to be in active status, which allows them to drill and to serve on active duty. All original appointments and enlistments into the Reserve are assigned to the Ready Reserve, which includes the Selected Reserve and Individual Ready Reserve. Eighty percent of all reservists are in the Ready Reserve (see table 1); currently, reservists must be in the Ready Reserve to be eligible for bonuses. Reserve incentives exist for the Individual Ready Reserve, but we do not have bonus data for that group.

Table 1. Navy Reserve enlisted force, March 2005[a]

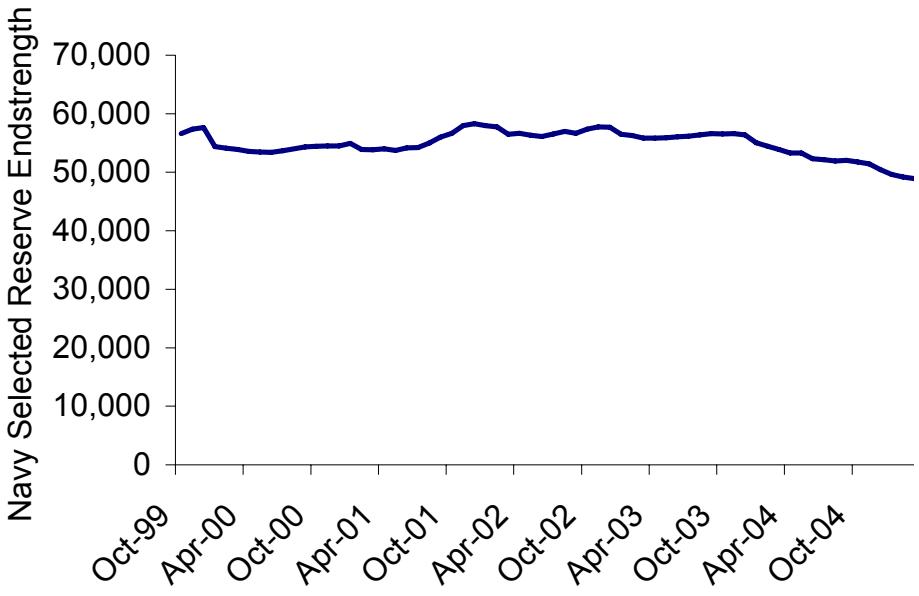
Reserve category	Size
Selected Reserve	48,939
Individual Ready Reserve	50,955
Retired Reserve	23,725
Standby Reserve (Active and Inactive)	100
Total Enlisted Reserve	123,719

a. Excluding Training and Administration of Reserves (TARs).

Figure 1 shows the size of the Selected Reserve from October 1999 through March 2005. It peaked in December of 2001 at 58,300. Since then, there has been a gradual decrease in size to 56,346 in December 2003—a 13-percent drop.

2. See Carey et al. [1] for a more in-depth summary of the background, categories, and size of the Navy Reserve. For official definitions of Navy Reserve categories, see COMNAVRESFOR INSTRUCTION 1001.51 and BUPERSINST 1001.39D.

Figure 1. Size of the Navy Selected Reserve[a]



a. Compiled from DMDC data.

Entrants into the Navy Ready Reserve include Navy servicemembers whose initial military obligation has not expired, Navy Veterans, Other Service Veterans, and non-prior-service accessions.

Navy Reserve affiliations

When entering the Navy, enlisted personnel sign either an active or reserve contract for a minimal length of obligated military service. Active-duty enlistment contracts designate a minimum active-duty obligation, with any portion of the military obligation not spent in active duty to be served in the Ready Reserve

Time spent in the delayed entry program (DEP) counts toward a military service obligation (MSO). Each month spent in DEP reduces the number of obligated months of service following DEP, the expected obligation to the Reserves, and the amount of any reserve accession bonus. Thus, any increases in the average amount of time spent in DEP will reduce obligated months of service in the Ready Reserve.

Non-prior-service accessions

Non-prior-service accessions incur an 8-year MSO. In general, non-prior-service accessions must participate in a minimum of 84 days of initial active-duty training (IADT) to be eligible for mobilization. The 84 days of IADT may consist of a 2-week bootcamp, training courses through the reserve center, and "A" school. Reservists without extended periods of time available to train may spend 2 or more years completing the obligated 84 days of training. In contrast, an accession with prior military service will have shorter initial training requirements and be eligible to mobilize sooner.

Non-prior-service accessions are currently recruited for the following three critical occupational communities: Seabees, Medical, and Supply. In March 2005, Medical Corpsmen, Seabees, and members of the supply community accounted for 9, 16, and 14.5 percent, respectively, of the Navy Selected Reserve.[3] For critical occupations, the Navy Reserves bring in non-prior-service civilians with related skills and retrain them. For example, a non-prior-service nurse would be trained as a Hospital Corpsman (HM).

Navy Reserve Incentive Program[4]

We have bonus eligibility and participation data only from October 1999 through March 2005. In this section, we discuss the bonus program during this period.

The Navy Selected Reserve bonus system changed little from October 1999 to March 2005. The Navy Reserve Forces Command (NRFC) managed incentive bonuses; that is, it determined bonus eligibility for the Enlisted Selected Reserve entrant and continuation bonuses. Bonus eligibility differed by rating and NEC and changed every 3 to

3. This excludes the TAR community. The Seabee classification includes BU, CE, CM, CN, EA, EO, SW, and UTs. The supply community classification includes CS, DK, PC, SH, and SK. We include the DT and HM ratings in the medical community.

4. This section draws heavily on correspondence with Paul Dowd, NRFC Director, Education and Incentive Programs.

6 months. During this period, all members in ratings and NECs eligible for the same bonus type received the same bonus amount. Since March 2005, the Navy Reserve bonus system has seen a number of changes. In accordance with the 2005 NDAA, the maximum allowable reserve bonus amounts were increased. In addition, the Navy implemented a three-tier bonus amount system for determining bonus levels across reserve ratings and NECs.

Table 2 lists, by incentive bonus type, the bonus amount and payment scheme offered to eligible enlisted members of the Selected Reserve from October 1999 through March 2005. A servicemember with an MSO of 18 or fewer months will receive any affiliation bonus in a lump-sum payment. All other bonuses are paid half up front and the rest in annual installments over the length of the contract.

Table 2. Navy Selected Reserve bonuses, October 1999 to February 2005

Bonus type	Contract length	Total amount	Payment plan
Affiliation	18 months or fewer[a]	$50/month of remaining MSO	Lump-sum payment
	More than 18 months[b]	$50/month of remaining MSO	Half upon affiliation, the remainder in one anniversary payment
Prior-service enlistment	3 years [c]	$2,500	Half up front and 3 anniversary payments
	6 years	$5,000	Half up front and 6 anniversary payments
Non-prior-service enlistment	6 years	$5,000	Half up front and 6 anniversary payments
Reenlistment/extension	3 years (first)[d]	$2,500	Half up front and 3 anniversary payments
	6 years	$5,000	Half up front and 6 anniversary payments

a. 18 or fewer months remaining on initial military service obligation (MSO).
b. More than 18 months remaining on initial MSO.
c. Once the 3-year enlistment period is up, the member is eligible to reenlist and get a $2,000 reenlistment bonus.
d. Bonus recipients of a 3-year reenlistment/extension bonus may receive an additional $2,000 for reenlisting for a second 3-year contract following the completion of the first reenlistment contract.

Bonus recipients are required to read and sign a written agreement before receiving a bonus. The contract is in addition to obligation contracts and states that the bonus recipient will maintain service in the Selected Reserve. Bonus recipients continue to receive a bonus as long as they maintain drilling status:

- In a bonus-eligible rating or NEC
- For the entire bonus period with less than 12 months spent in the Individual Ready Reserve (IRR)
- For at least 12 months before switching to officer status.

If these conditions aren't met, a portion of the bonus is recouped based on the amount of SELRES service. For bonuses paid in installments, the amount given back depends on how much of the bonus was paid out and proportional to the amount of service performed.

During the same time period, eligibility for all incentive bonuses was determined by the NRFC program manager of the Education and Incentive Program. Figure 2 is a general representation of how bonus eligibility was determined. Bonus determination was not based on any consistent manning metric; that is, bonus eligibility was not allocated either to maintain a certain manning threshold or in response to any predetermined manning level change. However, the NRFC program manager did base eligibility on retention manning information collected from NRFC recruiting, Navy Reserve command data, and the community managers.

Number of bonus from October 1999 through March 2005

From October 1999 through March 2005, 8,830 enlisted members received bonuses (see table 3). The majority of bonuses received are for prior service, either in the Navy or another Service, and for reenlisting, most of which are for 6-year contracts. The highest share of new contracts with bonuses were affiliation and prior-service enlistment contracts.

During this period, a significant number of bonuses—3,395—began in FY01, and the share of new contracts with bonuses was higher in 2001 than in other years examined. Figures 3 and 4 show the number

Figure 2. Bonus eligibility determination, October 1999 through March 2005

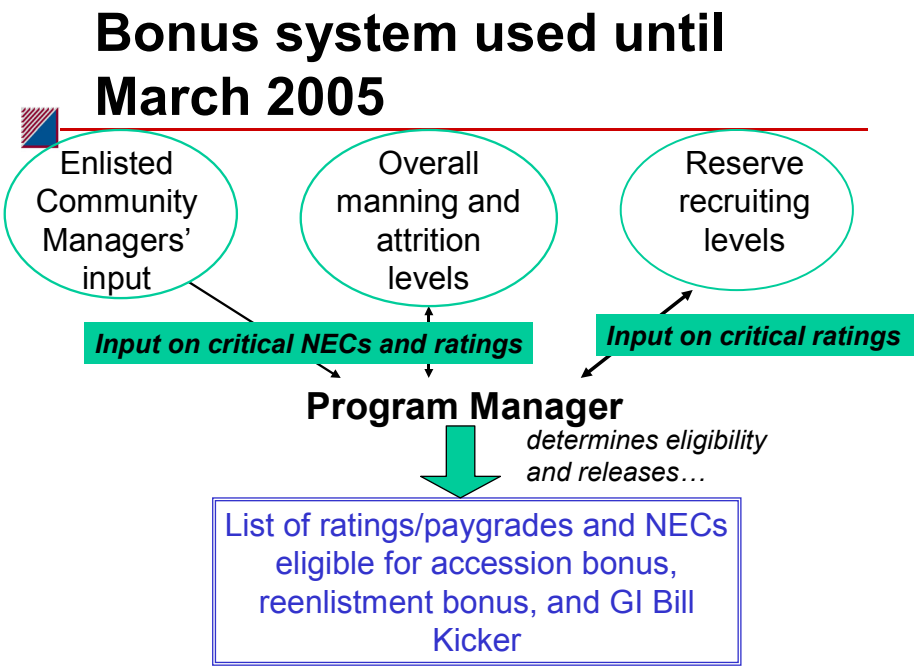
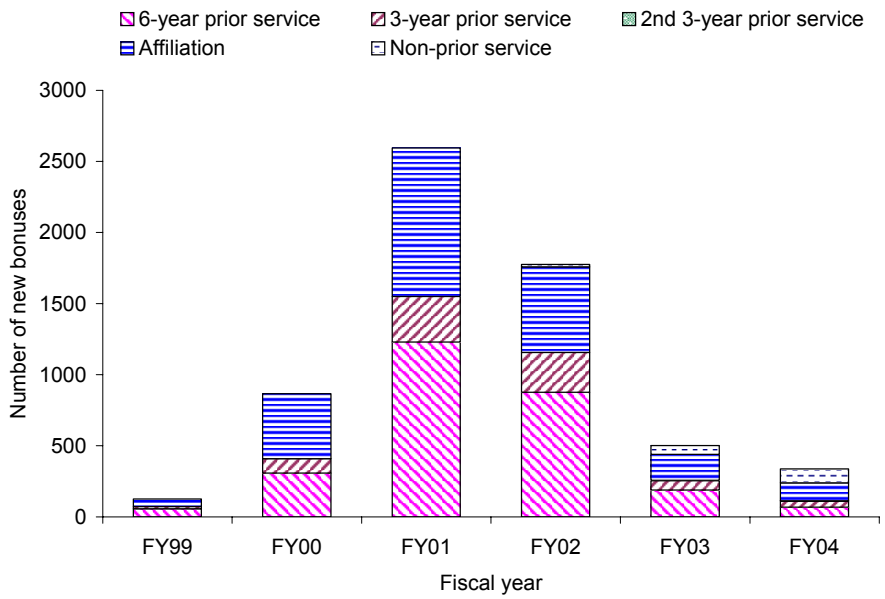


Table 3. Type and number of new Navy Enlisted Reserve contracts, October 1999 through March 2005

Contract type	Number of new contracts[a]	Number of new contracts with a bonus[b]	Share of new contracts with a bonus
Affiliation	14,068	2,453	17%
Non-prior-service enlistment	20,414	178	1%
Prior-service enlist-ment	20,278	3,510	17%
Reenlistment	18,222	2,683	15%

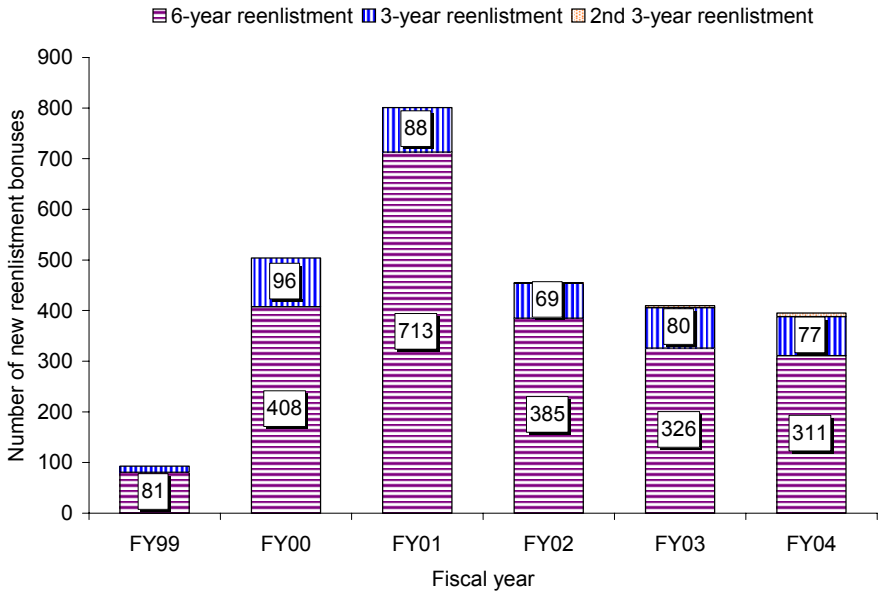
a. Compiled from DMDC data. For the non-prior-service, prior service, and reenlistment contracts, we include only new contracts that are at least 3 years in length.
b. Based on NRFC bonus eligibility data provided by Mr. Paul Dowd, June 2005. During this period, there were 6 contracts labeled as "unknown," which are not included in this table.

Figure 3. New entrant bonuses paid during FY99-04 (by type)[a]



a. Compiled from NRFC bonus eligibility data provided by Mr. Paul Dowd, June 2005.

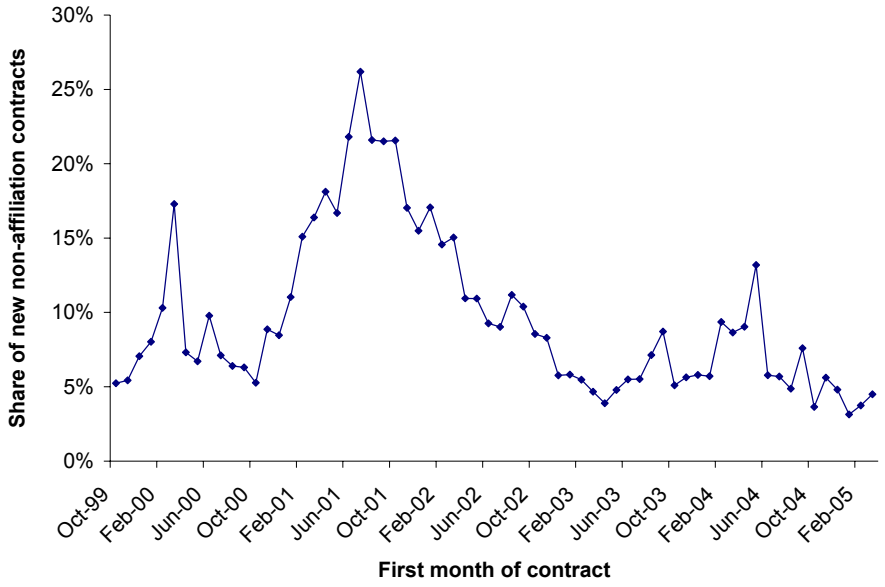
Figure 4. Reenlistment bonuses paid in FY99-FY04 (by type)[a]



a. Compiled from NRFC bonus eligibility data provided by Mr. Paul Dowd, June 2005.

of entrant and reenlistment bonuses paid, respectively, for FY99 through FY04. The number of enlistment and reenlistment bonuses was higher in 2001 than in any other year examined. A similar pattern is reflected in the share of new contracts with bonuses. Figure 5 shows the share of new contracts, excluding affiliation contracts, that included a bonus over this period.[5] Of new contracts that began in July 2001, 26 percent included a bonus compared with 7 percent of contracts in July 2000.

Figure 5. Share of new contracts, excluding affiliation contracts, that had a bonus attached.[a]



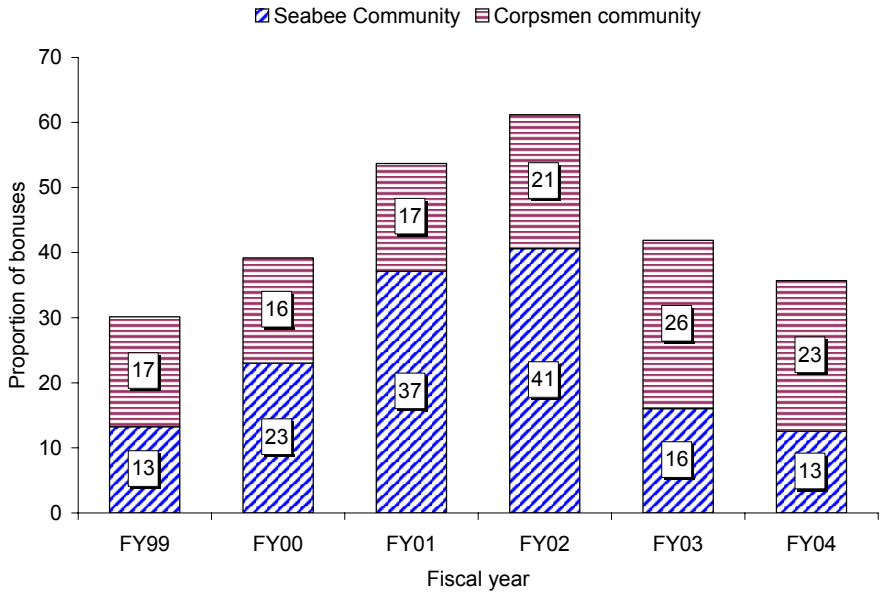
a. Compiled from DMDC data and NRFC bonus eligibility data provided by Mr. Paul Dowd, June 2005.

Some of the growth in bonuses around 2001 could have been from which NECs and ratings were eligible for a bonus. For example, some ratings and NECs may have higher reenlistment and enlistment rates

5. The new affiliation contract information is less reliable than information on the start of other contracts. For this reason, we focus on non-affiliation contracts, such as non-prior-service enlistment, prior service enlistment, and reenlistment contracts.

than other communities. In the past, the Seabee and Medical communities have been designated by NRFC as two of the critical designated communities. Figure 6 shows what proportion of all bonuses were received by members of either the Seabee or Medical community. In 2001 and 2002, there was a shift in the proportion of all bonuses designated toward these two communities. This proportion dropped off in 2003 and 2004 among the Seabee community but increased among the Medical community. [6]

Figure 6. Bonuses received by members of Seabee and Medical communities as a share of all bonuses, by fiscal year[a]



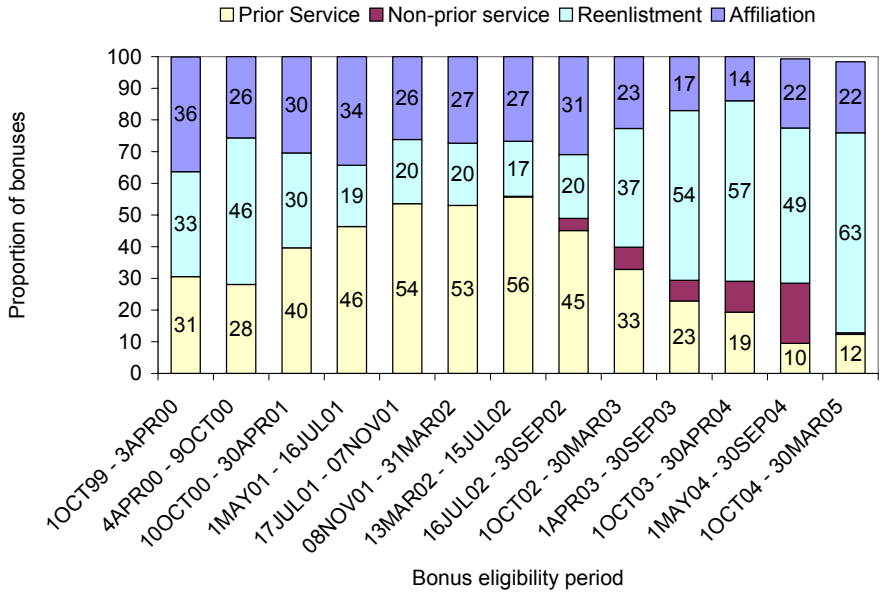
a. Compiled from NRFC bonus eligibility data provided by Mr. Paul Dowd, June 2005. We include the BU, CE, CM, EA, EO, SW, and UT ratings for Seabee community and the DT and HM ratings for Medical Corpsmen.

Within the last 2 years, the types of bonuses received have shifted from non-prior-service enlistment to reenlistment/extension

6. For the Seabee community we include the following ratings: BU, CE, CM, EA, EO, SW, and UT. We include the DT and HM ratings in the medical community.

bonuses. Figure 7 shows, by bonus eligibility period, the share of each type of bonus. From July 2001 to March 2002, 20 percent of bonuses paid out were for reenlistments. This share increased to 63 percent between October 2004 and March 2005. For example, from October 2004 through July 2005, 241 Selected Reserve Sailors began participation in the incentive program. Of those, 167 were reenlistment bonuses, followed by 43 affiliation bonuses.

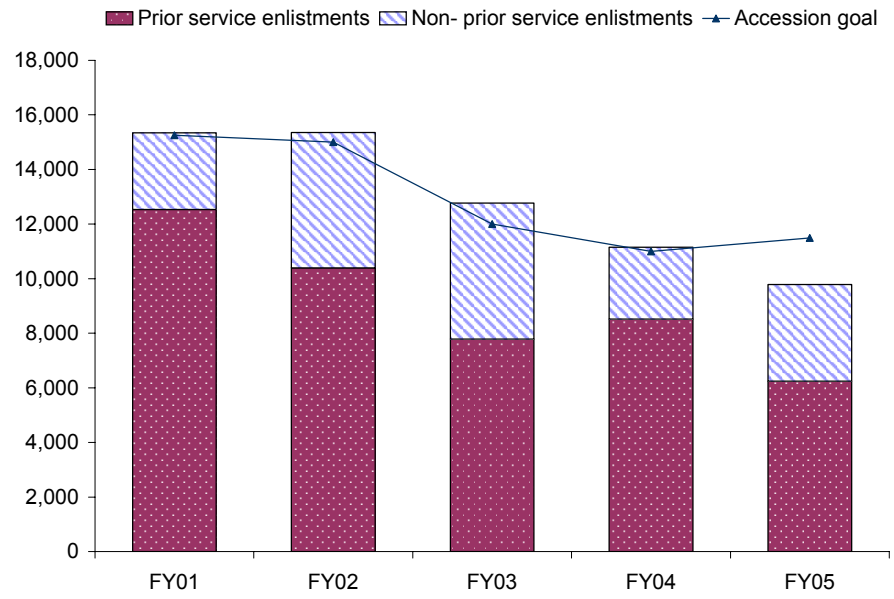
Figure 7. Share of bonuses received, of each type, by eligibility period[a]



a. Compiled from NRFC bonus eligibility data provided by Mr. Paul Dowd, June 2005. The 13 bonus eligibility periods vary from 3 to 7 months. The share of bonuses does not total 100 percent for 1 May to 30 Sep 2004 and 1 Oct 2004 to 30 Mar 2005 because bonus type fields were missing for six people in those two periods.

The proportional decrease in the number of affiliation bonuses may have been related to a corresponding drop in the accession goal. Figure 8 shows the number of prior-service and non-prior-service accessions and the accession goal by fiscal year. In addition to a decrease in the accession goal over this period, in FY05 the Navy Selected Reserve did not meet its accession goal. The Navy Selected Reserve reached only 85 percent of its accession goal in FY05.

Figure 8. Number of prior-service and non-prior-service enlistments compared with the Navy Selected Reserve accession goal[a]



a. Compiled from Navy Recruiting Command data.

Changes to bonus levels since March 2005

Table 4 lists the maximum Navy Reserve bonus amounts that were implemented in March 2005 in accordance with the 2005 National Defense Authorization Act. In addition to increasing the bonus amounts to the highest level established by the 2005 NDAA, the Navy implemented its own three-tier SELRES bonus system. Before March 2005, all bonus amounts were flat rates and did not vary depending on retention and recruiting needs. With the three-tier system, prior-service and reenlistment bonus amounts are inversely related to manning. Now, Sailors obligating for the same contract who are in different NECs or ratings may receive different bonus amounts.

Table 4. Maximum Navy Selected Reserve enlisted bonus amounts, as of March 2005

Bonus type	Contract length	Total amount	Payment plan
Affiliation	18 months or fewer[a]	$50/month of remaining MSO	Lump-sum payment
	More than 18 months[b]	$50/month of remaining MSO	Half upon affiliation, the remainder in one anniversary payment
Prior-service enlistment	3 years[c]	$7,500	Half up front and 2 anniversary payments
	6 years	$15,000	Half up front and 5 anniversary payments
Non-prior-service enlistment	6 years	$10,000	Half up front and 5 anniversary payments
Reenlistment/extension	3 years[d]	$7,500	Half up front and 2 anniversary payments
	6 years	$15,000	Half up front and 5 anniversary payments

a. 18 or fewer months remaining on initial MSO. No change in amount of affiliation bonus under 2005 NDAA.
b. More than 18 months remaining on initial MSO. No change in amount of affiliation bonus under 2005 NDAA.
c. After completion of 3-year enlistment period, member is eligible for a 3-year reenlistment bonus up to $6,000.
d. Bonus recipient of a 3-year reenlistment/extension bonus may receive an additional $6,000 for reenlisting for a second 3-year contract following the completion of the first reenlistment contract.

Literature on compensation and participation in the Selected Reserve

The bulk of the literature on the relationship between compensation and participation in the Selected Reserve uses cold war data. During this period, reserve service was very different from service in the active force [2]. Few reservists were activated and deployed, and most held civilian jobs while satisfying their reserve commitments. Despite these differences, the literature concludes that, in general, similar factors affected both active and reserve personnel, and with similar magnitudes [3]. Most notably, reserve recruiting and retention increases with increases in compensation [4, 5, and 6].

With the end of the cold war, the services have used reservists more frequently, for longer periods, and in more varied roles. Since most analyses looked at reservists prior to Desert Shield/Desert Storm, it is possible that the impact of compensation on recruiting and retention has changed. Reference [7], however, concludes that the responsiveness to pay of active-duty personnel has remained fairly constant over time, despite changes in optempo. Since the early literature finds similar behavioral relationships for both active and reserve personnel, one might conclude that the underlying relationships have not changed for reservists either.

Changes in the way that the services have used reservists are much more dramatic than changes in the optempo of active duty personnel. Anecdotal evidence suggests that uncertainty about and surrounding mobilizations and deployments has reduced the ability to successfully recruit prior-service personnel into the reserves [2 and 8]. If this is the case, it is possible that reservists' responsiveness to pay has shifted in response to increases in uncertainty and the probability of deployment. Since the start of Operation Iraqi Freedom, the uncertainty on probability of deployments may have decreased;

however, other uncertainties relating to deployments—such as timing and length of deployments—have persisted [9 and 10].

There has been little recent research on the relationship between compensation and participation in the Selected Reserve. A major obstacle has been the statistical challenge of obtaining precise estimates of this relationship. The typical approach is to estimate people's responsiveness to historical changes in compensation, holding all other factors constant. As table 2 shows, however, *there has been no variation* in Navy Selected Reserve bonuses over the past few years.[7]

Consequently, researchers must compare differences in participation between ratings that do and do not receive bonuses; alternatively, researchers must compare differences in participation within a rating, before and after it was eligible to receive a bonus. In this research memorandum, our estimates of the effect of compensation exploit both types of differences in participation.[8]

It is important to note, however, that our estimates are subject to more than one interpretation. In the first case, one cannot be certain whether the observed relationship is due to differences in compensation or to underlying differences in participation by rating.[9] In the second case, one cannot be certain whether the observed relationship is due to differences in compensation or to unobserved, additional factors that affect participation and that have been changing over time.

---

7. Since the nominal value of these bonuses has not changed, the real (i.e., inflation-adjusted) value of these bonuses has declined over time. However, identification of responsiveness to changes in compensation solely from changes in the purchasing power of a bonus is tenuous.

8. Our methodology is most closely related to [11].

9. Reference [12] provides an example of the statistical difficulties associated with estimating responsiveness to pay without significant variation in compensation. Reference [11] also notes the difficulty in obtaining a precise relationship between changes in compensation and changes in reservist behavior.

Furthermore, we note that the March 2005 changes to Selected Reserve bonuses are significant (see tables 2 and 4). Empirical estimates based on historical data are most reliable for predicting a behavioral response to *marginal* changes in compensation. While this research memorandum presents our best estimate of the effect of compensation on participation for the period before March 2005, further analysis would be needed to incorporate the more recent, dramatic changes in bonuses.

Data and methodology

This paper provides initial parameters for a decision support tool that the SAG Corporation is developing. The tool will assist community managers and reserve incentive project managers in determining the enlistment/affiliation and reenlistment effect of reserve bonus eligibility and changes in bonus amounts. In this section, we discuss the data and methodology used to estimate those parameters.

Data

We used the NRFC eligibility bonus listings, NRFC bonus recipient data, monthly extractions from the Reserve Components Common Personnel Data System (RCCPDS), and reserve data from the Contingency Tracking System (CTS) to construct our dataset.[10] We focused only on non-TAR members of the Selected Reserve.[11] Matching the NRFC bonus recipient data with RCCPDS and using NRFC's bonus eligibility messages, we created an individual-month-level dataset. We then merged in activation and deployment information from the CTS, which has activation data from October 2001 on. Our dataset has variables on whether a person was eligible for a bonus and whether he or she received a bonus, where bonus recipients are personnel who enlisted, reenlisted, extended service, or affiliated in the Navy Selected Reserve and enrolled in the bonus program. In addition, we included information on the types of contracts that servicemembers had and the length of those contracts. Other variables we extracted from RCCPDS included education measures, dependent status, and age. Based on home state of record, we merged in the

10. Paul Dowd, NRFC Director of Education and Incentive Programs, provided the bonus recipient data. The RCCPDS and CTS data came from the Defense Manpower Data Center.

11. Our Selected Reserve sample includes reservists training in units, training individually, or in the training pipeline.

Bureau of Labor Statistics monthly state unemployment rate. Our data on bonus eligibility and recipiency cover the October 1999 through March 2005 period, and we have information on continuation up through December 2005.

From this dataset, we constructed a reenlistment dataset to examine whether bonus eligibility influenced the decision to stay (i.e., reenlist or extend) in the Selected Reserve. We then constructed the following datasets to analyze the impact of receiving a bonus on continuation behavior in the Selected Reserve:

- Non-prior-service enlistments of at least 6 years
- 3-year and 4-year prior-service enlistments
- 6-year or longer prior-service enlistments
- 3-year and 4-year reenlistments/extensions
- 6-year or longer reenlistments/extensions.

Unfortunately, our data are limited both in time and in variation of the bonus amounts. Our data are censored in that we have monthly snapshots over 5 full fiscal years of data, whereas some of the enlistment and reenlistment contracts are 6-year commitments. During the period examined, there was no change in the amount of bonuses paid, either across years or across rating/NEC. The only variation is in bonus eligibility since the ratings and NECs eligible for a bonus changed during this period. We estimate separate retention models using a dummy variable indicating participation in the bonus program and present discounted value of expected bonus amounts using a 12-percent discount rate.[12]

12. The authors of [13] estimate a discount rate for active enlisted members that ranges from 17.5 to 19.8. Examining take rates of Redux, [14] suggests a discount rate closer to 12 percent. Unfortunately, there has been no research done on the discount rate of reserve members. While there is no reason to assume that reserve and active personnel are inherently different, reserve members are, on average, older than their active duty counterparts, and the empirical evidence does suggest that older people have significantly lower discount rates (see [15] for a review of the general literature). Therefore, we selected a discount rate from the lower end of the enlisted active-duty discount rate literature.

Reenlistment and length of contract models

For the majority of this part of our analysis, we use October 1999 through September 2004 monthly snapshot data. The monthly snapshots are of the reenlistment-eligible population, or servicemembers with 6 months left on an obligation contract. For this model, we focus on the reenlistment effect of bonus eligibility based on NRFC bonus eligibility lists. We first examine two discrete choice models of the reenlistment and extension decision: the decision to reenlist or not and the decision to select an obligation of at least 6 years. Looking at our pool of eligible reenlisters, we examine whether a reenlistment bonus influences the decision to reenlist or extend. We then focus on whether bonus eligibility influences the length of contract selected. We estimate the impact of bonus eligibility on the probability to sign a longer obligation contract, where we define a longer contract as 6 or more years.

For the analysis in this section, we created a monthly dataset in which each monthly cohort includes everyone who is 6 months from his or her current end of obligated service (EOS).[13] We have two definitions for bonus eligibility. Our first definition is being eligible for a bonus at that 6-month point. Reenlisting/extending, as well as the length of the new obligation contract, is based on any new obligation contract signed by the person 12 months from that 6-month point. For example, for the October 2000 snapshot, we look at everyone who has a current obligation that ends in April 2001. We then determine which Sailors in that snapshot are eligible for a bonus in October 2000 and whether they are observed signing up for a new obligation contract between October 2000 and October 2001.

Our second definition of bonus eligibility is that the Sailor is eligible for a bonus at any time from 6 months before the end of an obligation contract to the end of that contract. This definition accounts for Sailors reenlisting closer to the end of contract obligation and changes

13. According to OPNAVINST 5300.10, 27 June 1990, only those members who are within 90 days of EOS may reenlist into the reserve reenlistment/extension incentive program. In case some Sailors reenlist or extend early, we look at 6 months before the end of a contract.

in bonus eligibility over the 6 months leading up to the end of an obligation. To determine the second form of bonus eligibility in our previous example, we would determine which Sailors were eligible for a bonus from October 2000 through April 2001.

To estimate our discrete choice models—for example, the three choices of either leaving the Selected Reserve, signing an extension, or signing a reenlistment contract—we use a multinomial logit specification of the form:

$$p(Y = j) = \left(\frac{\exp(\beta x_{ij})}{\sum_{j=1}^{J} \exp(\beta x_{ij})} \right),$$

where p is the probability that the outcome of interest occurred and x_i stands for explanatory variables. The multinomial logit model reduces to the logit model when $J = 2$, as in the case of looking at reenlisting versus not reenlisting. Maximum likelihood allows us to get estimates of β.

Reenlistment model

We estimate the impact of being eligible for a bonus on the decision of Selected Reserve Sailors to sign a reenlistment or extension contract. First, we look at the decision to reenlist versus not reenlist, which could include extending a contract or leaving the Selected Reserve. We then examine how bonuses influence the decision to stay (i.e., sign either a reenlistment or extension contract) or to leave. Our model is a choice model in which the dependent variable equals 1 if a Sailor signs a reenlistment or extension contract. Failure, represented by 0, occurs if the person is no longer in the dataset 6 months after his or her expected end of obligated service. We estimate this decision using a logit model.

Second, we estimate a three-decision model consisting of the following discrete options: the decision to leave, to reenlist, or to extend using a multinomial logit model. As with our logit models, the

independent variable of interest is an indicator of bonus eligibility. In each of our reenlistment models, we include the following variables: paygrade, estimated years of service, dependent status, race/ethnicity, gender, age, highest education level achieved, Armed Forces Qualification Test (AFQT) score, home state unemployment rate, rating category, and monthly fixed effects. Our monthly fixed effects account for factors that affect all reservists equally but vary over time, such as a recession.

We then estimate a separate set of models accounting for the end of activation and deployment spells in the last 12 months of a reserve member's contract. We look at these models separately because we only have activation data since October 2001, so we can only look at activations over the past 12 months for reservists with contract end dates between October 2002 and September 2004. For this set of models, we look at any deactivation during the 12 months before the end of a contract and whether that activation spell did or did not include an activation. We also include an indicator variable for whether there was a break in the data during the last 12 months that resulted from a break in Selected Reserve service during this period.

Probability of selecting an obligation of at least 6 years

If a Sailor eligible for a bonus planned to reenlist and stay in the Navy Selected Reserve for 6 years, he or she would receive a greater bonus overall from a 6-year reenlistment contract than from signing two concurrent 3-year reenlistment contracts ($5,000 versus $4,500). Given these different bonus amounts, we would expect that bonus eligibility would influence the length of obligation. Using a multinomial logit model, we examine the effect of bonus eligibility on the decision (a) to leave, (b) to stay and sign a 3- or 4-year obligation contract, or (c) to stay and sign a contract of 6 or more years. In addition to bonus eligibility, the explanatory variables included in the model are paygrade, estimated years of service, rating, dependent status, race/ethnicity, gender, education levels, age, AFQT, home state unemployment rate, rating category, and monthly fixed effects.

Length of service in Selected Reserve

In our analysis, we focus on the effect that receiving a bonus has on a Sailor's retention behavior once he or she is in the Selected Reserve. Under that criterion, we consider "success" in our models as service in the Selected Reserve. We examine how much of enlistment and reenlistment contracts were fulfilled using continuation and duration models, described below, for the following populations:

- 3- year and 4-year prior-service enlistment contracts
- 3-year and 4-year reenlistment contracts
- 6-year or longer prior-service enlistment contracts
- 6-year or longer reenlistment contracts
- Non-prior-service 6-year or longer enlistment contracts.

12- and 24-month continuation models

Of those signing at least a 3-year contract, we estimate the probability of fulfilling the first 12 or 24 months of that contract. Ideally, we could examine whether a Sailor fulfilled his or her entire obligated service; however, we have only 66 months of data, and many contracts began in the later portion of that period.

We model the continuation model as a bivariate choice using a logit specification. Our dependent variable equals 1 if the Sailor served the first 12 or 24 months of his or her contract in the Selected Reserve and 0 otherwise. For our 12-month continuation model, we look at the October 1999 through December 2004 monthly cohorts. For our 24-month continuation model, we look at the October 1999 through December 2003 monthly cohorts. These monthly cohorts are from the start of the obligation contract. The independent variable of interest is bonus received. We estimate separate models for two different measures of bonus recipiency. Our bonus variables are a bonus dummy and the expected amount of bonus, measured as the discounted stream of bonus payments, adjusting for inflation, over the length of the contract. The other explanatory variables include paygrade, estimated years of service, dependent status, race/ethnicity,

gender, education levels, AFQT, age, home state unemployment rate, rating category, and monthly fixed effects.

We don't know whether all of the enlistment and reenlistment contracts that we observe starting between October 1999 and March 2005 were completed. Due to this censoring issue, we also analyze continuation using a duration model, which is described next.

Duration of Selected Reserve service

We use a duration model to estimate the impact of different determinants, such as expected amount of reserve bonus, on the probability of staying in the Navy Reserve for an additional month conditional on having stayed in the Selected Reserve to the beginning of that month. This model is particularly useful since our data are censored (i.e., we do not observe the end of many reenlistment contracts).[14]

The proportional hazard function we estimate is of the form:

$$\lambda(t, x) = \lambda_o(t)\exp\{\beta x_i\},$$

where λ_0, the baseline hazard, is an individual specific constant, β is a vector of parameters to be estimated, and x_i is a vector of explanatory covariates.[15] We estimate the model from the signing of a reenlistment contract.[16] Our covariates include present discounted value of expected bonus payments, years of service, paygrade, dependent status, race/ethnicity, gender, education level, AFQT, rating category, and age. These characteristics are observed at the start of the specific

14. In addition to 1-month spells, we looked at 3-month spells in case the Navy is interested in periods of Selected Reserve completion longer than a month, and 3 months is consistent with quarterly updates of the decision support tool. The results were quantitatively the same between our 1- and 3-month-spell models, so we present results only for our 1-month spells. Full results are available from the author on request.

15. The amount of bonus received is calculated as the discounted stream of bonus payments over the length of the contract, adjusted for inflation.

16. Ideally for the enlistment and reenlistment samples, we would want to examine the model from the initial point of service (either Active or Reserve); however, our length-of-service variable is a rough estimate.

Selected Reserve contract and are assumed to be time invariant.[17] We estimate this model for the same contract groups as we estimated the 12- and 24-month continuation model. Because this model accounts for censoring of data, we include all monthly cohorts (October 1999 through March 2005).

Summary of methodological approach

In table 5, we summarize our methodological approach.

17. We have limited data on the time invariant characteristics that are most likely to influence service completion behavior—reserve activation experience, and civilian job opportunities. The covariates we do include for the most part change little or are not updated in the data frequently enough to warrant the use of a time invariant duration model.

Table 5. Methodological approach

Model	Specification	Population	Data period	Outcome of interest	Explanatory variables[a]
Reenlistment (extension)	Logit and multinomial logit	Eligible for reenlistment	Oct. 1999 - Sep. 2004[b]	Reenlist, extend or leave	c, d, e
Contract length	Multinomial logit	Eligible for reenlistment	Oct. 1999 - Sep. 2004[b]	Leave Reenlist/extend for at least 6 years Reenlist/extend for less than 6 years	c, d
12-month continuation	Logit	5 enlisted and reenlisted samples	Oct. 1999 - Dec. 2004[f]	=1, completed first 12 months of SELRES obligation =0, didn't	g, h, i
24-month continuation	Logit	5 enlisted and reenlisted samples	Oct. 1999 - Dec. 2003[f]	=1, completed first 24 months of SELRES obligation =0, didn't	g, h, i
Duration of service	Cox proportional hazard	5 enlisted and reenlisted samples	Oct. 1999 - Mar. 2005[f]	Completion of each month of SELRES obligation	g, h, j

a. Definitions of the variables are in appendix A.
b. Monthly snapshots 6 months before the end of a contract.
c. Indicators for bonus eligibility are measured at 6 months before the contract end and at any point in the 6 months leading up to the contract end. Bonus eligibility is calculated from NRFC bonus eligibility listings.
d. Explanatory variables determined at 6 months before the end of contract include paygrade, pay entry based date estimated years of service, dependent status, race/ethnicity, gender, education level, age, AFQT, rating community, unemployment rate in home state, and monthly fixed effects.
e. Models of the March 2002 through September 2004 reenlistment-eligible population include dummy variables indicating recent deactivation experience.
f. Monthly snapshots of the contract begin date.
g. Explanatory variables include an indicator of bonus participation. Bonus recipiency is based on data received from Mr. Paul Dowd of NRFC, June 2005.
h. Explanatory variables include discounted stream of bonus payments over the contract length adjusted for inflation. Bonus recipiency is based on data received from Mr. Paul Dowd of NRFC, June 2005. The amount of bonus received is based on obligation contract types calculated from RCCPDS data.
i. Explanatory variables at the start of the contract include paygrade, pay entry based date estimated years of service, dependent status, race/ethnicity, gender, education level, age, AFQT, rating community, unemployment rate in home state, and monthly fixed effects.
j. Explanatory variables at the start of the contract include pay entry based date estimated years of service, paygrade, dependent status, race/ethnicity, education level, age, AFQT, and rating community.

Effect of bonuses on reenlistment decision

The main objective of this paper is to provide the SAG Corporation with bonus model parameters. We also discuss our findings in a policy context.[18] Here, we briefly discuss our findings on the effect of bonus eligibility on the decision to reenlist and how long to obligate. We report our results defining bonus eligibility as the eligibility over the 6 months leading up to the end of an obligation contract; we note our results when using the more narrow definition of bonus eligibility at the point 6 months before the end of the obligation contract.

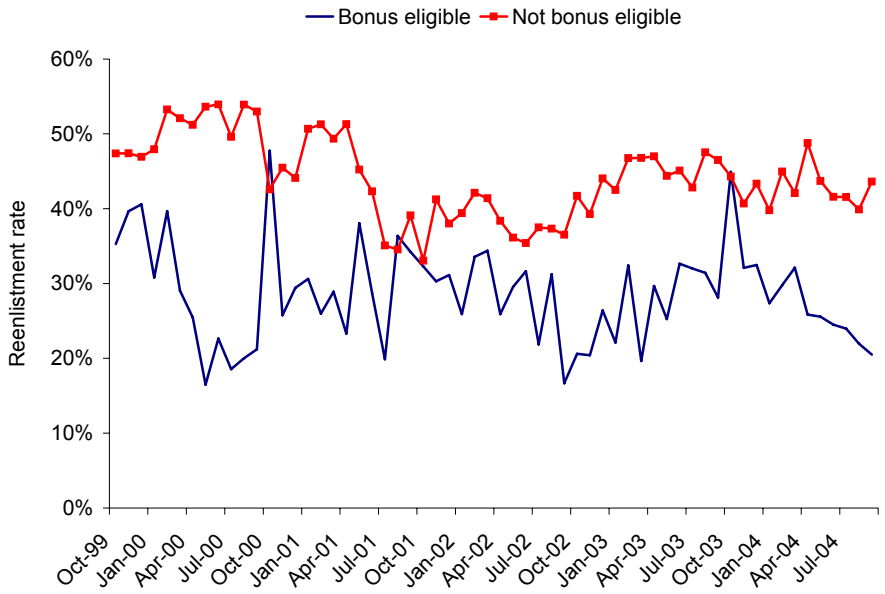
There are no clear trends in the reenlistment rate over this period, in aggregate or by bonus eligibility (see figure 9). The reenlistment rate among the bonus eligible is lower than for other reservists, which is consistent with the fact that the determination of bonus eligibility was partially based on low retention patterns. While there is no clear trend, the minor changes in the reenlistment rate over this period could have been caused by permanent differences across all reservists that vary over time, such as a recession. We account for any changes in the reenlistment rate due to time variant factors that permanently affect all reservists' reenlistment decisions equally by including monthly dummy variables, or monthly fixed effects, in our reenlistment models.

Decision to reenlist or to extend

At the end of an existing Selected Reserve contract, a Sailor can leave the Selected Reserve, sign a reenlistment contract, or extend his or her existing contract. We find that bonus eligibility influences the decision to reenlist, from a decrease in both the probability of extending and the probability of staying. Figure 10 shows the predicted probabilities, based on our multinomial logit estimates, of leaving,

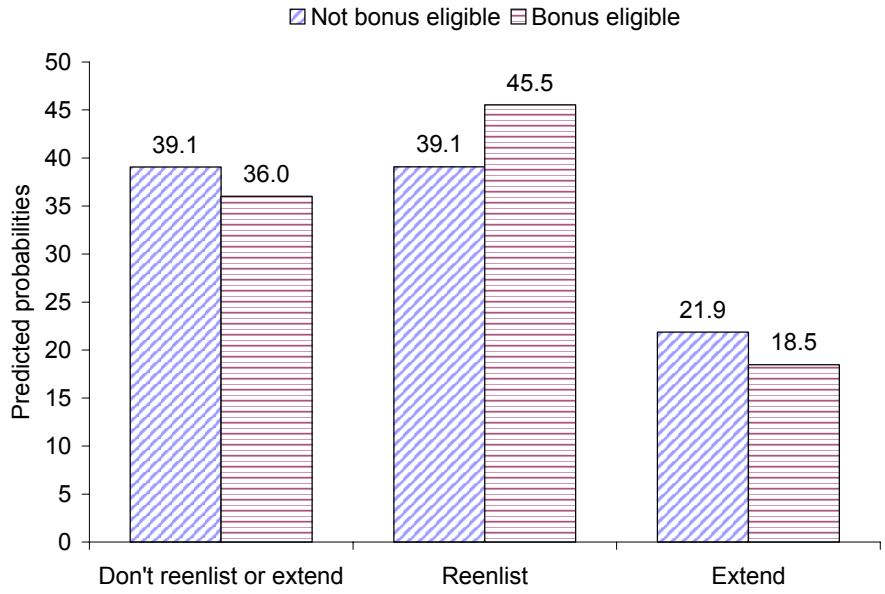
18. Full regression results are available from the author on request.

Figure 9. Reenlistment rate by bonus eligibility[a]



a. Compiled from DMDC data and NRFC bonus eligibility data provided by Mr. Paul Dowd, June 2005.

Figure 10. Predicted probability of leaving, reenlisting, or extending



staying and reenlisting, or staying and extending. This shows the predicted share of servicemembers who reenlist or extend at any point between 6 months before and 6 months after the end of their obligation contract. The predicted share signing a reenlistment contract *increases* by 6.4 percentage points with bonus eligibility, while the predicted share extending *decreases* 3.4 percentage points with bonus eligibility.[19] Our findings show that the decision to stay and sign a reenlistment contract instead of an extension is significantly influenced by bonus eligibility.

Our finding of bonus eligibility decreasing the predicted probability that a Sailor will leave the service is in stark contrast with our estimates when using a narrower definition of bonus eligibility. If we define bonus eligibility at the point 6 months before the end of a contract, we find that bonus eligibility affects the probability to reenlist instead of extend and to sign longer contracts; however, it has very little effect on the decision to leave versus stay (reenlist or extend).

Effect of activations and deployments on results

For our reenlistment-eligible population, we have activation and deployment data for the October 2001 through September 2004 period. So, looking at the 12 months prior to the end of an obligation contract, we can include activation data for contracts that end in October 2002 through September 2004.[20] We look at whether including an indicator for deactivating in the 12 months prior to the end of a contract in our models changes the bonus estimates. Table 6 shows the marginal effect of bonuses on reenlistment behavior, for our entire dataset and for more restricted data periods, with and without the activation data.

---

19. In this case, we define bonus eligibility as being eligible at any point 6 months prior to the end of an obligation contract. When we use our definition of bonus eligibility *at* the 6-month-prior point, we estimate that the predicted share signing a reenlistment contract increases by 4.4 percentage points and the predicted share extending decreases 3.9 percentage points. We find that the decision to leave decreases by 0.7 percentage point.

20. Our monthly snapshots are of the reenlistment eligible 6 months prior to the end of an obligation contract. So our models include March 2002 through September 2004 data

Table 6. Reenlistment logit estimates[a, b]

Effect of bonus eligibility on reenlistment decision				
Marginal effect of bonus eligibility[c]				
Percentage-point change	6.36*	8.52*	3.34*	3.22*
Percentage change	16.28*	21.30*	8.72*	8.41*
Variables included in model				
Recently deactivated[d]	No	No	No	Yes
Data period	October 1999–September 2004	October 1999–February 2002	March 2002–September 2004	March 2002–September 2004
Reenlistment-eligible population size	52,280	25,609	26,671	26,671

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, monthly fixed effects, and rating category fixed effects.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.
c. The marginal effect is the impact of being eligible for a bonus, indicated by a dummy variable, on the predicted probability of reenlisting.
d. This model included the following covariates: indicators for deactivated from an activation without any deployments in the 12 months before contract end date, deactivated from an actuation with any deployments in the 12 months before contract end date, or other activation experiences in the past 12 months, where the left out variable is never activated at any time during the past 12 months. In addition, we include an indicator for a break-in Selected Reserve service during this period.

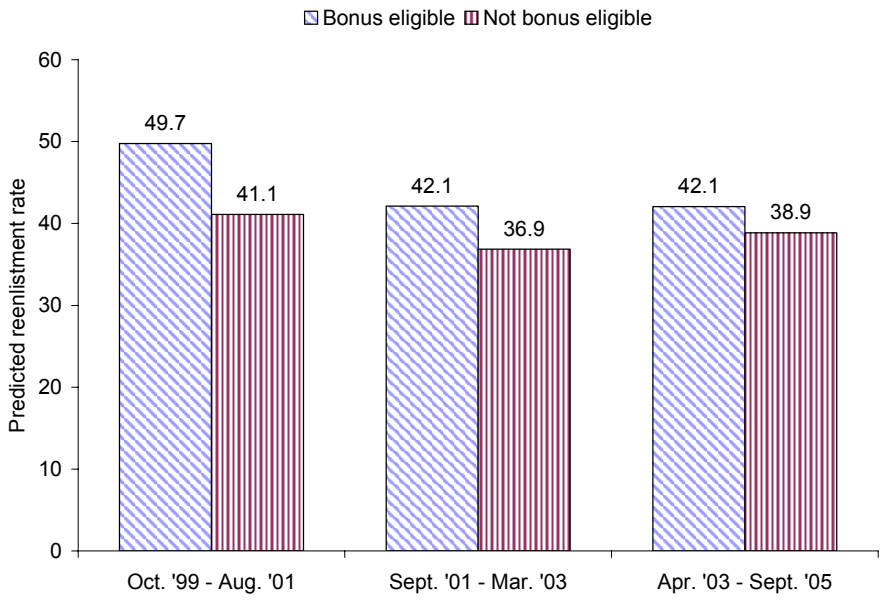
We find that including activation information in our model does change the estimated effect of bonus eligibility on reenlistment behavior. The difference between our bonus estimates from the model without any activation data is statistically different from the bonus estimate from the model with activation data. However, including information on any recent activation experience only marginally changes the estimates from a 3.3- to 3.2-percentage-point change. We recommend that, if activation or deployment data are available, they be included in reserve compensation analysis.

The time period examined also influences our bonus results. We find that bonuses were statistically more effective in influencing reenlistment for the October 1999 through February 2002 data period than for the March 2002 through September 2004 period. For the October 1999 through February 2002 data period, we estimate that bonus

eligibility increases predicted reenlistment rates by 21 percent. For March 2002 through September 2004, we estimate that bonus eligibility increased the predicted reenlistment rate by 8.7 percent.

The September 11, 2001 terrorist attacks and the Iraq War may have influenced reenlistment behavior and how reservists responded to monetary incentives. Figure 11 shows the predicted reenlistment rate before and after those events by monthly cohorts within 6 months of the end of an obligation contract. For the reenlistment-eligible cohorts after September 2001, holding other factors constant, we find that reenlistment rates are slightly lower and responsiveness to bonuses is significantly lower.

Figure 11. Predicted probability of reenlisting in different time periods[a]



a. The predicted probabilities are from a logit model of the likelihood of reenlisting that included these covariates: bonus and time period interaction, paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, and rating category fixed effects.

There are a number of potential explanations for the decrease in responsiveness to bonuses, and it is unclear what the implications of this finding are on the expected effect of the March 2005 bonus increases following the 2005 NDAA. One potential explanation for our findings is that the reenlistment bonus payment did not change during the period examined, so the real value of reenlistment bonuses decreased over time. That explanation would suggest that the recent increases in reenlistment bonuses under the 2005 NDAA should significantly increase reenlistment rates. However, the responsiveness to pay could have decreased if Navy Selected Reserve members were motivated to reenlist for nonmonetary reasons, such as an increased sense of patriotism. This would suggest a more muted than expected response to the bonus increases following the 2005 NDAA. A third potential cause of our finding is that the decrease in responsiveness to the bonuses was a function of who was bonus eligible. This could have occurred, for example, if the ratings and NECs that became bonus eligible changed over this period to ratings and NECs populated by Sailors with different civilian employment opportunities than before. This suggests that who is eligible for a bonus will significantly influence the effect of the higher bonus amounts.

Effect of activations and deployments on the decision to stay in the Selected Reserves

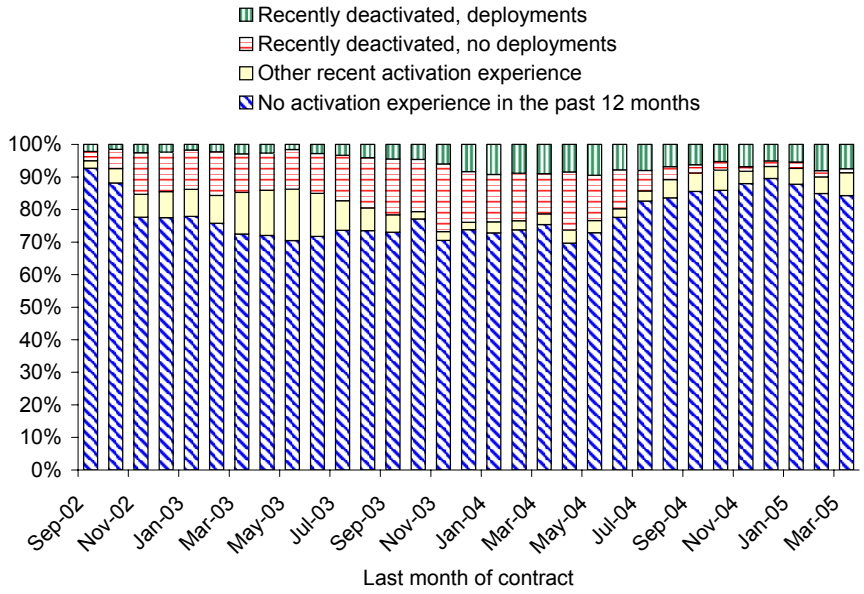
A relatively small proportion of Navy reservists have deactivated within the last 12 months and even fewer Navy reservists have deactivated within the last 12 months from an activation spell that included deployment. Figure 12 shows, by contract end date, the share of reservists who have recently deactivated by the type of activation spell.[21]

Using deactivation data, we explore how activations influence reenlistment behavior. We focus on the effects of deactivating in the past 12 months. The comparison group for our deactivation estimates are reservists who did not have any activation experience in the last 12 months. We also control for those reserve members who have not

21. We define recently deactivated as being deactivated at some point in the 12 months before the end of an obligation contract.

recently deactivated but have some activation experience in the past 12 months. This group includes currently activated reservists who did not recently deactivate from an earlier activation spell.

Figure 12. Share of reenlistment-eligible population with activation experience



Holding a number of factors constant, including bonus eligibility, we find that activations that *don't* include any deployments negatively influence the decision to reenlist. Deactivating from an activation without deployments decreases reenlistment rates by 14.5 percentage points (34.4 percent).[22]

22. All reported estimates are significant at the 1-percent level and are from a logit reenlistment model for the March 2002–September 2004 period that controls for bonus eligibility, as well as from the covariates listed in footnote c of table 5. When we don't account for bonus eligibility, the results are statistically different. Without a bonus covariate, we estimate that deactivating without any deployments decreases predicted reenlistment rates by 14.4 percentage points (34.3 percent).

However, we find less of a negative reenlistment effect of being recently deactivated from an activation that *did* include a deployment. Deactivating from an activation with some deployment experience decreases reenlistment rates by 4.2 percentage points (9.9 percent).[23]

The difference in reenlistment responses to activations with and without deployments may be because being deployed during an activation involves more of a sense of mission than being activated and not deployed. For example, SELRES Marines in focus groups, documented in [16], stated that if activated they would prefer to deploy since they didn't want to mobilize OCONUS and do nothing. Thus, if the Navy SELRES is going to activate Sailors, from a reenlistment standpoint, it is better to deploy than to not deploy them.

Our findings that a recent deactivation negatively influences reenlistment rates may not seem consistent with the literature on Selected Reserve loss rates following a deactivation. The authors of [17] find that the loss rates 6 months after a deactivation are lower than the loss rates of those never activated. Our analysis and that done by the authors of [17] differ in terms of the populations we're examining, the outcome of interest, and the comparison group. We focus only on reenlistment behavior for reserve members who are facing the end of their obligated ready reserve contract, whereas the authors of [17] are measuring total losses to the Selected Reserve after a deactivation. The outcome of interest we focus on is signing a reenlistment contract within 6 months after the end of an obligation contract; the authors of [17] focus on a loss to the Selected Reserve 6 months after the end of a deactivation. Finally, in our analysis we compare the recently deactivated with those who have no activation experience in the past 12 months. The authors of [17] use a more restrictive

23. All reported estimates are significant at the 5-percent level and are from a logit reenlistment model for the March 2002–September 2004 period that controls for bonus eligibility, as well as from the covariates in footnote c of table 5. When we don't account for bonus eligibility, the results are statistically different. Without a bonus covariate, we estimate that deactivating with some deployment experience decreases predicted reenlistment rates by 3.90 percentage points (9.27 percent).

comparison group of reservists with no activation experience during the entire data period examined. These substantial analytical differences need to be taken into consideration before making any comparison of our findings with the findings in [17].

Decision to obligate for a 6-year contract

We find that bonus eligibility influences the decision to sign a longer reenlistment contract both from a decrease in the predicted probability of leaving and from a decrease in the predicted probability of signing a shorter contract. Figure 13 shows the predicted probabilities by bonus eligibility of leaving, staying and signing a less-than-6-year contract, or staying and signing a more-than-6-year contract.[24] The predicted probabilities in figure 13 are based on our multinomial logit estimates. In both our reenlistment and contract length models, bonus eligibility decreases the predicted probability that a Sailor will leave the Selected Reserve by almost 3 percentage points.

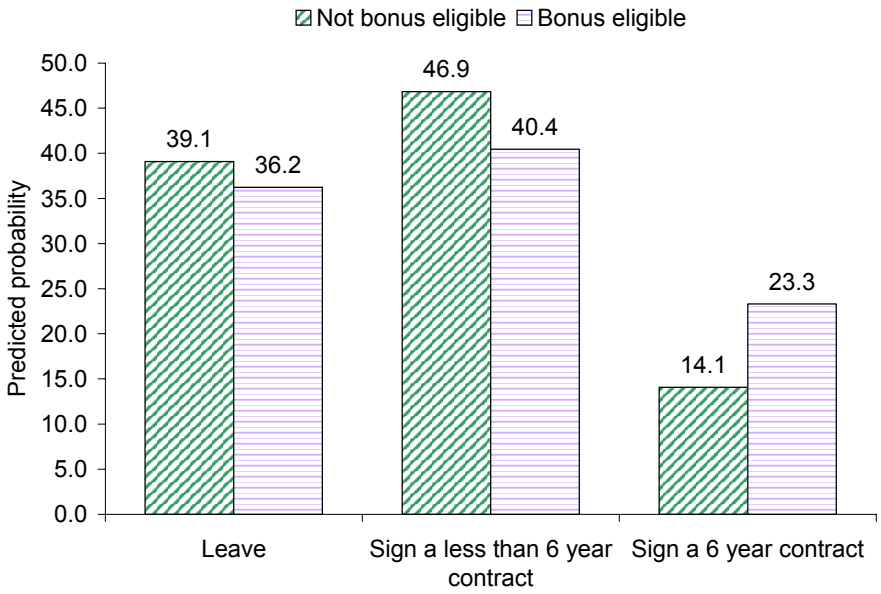
To double-check our results, we also estimated a model in which the decision to sign a contract was dependent on already deciding to reenlist. Our predictions using a Heckman selection model are very similar to the results we got when using a multinomial logit model.[25] For that reason, we are fairly confident in our findings in figure 13 that bonus eligibility influences the decision to stay in the Selected Reserve and sign a reenlistment and longer contract.

---

24. When we define bonus eligibility as being eligible at the 6-month-prior point, we find that bonus eligibility increases the probability of signing a 6-year-or-longer obligation by 7.7 percentage points. We estimate that bonus eligibility decreases the probability of signing a 3- or 4-year obligation contract by 7.3 percentage points, and the predicted probability of leaving the Selected Reserves decreases by 0.4 percentage point.

25. Using a Heckman selection model, we predict the share signing a less-than-6-year contract to be 46.9 percent without bonus eligibility and 40.6 with bonus eligibility. The shares selecting to sign a 6-year contract are the same as we estimated with the multinomial logit model: 14.1 percent without bonus eligibility and 23.3 percent with bonus eligibility.

Figure 13. Predicted probability of leaving, staying and signing a less-than-6-year obligation, or staying and signing a more-than-6-year obligation



Effect of bonuses on retention in the Selected Reserve

In this section, we present our analysis on how receiving a bonus influences the decision to stay in the Selected Reserve once an obligation contract is signed. For our five continuation populations, described in a previous section, we present actual continuation rates and the main findings from our multivariate analysis. We use two methodologies to estimate whether and to what degree bonuses influence continuation behavior. In our first methodology, which we discuss first, we look at completion rates of the first 12 and 24 months of service, using a number of specifications. Next, we present our results of the impact of bonuses on the duration of a contract completed.[26]

For our continuation and duration analysis, we look at bonus recipiency as opposed to bonus eligibility. While in theory one would expect any reserve member eligible for a bonus to take the bonus, that is not the case. We observe only 32 percent of our reenlistment and bonus-eligible population who do reenlist actually signing up for a bonus. This could be occurring if eligibility for a bonus is not well known or if Sailors are reluctant to take part in the bonus program since it adds more constraints to Selected Reserve service. Sailors in the bonus program are required to read and sign a written agreement in addition to an obligation contract.[27] As part of that agreement, if a bonus recipient separates from the Selected Reserve, changes to a non-bonus-eligible rating, NEC, or unit (unless directed by the Navy), or becomes an officer, he or she will not receive any additional bonus payments and must repay any bonus received for other-than-Selected-Reserve service. Looking at bonus recipiency behavior in the Marine

26. Full regression results are available from the author on request.

27. Navy Enlisted Selected Reserve members sign enlistment and reenlistment contracts but may switch to IRR, provided that they are not under mobilization orders.

Corp Selected Reserve, the authors of [16] found that Marines were at times reluctant to accept a bonus due to the additional constraints it imposed on serving in the Selected Reserve.

Continuation behavior

Tables 7 through 11 present our continuation results for five samples that vary by contract type and length. Each table presents results from regressions with different specifications. First, we focus on the impact of having a bonus by using a dummy variable in the regression. For that specification, we estimated models that included yearly fixed effects, rating category and / or monthly fixed effects. Second, we estimate the impact of the amount of bonus by including the expected stream of bonus payments. We find that our bonus participation results are consistent across each specification.

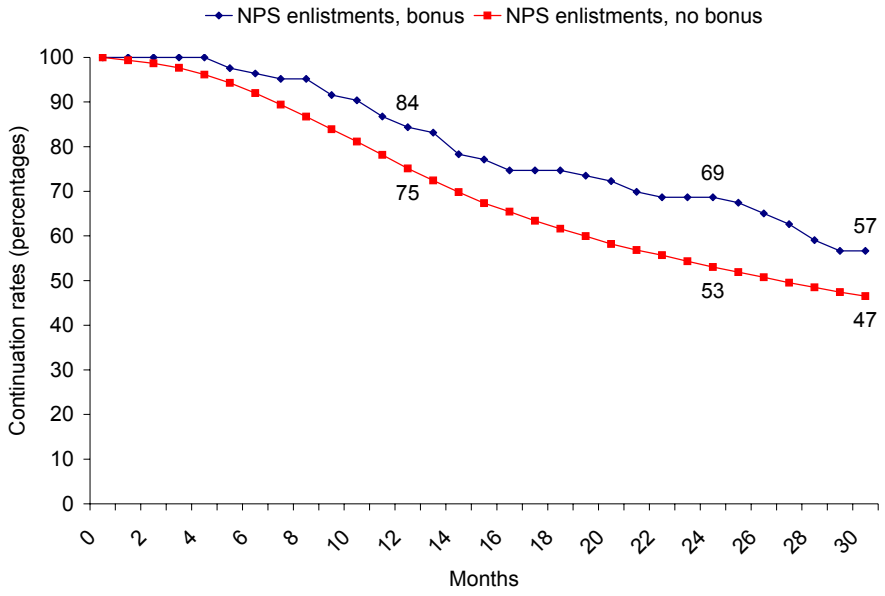
We use the estimates from our models, including the expected discounted stream of bonus payments to calculate a bonus elasticity. The bonus elasticity is the percentage change in continuation rates from a 1-percent increase in the bonus amount. As noted in table 2, the nonaffiliation bonuses received during our data period roughly ranged from $2,500 for 3-year commitments to $5,000 for 6-year commitments. The bonus elasticities presented later in this section range from 0.00 to 0.11, indicating an inelastic response to changes in bonus amounts.[28] Bonus elasticities in this section are based on pre-March 2005 and are only reliable predictions for marginal changes in the bonus amounts. The increase in bonus amounts implemented in response to the 2005 NDAA were not marginal and in some cases tripled the amount of bonus. Thus, any predictions in reference to the bonus increases following March 2005 that are based on our bonus elasticity estimates are rough approximations.

28. Our continuation bonus elasticities are significantly lower than the enlistment pay elasticity estimates of [4 and 6] that ranged from 0.43 to 0.82. In addition to separate populations, a bonus elasticity that is lower than a pay elasticity is not surprising because, over the typical 3- or 6-year Selected Reserve commitment, a 1-percent increase in bonus is less than the amount of a 1-percent increase in basic pay.

Non-prior-service 6-year contracts

Continuation rates over the first 30 months of an obligation contract differ by bonus recipiency in the case of 6-year non-prior-service enlistments. Figure 14 compares the continuation rates of non-prior-service enlistees who obligate for a 6-year contract and are participating in the bonus program with those who didn't participate in the program. However, this is based on a few non-prior-service accessions who received bonuses. Between October 1999 and May 2003, there were only 83 non-prior-service bonus recipients compared with 13,926 non-prior-service entrants without a bonus.

Figure 14. Continuation rates of 6-year non-prior-service enlistment contracts (in percentages, October 1999 through May 2003)



Controlling for a number of demographic and economic factors, we predict that a bonus attached to a 6-year non-prior-service contract increases 12-month continuation rates by 8.9 percentage points, or 12 percent (see table 7). In the case of 24-month continuation rates, our prediction is that bonus participation increases 24-month continuation by 14 percentage points, or 26 percent. Looking at actual bonus recipients, we find no effect in continuation behavior from increasing the bonus amount received by 1 percent.

Table 7. Effect of a bonus on the predicted probability of completing the first 12 or 24 months of a non-prior-service 6-year obligation contract[a, b]

Effect of bonus	12-month continuation			24-month continuation		
Marginal effect of bonus[c]						
Percentage-point change	8.87***	9.93**	8.62***	13.5**	14.6*	13.7**
Percentage change	11.8***	13.2**	11.5***	25.8**	27.9*	26.3**
Bonus elasticity[d]	0.00			0.00		
Fixed effects						
Month	X		X	X		X
Year		X			X	
Rating category	X	X		X	X	
Sample size	19,329	19,340	19,333	17,354	17,354	17,358

a. All models also include the following covariates: paygrade, rating, dependent status, race/ethnicity, gender, education level, age, AFQT, years of service, and unemployment rate in home state.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.
c. The marginal effect is the impact of having a bonus, indicated by a dummy variable, on the predicted probability of completing either the first 12 months or 24 months of the service contract.
d. The bonus elasticity is the predicted percent change in the 12-month or 24-month continuation rate given a 1-percent increase in the bonus amount.

Prior-service enlistment contracts

Figures 15 and 16 show the continuation rates of prior-service enlistments from October 1999 through May 2003, by contract length and bonus participation. Prior-service enlistments with bonuses have higher continuation rates over the first 30 months than prior-service enlistments without bonuses. In this period, 9.4 percent of new 3-year prior-service enlistment contracts included a bonus, and 39 percent of new 6-year prior-service enlistment contracts involved a bonus.

Our regression results are consistent with the continuation pattern in figures 15 and 16 (see tables 8 and 9). Among 3-year prior-service enlistment contracts, we estimate that a bonus increases the probability of completing the first 12 or 24 months of the contract by 12 and 18 percentage points, respectively. In the case of 6-year prior-service enlistments, bonus participation increases 12- and 24-month completion by 15 and 15.6 percentage points, respectively.

Figure 15. Continuation rates of prior-service 3-year enlistment contracts (in percentages, October 1999 through May 2003)

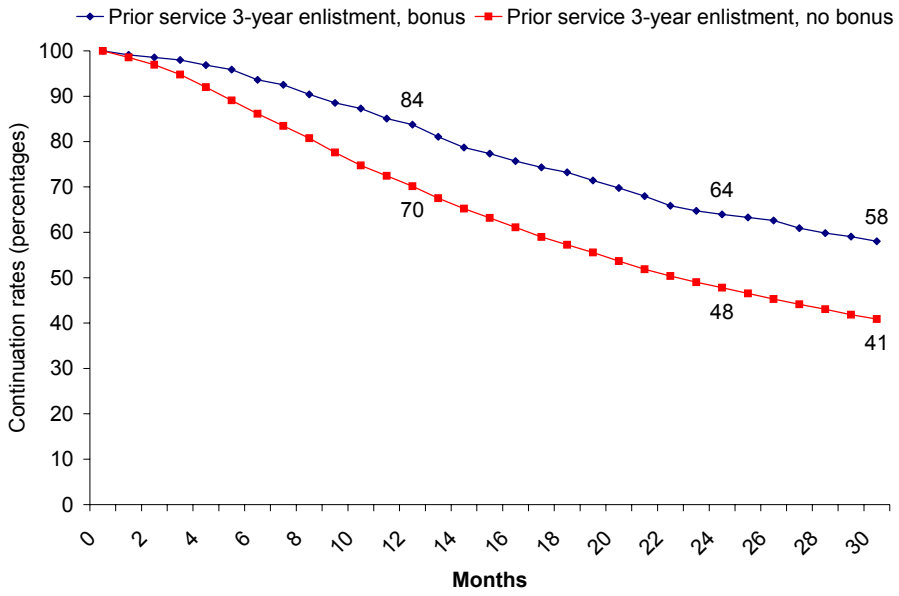


Figure 16. Continuation rates of prior-service 6-year enlistment contracts (in percentages, October 1999 through May 2003)

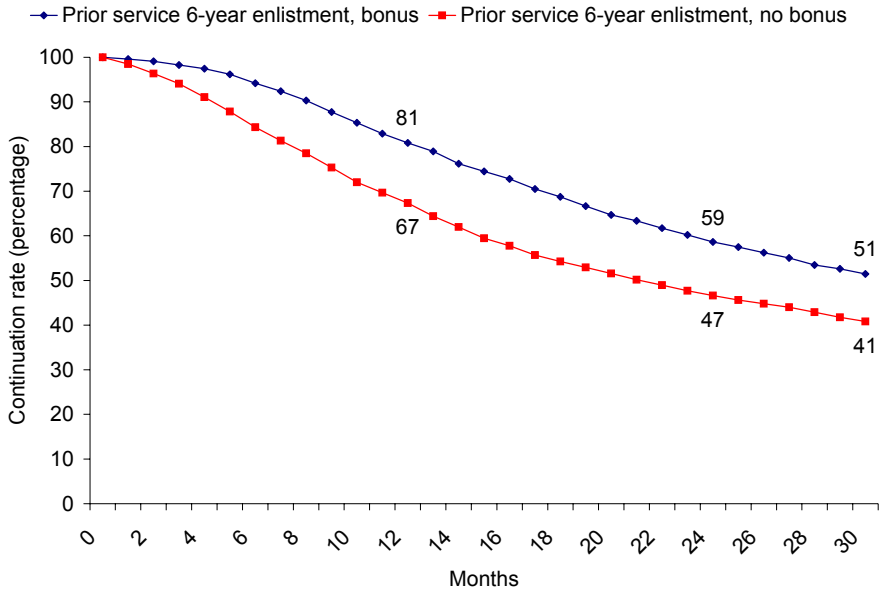


Table 8. Effect of a bonus on the predicted probability of completing the first 12 or 24 months of a 3- or 4-year prior-service enlistment contract[a,b]

Effect of bonus	12-month continuation			24-month continuation		
Marginal effect[c]						
Percentage-point change	12.4*	12.5*	13.3*	17.5*	17.4*	18.3*
Percentage change	17.4*	17.5*	18.7*	36.0*	35.8*	37.9*
Bonus elasticity[d]	0.01			0.03		
Fixed effects						
Month	X		X	X		X
Year		X			X	
Rating category	X	X		X	X	
Sample size	13,090	13,090	13,093	10,937	10,937	10,937

a. All models also controlled for the following: paygrade, estimated years of service, rating, dependent status, race/ethnicity, gender, education level, age, AFQT, years of service, and unemployment rate in home state.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.
c. The marginal effect is the impact of having a bonus, indicated by a dummy variable, on the predicted probability of completing either the first 12 months or 24 months of the service contract.
d. The bonus elasticity is the predicted percent change in the 12-month or 24-month continuation rate given a 1-percent increase in the bonus amount.

Table 9. Effect of a bonus on the predicted probability of completing the first 12 or 24 months of at least a 6-year prior-service enlistment contract[a b]

Effect of bonus	12-month continuation			24-month continuation		
Marginal effect[c]						
Percentage-point change	15.0*	15.3*	14.8*	15.6*	15.9*	15.3*
Percentage change	21.7*	22.2*	21.4*	33.5*	34.3*	33.0*
Bonus elasticity[d]	0.05			0.11		
Fixed effects						
Month	X		X	X		X
Year		X			X	
Rating category	X	X		X	X	
Sample size	6,688	6,688	6,689	6,181	6,181	6,182

a. All models also include the following covariates: paygrade, estimated years of service, rating, dependent status, race/ethnicity, gender, education level, age, AFQT, years of service, and unemployment rate in home state.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance ** 5% significance and * 1% significance.
c. The marginal effect is the impact of having a bonus, indicated by a dummy variable, on the predicted probability of completing either the first 12 months or 24 months of the service contract.
d. The bonus elasticity is the predicted percent change in the 12-month or 24-month continuation rate given a 1-percent increase in the present discounted bonus amount.

We find an increase among 6-year contracts in continuation from higher bonus levels paid to current bonus recipients. A 1-percent increase in the bonus amount paid to existing recipients is estimated to increase 12- and 24-month completion by 0.05 and 0.11 percent, respectively. In March 2005, the Navy increased bonus amounts so that the maximum bonus amount for a 6-year prior-service enlistment increased from $5,000 to $15,000. This increase represented a 206-percent increase in the expected discounted value of 6-year prior-service enlistment bonuses. Our bonus elasticity of 0.11 suggests that this increase in the bonus amount would result in a 23-percent increase in 24-month continuation behavior of non-prior-service members with 6-year contracts. However, this prediction is a rough approximation since our estimates are appropriate for marginal changes in bonus amounts.

Reenlistment contracts

We find no difference in the continuation rates of reenlisting bonus recipients and nonrecipients. Figure 17 compares the continuation rates over the first 30 months of a 3-year reenlistment contract by bonus recipiency. For our 6-year reenlistment contract, there is no difference in continuation rates over the first 30 months of the contract for those who do and do not participate in the incentive program (see figure 18).

Our regression results are consistent with the continuation rates in figures 17 and 18; we find little effect of reenlistment bonuses on continuation behavior (see tables 10 and 11). Sailors who are reenlisting should have more accurate expectations of whether the Selected Reserve is appropriate for them than Sailors who are just enlisting into the Selected Reserve. Our regression results, as well as the actual continuation rates in figures 15 and 16, show that, on average, Sailors with reenlistment contracts have high continuation rates when compared with enlistment contract continuation rate. In addition, there is less of a difference in continuation behavior between Sailors who do or do not receive a bonus. This suggest that reenlistment contracts should be used more as a tool to induce reenlistment or longer contract lengths than as a tool to increase continuation.

Figure 17. Continuation rates of 3-year reenlistment contracts (in percentages, October 1999 through May 2003)

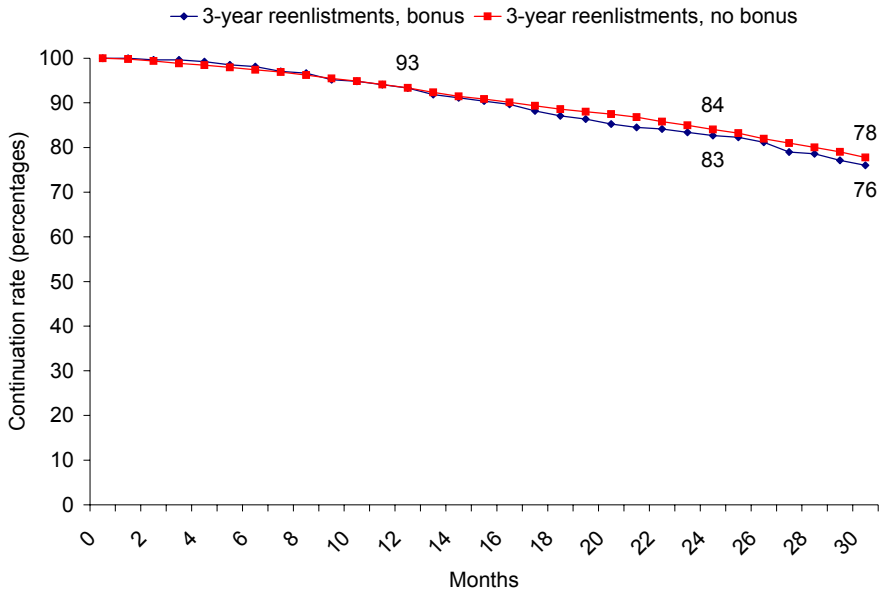


Figure 18. Continuation rates for 6-year reenlistment contracts (in percentages, October 1999 through February 2003)

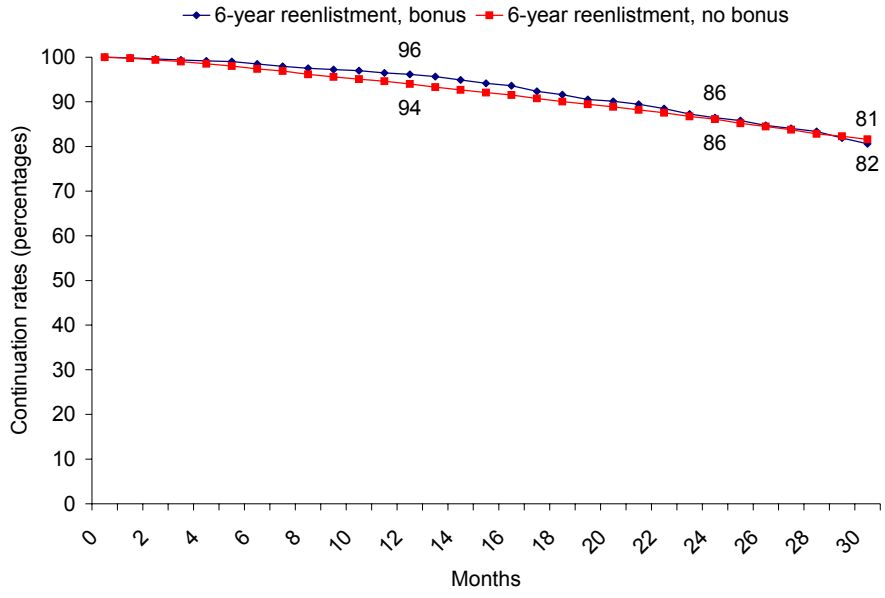


Table 10. Effect of a bonus on predicted probability of completing the first 12 or 24 months of a 3- or 4-year reenlistment contract[a] [b]

Effect of bonus	12-month continuation			24-month continuation		
Marginal effect of bonus[c]						
Percentage-point change	2.53**	2.90**	2.60**	4.34**	4.97**	3.83***
Percentage change	2.74**	3.15**	2.82**	5.27**	6.05**	4.65***
Bonus elasticity[d]	0.00			0.00		
Fixed effects						
Month	X		X	X		X
Year		X			X	
Rating category	X	X		X	X	
Sample size	7,118	7,118	7,124	5,644	5,644	5,644

a. All models also include the following covariates: paygrade, estimated years of service, rating, dependent status, race/ethnicity, gender, education level, age, AFQT, years of service, and unemployment rate in home state.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.
c. The marginal effect is measured from the impact of having a bonus, indicated by a dummy variable, on the predicted probability of completing either the first 12 months or 24 months of the service contract.
d. The bonus elasticity is the predicted percent change in the 12-month or 24-month continuation rate given a 1-percent increase in the present discounted bonus amount.

Table 11. Effect of a bonus on the predicted probability of completing the first 12- or 24-months of at least a 6-year reenlistment contract[a] [b]

Effect of bonus	12-month continuation			24-month continuation		
Marginal effect[c]						
Percentage-point change	3.56*	4.61*	3.54*	4.99*	6.25*	4.65*
Percentage change	3.88*	5.05*	3.86*	6.00*	7.58*	5.61*
Bonus elasticity[d]	0.01			0.01		
Fixed effects						
Month	X		X	X		X
Year		X			X	
Rating category	X	X		X	X	
Sample size	10,108	10,108	10,160	8,570	8,570	8,570

a. All models also include the following covariates: paygrade, estimated years of service, rating, dependent status, race/ethnicity, gender, education level, age, AFQT, years of service, and unemployment rate in home state.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.
c. The marginal effect is measured from the impact of having a bonus, indicated by a dummy variable, on the predicted probability of completing either the first 12 months or 24 months of the service contract.
d. The bonus elasticity is the predicted percent change in the 12-month or 24-month continuation rate given a 1-percent increase in the present discounted bonus amount.

Duration of contract

In this subsection, we present the results from our second method of examining how bonuses influence length of Selected Reserve service. We use a Cox proportional hazard function to estimate the probability a Sailor stays an additional period given that the Sailor was still in the Selected Reserves at the beginning of that period. We estimated the models for each of our five enlistment and reenlistment populations using two specifications. The first specification set a duration spell at 1 month and the second specification set a spell at 3 months. We got similar results for both specifications and report only results for 1-month spells.

We summarize our findings here by presenting the estimated survival density based on our Cox proportional hazard regression for each of our samples (see figures 19 through 23). In each case, we estimate the survival density assuming everyone received a bonus and no one received a bonus. For the enlistment populations, the findings from our duration model estimates reflect the findings we found with our continuation rate models.

Enlistment contracts

Receiving a bonuses increases the chance that a Sailor with an enlistment contract will stay in the Selected Reserves to the end of some given period (1 month in this case) given that he or she was there at the beginning of that period (see figures 19 through 21. This was most prominent in the case of 3-year prior-service enlistments (see figure 20).

Reenlistment contracts

As shown in figures 22 and 23, for reenlistment contracts, bonus recipiency has no influence on the likelihood of staying in the Selected Reserve.

For 6-year contracts, we found that receiving a bonus slightly decreased the chance of staying in the Selected Reserve. The difference between this result and the small but positive results we found from our continuation models may be because the duration model includes more recent data.

Figure 19. Survival density for non-prior-service 6-year sample

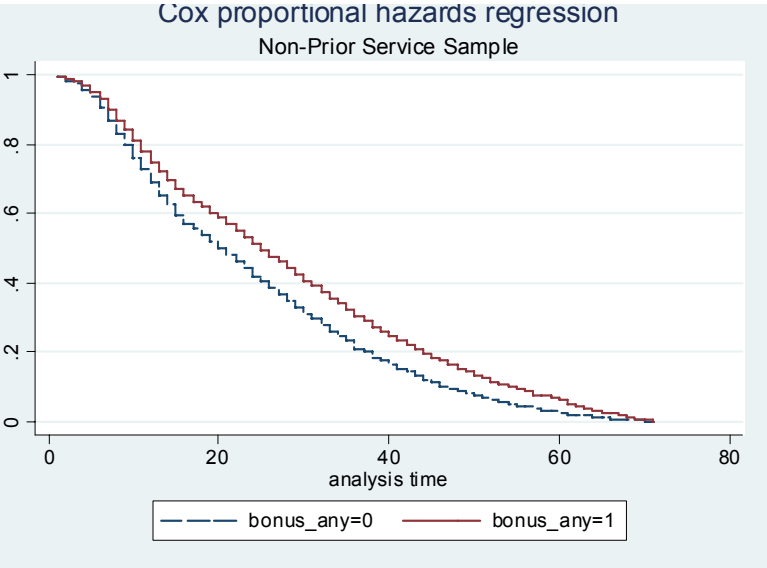


Figure 20. Survival density for 3-year prior-service enlistment sample

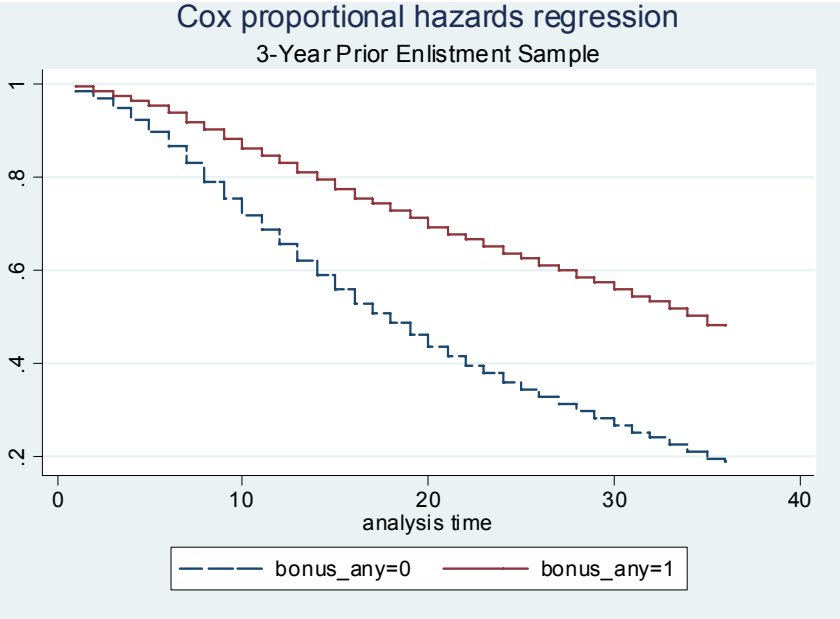


Figure 21. Survival density for 6-year prior-service enlistment sample

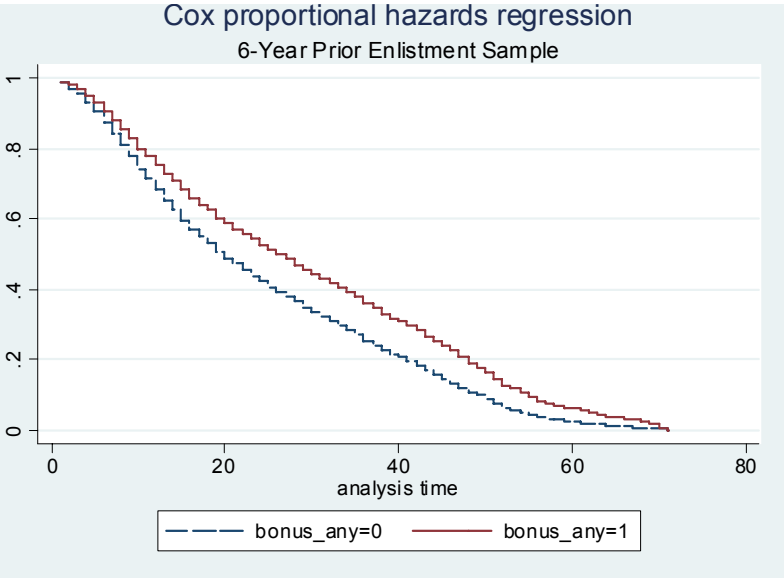


Figure 22. Survival density for 3-year reenlistment sample

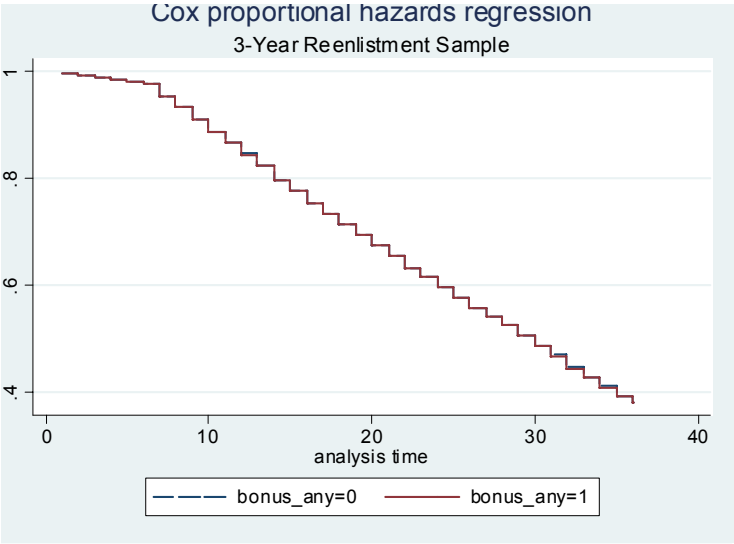
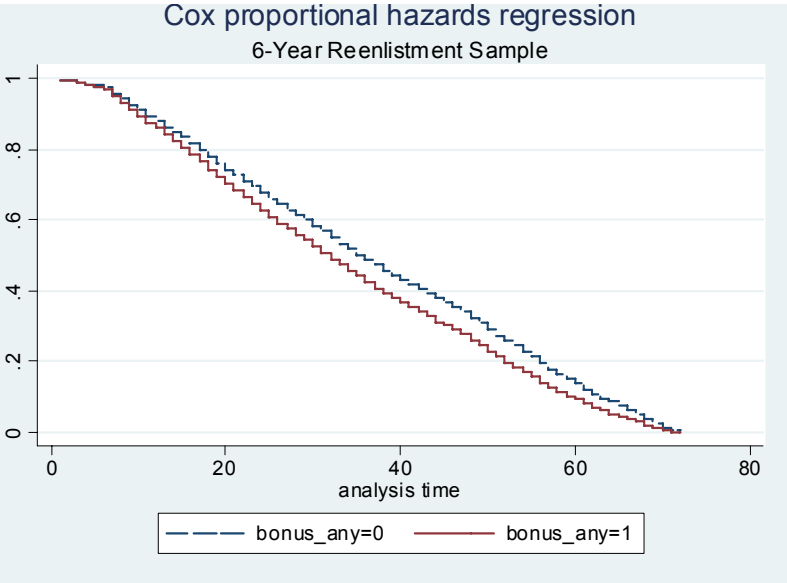


Figure 23. Survival density for 6-year reenlistment sample



Conclusions

To provide a systematic method of determining bonus eligibility and to track the progress of the program, N1 asked the SAG Corporation to develop a decision support tool. This paper documents how we estimated the initial parameters for that tool. In addition to calculating those parameters, our findings have a number of policy implications, which we summarize below.

Influencing reenlistment behavior

We find that bonuses positively influence the decision to reenlist and also influence the decision to obligate for longer contract lengths. Reservists who would have left the Selected Reserves or extended without a bonus are more likely to sign a reenlistment contract and select a 6-year-or-longer contract if a bonus is attached. Holding all else constant, including bonus eligibility, we find that being recently deactivated negatively influences the decision to reenlist. There is less of a negative reenlistment effect of deactivating from an activation spell without any deployments than from an activation spell with deployments, suggesting that activation type matters. Our reenlistment results suggest that bonuses are a compensation tool that could be used to mitigate any negative reenlistment effects of activations.

Increasing the share of non-prior-service accessions

During the time period examined, the Navy has accessed more prior-service members than non-prior-service accessions. This may have happened for numerous reasons. For example, non-prior-service members require a minimum of 84 days of training before being mobilized, and prior-service members are an easier pool from which to recruit. However, changes in the size of active-duty Navy endstrength will influence the pool of Selected Reserve enlistments. Reductions in active-duty endstrength from reenlistment cuts would result in a larger pool of prior-service Sailors in the short term; but,

in the long term, such reductions would decrease the overall pool of qualified prior-service Sailors. Reductions in active-duty endstrength from fewer accessions will reduce the number of qualified prior-service Sailors. If there isn't a decrease in the size of the Selected Reserve that corresponds with any decrease in active duty endstrength, the Navy will have to recruit more non-Navy prior-service and/or non-prior-service accessions than in the past.

Our findings suggest that increasing the pool of non-prior-service accessions will not significantly decrease overall manning levels. First, there is no indication that non-prior-service members are more likely to leave 12 or 24 months into the contract given that the continuation rates of non-prior-service entrants who did not receive a bonus were similar to the rates of prior-service entrants. However, this comparison isn't one to one. Non-prior-service accessions require more training, so at the 12-month point a non-prior-service enlistee may still be in training while a prior-service enlistee is more likely to be available for a deployment. Non-prior-service accessions don't replace prior-service accessions if the Navy is more interested in days available to deploy than the completion of any day of Selected Reserve service.

Second, despite the small portion of non-prior-service accessions who received bonuses, they are statistically responsive to bonuses.[29] Our findings show that non-prior-service accessions who received bonuses had much higher continuation rates than those who did not. Yet, if the Navy were to drastically increase the pool of non-prior-service accessions receiving bonuses, they might not be as highly qualified and/or strictly selected as in the past, in which case the future effect of the bonus may not be as high as we have estimated.

Different continuation patterns

The continuation pattern of Sailors who are just enlisting with the Selected Reserve is different from that of Sailors who are reenlisting. This is true even for prior-service enlistments, suggesting that the expectations of prior-service members aren't matching their reserve

29. We can study continuation behavior only; our results give no indication of whether bonuses would help recruit non-prior-service accessions.

experience. First-term Selected Reserve Sailors do not have complete information on their preferences for reserve service when they enter the Service. If expectations don't match experiences, Sailors may leave the Service, accounting for the continuation rates of prior-service enlistments being lower than those of Sailors in at least their second Selected Reserve obligation.

It is not immediately clear how to interpret these findings. Our findings might or might not suggest that active duty differs from reserve duty. On one hand, expectations are partially formed by active service, so prior-service accessions having lower continuation rates could be a reflection of reserve duty being unlike active duty. On the other hand, reserve duty may be too similar to active duty, which non-prior-service enlistees left for a reason. For example, a Sailor who left the active component to avoid deployments and is immediately deployed with a reserve unit may be less likely to stay. Unfortunately, our continuation models do not control for actual experiences during Active or Selected Reserve service.

In addition to a difference in continuation rates, we find a difference in responsiveness to bonuses. We estimate that reenlistment bonuses do not make as much of a difference for continual service in a reenlistment contract as they do in completing portions of an enlistment contract. Thus, enlistment bonus should be considered as serving the dual purposes of increasing initial participation and encouraging continual participation, whereas reenlistment bonuses should be used to target key personnel to reenlist and obligate for longer contracts. While there are differences in the effects of using reenlistment or enlistment bonuses, the goals of enlistment and reenlistment bonuses must be coordinated to achieve specific strength levels.

Finally, our findings have implications for the payment structure of bonuses, specifically lump-sum bonuses. The main problem with using lump-sum bonuses is the potential for reneging, which in our case would be a Sailor leaving Selected Reserve service. Our findings suggest that lump-sum payments are a better option for reenlistment contracts—where continuation rates are high for non-bonus participants—than for enlistment contracts. Thus, if lump-sum bonus payments are being considered by the Navy, we recommend that a pilot program be targeted first at reenlistment obligations.

Appendix A: Variable definitions and descriptive statistics

Definitions of variables

Table 12 defines the variables, which are grouped into six categories.

Table 12. Variable definitions[a]

Variable	Definition
	BONUS
Bonus eligible	Equals 1 if the member is eligible for a bonus 6 months prior to the end of his or her obligated contract, 0 otherwise
6-month bonus eligibility	Equals 1 if the member is eligible for a bonus at any time in the 6 months leading up to his or her obligated contract, 0 otherwise
Bonus recipient	Equals 1 if the member participates in the bonus program, 0 otherwise
Expected bonus	The discounted amount of bonus over the length of the contract adjusted for inflation
	CAREER
E5-E6	Equals 1 if paygrades E5-E6, 0 otherwise
E7-E9	Equals 1 if paygrades E7-E9, 0 otherwise
Years of service	Years of military service based on the pay entry based date
	ACTIVATION EXPERIENCE
Recently deactivated, not deployed	Equals 1 if the member was deactivated in the past 12 months from an activation spell that didn't include any deployments, 0 otherwise
Recently deactivated, deployed	Equals 1 if the member was deactivated in the past 12 months from an activation spell that did include any deployments, 0 otherwise
Other activation experience	Equals 1 if the member had some activation experience in the past 12 months that does not match the last two categories, 0 otherwise
Censor	Equals 1 if there is a break in the activation information caused by a break in Selected Reserve service, 0 otherwise
	PERSONAL CHARACTERISTICS
High school dropout	Equals 1 if member did not receive a high school diploma or HS degree equivalent, 0 otherwise
High school equivalency	Equals 1 if member received a HS degree equivalent (ex. a GED), 0 otherwise

Table 12. Variable definitions[a] (continued)

Variable	Definition
Associate degree	Equals 1 if member received an associates degree, 0 otherwise
Bachelor degree	Equals 1 if member received a bachelor degree, nursing degree, or had postgraduate degree experience, 0 otherwise
Education missing	Equal 1 if the education field was missing, 0 otherwise
Upper mental group	Equals 1 if AFQT score > 50, 0 otherwise
Male	Equals 1 if male, 0 otherwise
Black	Equals 1 if black, 0 otherwise
Asian Pacific/Islander	Equals 1 if asian, 0 otherwise
Hispanic	Equals 1 if hispanic, 0 otherwise
Other race or ethnicity	Equals 1 if neither white, black, Asian Pacific/Islander, or Hispanic, 0 otherwise
Dependents	Equals 1 if any dependents, 0 otherwise
Age 26 to 30	Equals 1 if age 26 to 30, 0 otherwise
Age 31 to 35	Equals 1 if age 31 to 35, 0 otherwise
Age 36 to 40	Equals 1 if age 36 to 40, 0 otherwise
Age 41 up	Equals 1 if age 41 or older, 0 otherwise
Age missing	Equals 1 if age field is missing, 0 otherwise
ECONOMIC	
Unemployment rate	Unemployment rate in home state
RATING CATEGORIES	
Seabee	Equals 1 if rating falls in Seabee community, 0 otherwise
Surface Operations	Equals 1 if rating falls in Surface Operations community, 0 otherwise
Surface Combat Systems Operations	Equals 1 if rating falls in Surface Combat Systems Operations Community, 0 otherwise
Aviation	Equals 1 if rating falls in Aviation community, 0 otherwise
Administration	Equals 1 if rating falls in administration community, 0 otherwise
Nuclear	Equals 1 if rating falls in the Nuclear community, 0 otherwise
Force Health Protection	Equals 1 if rating falls in health care community, 0 otherwise
Intelligence	Equals 1 if rating falls in intelligence community, 0 otherwise
Cryptology	Equals 1 if rating falls in cryptology community, 0 otherwise
Security	Equals 1 if rating falls in security community, 0 otherwise
Submarine	Equals 1 if rating falls in Submarine community, 0 otherwise
Surface Engineering	Equals 1 if rating falls in Surface Engineering community, 0 otherwise
Supply	Equals 1 if rating falls in Supply community, 0 otherwise
Other category	Equals 1 if rating field is missing or rating does not appear in any of the other rating categories, 0 otherwise

a. We measure time-dependent variables at the time of gain, unless we note otherwise.

Rating category classification

This subsection lists the Navy enlisted ratings found in each occupational group used in our analysis. To the best of our ability, given the rating and NEC variables in the RCCPDS, our classification categories reflect ratings grouped by community. Unfortunately, the RCCPDS data do not have information on submarine classification; for that reason, the Submarine community includes only the STS rating.

1. Administration
   - — Draftsman Illustrator (DM), Instrumentman (IM), Journalist (JO), Lithographer (LI), Legalman (LN), (NC), Photographer's Mate (PH), Patternmaker (PM), Personnelman (PN), (PS), Religious Program Specialist (RP), Musician (MU), Yeoman (YN)
2. Aviation
   - — Aviation Boatswain's Mate - Launching and Recovery Equipment, Fuels, Aircraft Handling (AB, ABE, ABF, ABH), Air Traffic Controller (AC), Aviation Machinist's Mate (AD), Aviation Electrician's Mate (AE), Aircraft Maintenceman (AF), Aerographer's Mate (AG), Structures (AM, AME, AMH, AMS), Aviation Technology (AN), Aviation Ordnanceman (AO), Aviation Support Equipment Technician - Electrical Hydraulics and Structures, Mechanical (AS, ASE, ASH, ASM), Aviation Storekeeper (AK), Aviation Electronics Technician (AT), (AV), Aviation Antisubmarine Warfare Operator (AW), Aviation Maintenance Administrationman (AZ), Parachute Rigor (PR)
3. Cryptology
   - — Cryptologic Technician - Administration, Interpreter/Linguist, Maintenance, Communications, Collection, Technical (CTA, CTI, CTM, CTN, CTO, CTR, CTT)
4. Force Health Protection
   - — Health Science Technology (DN), Dental Technician (DT), Hospital Corpsman (HM), Health Science Technology (HN)

5. Naval Intelligence

   — Intelligence Specialist (IS)

6. Nuclear

   — Machinist's Mate, Nuclear (MM), Electronics Technology, Nuclear (ET), Electrician's Mate, Nuclear (EM)

7. Seabees

   — Builder (BU), Construction Electrician (CE), Construction Mechanic (CM), Constructionman (CN), Construction Technology & Management (CU), Engineering Aide (EA), Equipment Operator (EO, EQ), Steelworker (SW), Utilitiesman (UC, UT)

8. Security

   — Master-at-Arms (MA)

9. Submarine

   — Sonar Technician, Submarine (STS)

10. Surface Combat Systems Operations

    — Electrician's Technology (ET), Electronics Warfare Technician (EW), Fire Control Technician (FC), Fire Control Technician (FT), Fireman apprentice (FN), Electrical Mechanical Technology (GM), Molder (ML, MN), Missile Technician (MT), Sonar Technician, Surface (STG), Electrical Mechanical Technology (TM)

11. Surface Operations

    — Boatswain Mate (BM), Boiler Technician (BT), Data Systems Technician (DS), Information Systems Technician (IT), Operations Specialist (OS), Quartermaster (QM), Signalman (SM), Seaman (SN)

12. Surface Engineering

    — Damage Controlman (DC), Electrician's Mate, non-nuclear (EM), Engineman (EN), Mechanical (GS, GSE, GSM), Hull Maintenance Technician (HT), Interior Communications

Technician (IC), Machinery Repairman (MR), Opticalman (OM), Machinist's Mate, non-nuclear (MM)

13. Supply

    — Culinary Specialist (CS), Disbursing Clerk (DK), Postal Clerk (PC), Ship's Servicemen (SH), Storekeeper (SK).

Descriptive statistics

Tables 13 through 17 provide descriptive statistics for Sailors eligible for reenlistment, with 6-year non-prior-service enlistment contracts, with 3- or 6-year prior-service enlistment contracts, and 3- or 6-year reenlistment contracts. For enlistments and reenlistments (tables 14 through 17), we present descriptive statistics for the months corresponding to our 12- and 24-month continuation models and duration models.

Table 13. Descriptive statistics, reenlistment-eligible sample for October 1999 through September 2004

Variable	Mean	Standard deviation
Bonus eligible	0.172	0.377
6-month bonus eligibility	0.2292	0.420
Old non-prior-service contract	0.002	0.043
Old prior-service contract	0.084	0.277
Old extension contract	0.101	0.301
Old reenlistment contract	0.107	0.309
Years of service	13.835	5.532
Home state unemployment rate	4.962	1.447
E5-E6	0.661	0.473
E7-E9	0.116	0.320
High school dropout	0.005	0.070
High school equivalency	0.0795	0.270
Associate degree	0.1605	0.367
Bachelor degree	0.1325	0.339
Education missing	0.0175	0.130
Upper mental group	0.2445	0.430
Male	0.821	0.384
Black	0.160	0.367
Asian Pacific/Islander	0.045	0.207
Hispanic	0.08	0.272
Other race or ethnicity	0.065	0.246
Dependents	0.698	0.459
Age 26 to 30	0.188	0.390
Age 31 to 35	0.236	0.425
Age 36 to 40	0.237	0.425
Age 41 up	0.339	0.474
Age missing	0.000	0.008
Seabee	0.156	0.363
Surface Operations	0.162	0.369
Surface Combat Systems Operations	0.089	0.285
Administration	0.073	0.260
Nuclear	0.004	0.061
Force Health Protection	0.113	0.316
Intelligence	0.0179	0.132
Cryptology	0.012	0.108
Security	0.014	0.117
Submarine	0.002	0.045
Surface Engineering	0.099	0.299
Supply	0.125	0.331
Other category	0.001	0.033
Number of observations	52,285	

Table 14. Descriptive statistics, non-prior-service 6-year contracts

	Oct. 1999 - Dec. 2004 (12-month continuation)		Oct. 1999 - Dec. 2003 (24-month continuation)	
Variable	Mean	Standard deviation	Mean	Standard deviation
Bonus recipient	0.007	0.084	0.006	0.075
Exp. bonus amount	30.83	369.87	25.89	341.85
Home state unemployment rate	5.34	1.32	5.31	1.34
E5-E6	0.099	0.299	0.109	0.312
E7-E9	0.000	0.000	0.000	0.000
High school dropout	0.030	0.170	0.030	0.172
High school equivalency	0.020	0.141	0.020	0.141
Associate degree	0.080	0.272	0.081	0.273
Bachelor degree	0.161	0.368	0.163	0.369
Education missing	0.002	0.040	0.002	0.042
Upper mental group	0.005	0.700	0.002	0.044
Male	0.691	0.462	0.685	0.464
Black	0.196	0.397	0.195	0.396
Asian Pacific/Islander	0.067	0.250	0.067	0.250
Hispanic	0.125	0.331	0.125	0.330
Other race or ethnicity	0.085	0.279	0.086	0.280
Dependents	0.504	0.499	0.504	0.500
Age 26 to 30	0.335	0.472	0.346	0.476
Age 31 to 35	0.267	0.442	0.272	0.445
Age 36 to 40	0.157	0.364	0.156	0.376
Age 41 up	0.004	0.066	0.004	0.061
Age missing	0.000	0.018	0.000	0.017
Administration	0.079	0.270	0.084	0.278
Cryptology	0.003	0.058	0.003	0.057
Health Protection	0.071	0.256	0.071	0.257
Naval Intelligence	0.038	0.190	0.040	0.196
Nuclear	0.000	0.000	0.000	0.000
Seabees	0.114	0.318	0.120	0.325
Security	0.029	0.167	0.023	0.149
Submarine	0.000	0.014	0.000	0.016
Surface Combat Systems Operations	0.063	0.243	0.061	0.239
Surface Operations	0.228	0.420	0.209	0.407
Surface Engineering	0.034	0.182	0.035	0.183
Supply	0.175	0.380	0.186	0.389
Other rating category	0.016	0.124	0.011	0.105
Number of observations	19,344		17,358	

Table 15. Descriptive statistics, prior-service enlistment contracts

	3-year contracts		6-year contracts	
	10/99 - 12/04 (12-month continuation)	10/99 - 12/03 (24-month continuation)	10/99- 12/04 (12-month continuation)	10/99 - 12/03 (24-month continuation)
Variable	Mean (std. dev.)	Mean (std. dev.)	Mean (std. dev.)	Mean (std. dev.)
Bonus recipient	0.075 (0.263)	0.086 (0.280)	0.345 (0.475)	0.365 (0.481)
Exp. bonus amount	198.91 (757.8)	209.37 (684.12)	1574.5 (2170)	1667.38 (2200.9)
Home state unemployment rate	5.161 (1.25)	5.08 (1.27)	5.05 (1.24)	5.01 (1.25)
Years of service	8.47 (3.46)	8.51 (3.47)	8.09 (3.73)	8.13 (3.70)
E5-E6	0.428 (0.495)	0.453 (0.498)	0.371 (0.483)	0.373 (0.484)
E7-E9	0.003 (0.053)	0.003 (0.055)	0.007 (0.084)	0.007 (0.085)
High school dropout	0.006 (0.078)	0.006 (0.080)	0.005 (0.074)	0.005 (0.072)
High school equivalency	0.013 (0.111)	0.014 (0.117)	0.017 (0.130)	0.017 (0.128)
Associate degree	0.051 (0.220)	0.050 (0.218)	0.055 (0.229)	0.054 (0.226)
Bachelor degree	0.070 (0.255)	0.069 (0.253)	0.062 (0.242)	0.061 (0.240)
Education missing	0.005 (0.068)	0.005 (0.073)	0.005 (0.069)	0.005 (0.072)
Upper mental group	0.016 (0.125)	0.018 (0.134)	0.026 (0.160)	0.028 (0.166)
Male	0.890 (0.313)	0.892 (0.311)	0.851 (0.356)	0.855 (0.355)
Black	0.184 (0.388)	0.172 (0.377)	0.176 (0.380)	0.170 (0.376)
Asian Pacific/Islander	0.045 (0.206)	0.038 (0.192)	0.034 (0.181)	0.032 (0.175)
Hispanic	0.089 (0.284)	0.081 (0.273)	0.075 (0.263)	0.071 (0.257)
Other race or ethnicity	0.101 (0.302)	0.104 (0.305)	0.106 (0.308)	0.105 (0.307)
Dependents	0.601 (0.490)	0.594 (0.491)	0.600 (0.490)	0.595 (0.491)
Age 26 to 30	0.302 (0.459)	0.301 (0.459)	0.339 (0.473)	0.344 (0.475)

Table 15. Descriptive statistics, prior-service enlistment contracts (continued)

	3-year contracts		6-year contracts	
	10/99 - 12/04 (12-month continuation)	10/99 - 12/03 (24-month continuation)	10/99- 12/04 (12-month continuation)	10/99 - 12/03 (24-month |continuation)
Variable	Mean (std. dev.)	Mean (std. dev.)	Mean (std. dev.)	Mean (std. dev.)
Age 31 to 35	0.332 (0.471)	0.337 (0.473)	0.322 (0.468)	0.326 (0.469)
Age 36 to 40	0.207 (0.406)	0.209 (0.407)	0.181 (0.385)	0.179 (0.383)
Age 41 up	0.124 (0.330)	0.125 (0.331)	0.107 (0.309)	0.105 (0.307)
Age missing	0.000 (0.021)	0.001 (0.023)	0.000 (0.021)	0.00 (0.022)
Administration	0.060 (0.237)	0.061 (0.239)	0.049 (0.215)	0.048 (0.215)
Cryptology	0.011 (0.102)	0.010 (0.099)	0.028 (0.165)	0.028 (0.164)
Health Protection	0.087 (0.281)	0.085 (0.278)	0.129 (0.335)	0.128 (0.334)
Naval Intelligence	0.023 (0.148)	0.024 (0.153)	0.028 (0.164)	0.028 (0.166)
Nuclear	0.000 (0.015)	0.000 (0.017)	0.000 (0.012)	0.000 (0.013)
Seabees	0.231 (0.421)	0.230 (0.421)	0.237 (0.425)	0.243 (0.430)
Security	0.037 (0.189)	0.030 (0.170)	0.027 (0.162)	0.022 (0.145)
Submarine	0.003 (0.055)	0.003 (0.058)	0.003 (0.056)	0.003 (0.054)
Surface Combat Systems Operations	0.070 (0.255)	0.072 (0.259)	0.070 (0.255)	0.069 (0.254)
Surface Operations	0.152 (0.360)	0.155 (0.362)	0.142 (0.350)	0.140 (0.347)
Surface Engineering	0.092 (0.290	0.092 (0.289)	0.073 (0.261)	0.072 (0.258)
Supply	0.107 (0.309)	0.109 (0.312)	0.098 (0.298)	0.100 (0.301)
Other rating category	0.003 (0.060)	0.004 (0.064)	0.008 (0.089)	0.009 (0.092)
Number of observations	13,093	10,937	6,692	6,182

Table 16. Descriptive statistics, reenlistment contracts

	3-year contracts		6-year contracts	
	10/99 - 12/04 (12-month continuation)	10/99 - 12/03 (24-month continuation)	10/99 - 12/04 (12-month continuation)	10/99 - 12/03 (24-month continuation)
Variable	Mean (std. dev.)	Mean (std. dev.)	Mean (std. dev.)	Mean (std. dev.)
Bonus recipient	0.057 (0.232)	0.057 (0.232)	0.194 (0.395)	0.199 (0.399)
Exp. bonus amount	137.12 (558.8)	139.57 (566.72)	880.59 (1795.8)	908.27 (1825.12)
Home state unemployment rate	5.00 (1.38)	4.91 (1.40)	4.88 (1.38)	4.78 (1.38)
Years of service	14.98 (4.85)	14.93 (4.86)	13.50 (4.71)	13.46 (4.68)
E5-E6	0.718 (0.450)	0.718 (0.450)	0.679 (0.467)	0.677 (0.468)
E7-E9	0.159 (0.366)	0.152 (0.360)	0.121 (0.326)	0.116 (0.320)
High school dropout	0.002 (0.046)	0.002 (0.042)	0.002 (0.050)	0.002 (0.047)
High school equivalency	0.087 (0.281)	0.087 (0.282)	0.088 (0.282)	0.090 (0.286)
Associate degree	0.189 (0.391)	0.190 (0.393)	0.177 (0.382)	0.183 (0.387)
Bachelor degree	0.151 (0.358)	0.156 (0.363)	0.146 (0.353)	0.148 (0.356)
Education missing	0.005 (0.068)	0.006 (0.075)	0.003 (0.059)	0004 (0.064)
Upper mental group	0.265 (0.441)	0.275 (0.446)	0.282 (0.450)	0.294 (0.456)
Male	0.825 (0.380)	0.822 (0.383)	0.823 (0.381)	0.825 (0.380)
Black	0.150 (0.357)	0.149 (0.356)	0.127 (0.334)	0.128 (0.334)
Asian Pacific/Islander	0.039 (0.194)	0.036 (0.186)	0.038 (0.192)	0.036 (0.186)
Hispanic	0.075 (0.266)	0.073 (0.260)	0.081 (0.274)	0.079 (0.269)
Other race or ethnicity	0.047 (0.212)	0.047 (0.212)	0.052 (0.221)	0.050 (0.218)
Dependents	0.752 (0.432)	0.744 (0.436)	0.740 (0.439)	0.735 (0.441)
Age 26 to 30	0.135 (0.339)	0.143 (0.350)	0.163 (0.370)	0.170 (0.375)

Table 16. Descriptive statistics, reenlistment contracts (continued)

	3-year contracts		6-year contracts	
	10/99 - 12/04 (12-month continuation)	10/99 - 12/03 (24-month continuation)	10/99 - 12/04 (12-month continuation)	10/99 - 12/03 (24-month continuation)
Variable	Mean (std. dev.)	Mean (std. dev.)	Mean (std. dev.)	Mean (std. dev.)
Age 31 to 35	0.233 (0.423)	0.233 (0.423)	0.267 (0.442)	0.270 (0.443)
Age 36 to 40	0.280 (0.449)	0.273 (0.446)	0.245 (0.430)	0.244 (0.429)
Age 41 up	0.388 (0.487)	0.383 (0.486)	0.341 (0.474)	0.333 (0.471)
Age missing	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Administration	0.070 (0.255)	0.070 (0.255)	0.067 (0.250)	0.066 (0.248)
Cryptology	0.014 (0.117)	0.012 (0.111)	0.016 (0.126)	0.015 (0.123)
Health Protection	0.105 (0.307)	0.109 (0.312)	0.100 (0.300)	0.100 (0.300)
Naval Intelligence	0.018 (0.132)	0.015 (0.121)	0.031 (0.174)	0.032 (0.177)
Nuclear	0.002 (0.049)	0.002 (0.048)	0.003 (0.059)	0.004 (0.059)
Seabees	0.147 (0.354)	0.147 (0.352)	0.184 (0.388)	0.189 (0.392)
Security	0.015 (0.120)	0.012 (0.110)	0.022 (0.147)	0.019 (0.135)
Submarine	0.002 (0.039)	0.001 (0.035)	0.002 (0.041)	0.002 (0.041)
Surface Combat Systems Operations	0.090 (0.287)	0.094 (0.292)	0.084 (0.278)	0.085 (0.280)
Surface Operations	0.165 (0.371)	0.163 (0.369)	0.159 (0.366)	0.158 (0.365)
Surface Engineering	0.101 (0.302)	0.104 (0.306)	0.095 (0.293)	0.095 (0.294)
Supply	0.137 (0.344)	0.134 (0.340)	0.128 (0.334)	0.129 (0.335)
Other rating category	0.000 (0.029)	0.001 (0.033)	0.000 (0.026)	0.001 (0.029)
Number of observations	7,124	5,644	10,160	8,570

Table 17. Descriptive statistics for Oct. '99-March '05 (duration model period)

Variable	Non-prior service Mean (std. dev.)	3-year enlistments Mean (std. dev.)	6-year enlistments Mean (std. dev.)	3-year reenlistments Mean (std. dev.)	6-year reenlistments Mean (std. dev.)
Bonus recipient	0.007 (0.083)	0.0731 (0.260)	0.341 (0.474)	0.056 (0.230)	0.192 (0.394)
Exp. bonus amount	30.078 (365.274)	194.468 (749.684)	1508.851 (2145.442)	133.338 (586.877)	841.400 (1758.428)
Years of service		8.458 (3.472)	8.072 (3.745)	15.003 (4.846)	13.510 (4.710)
E1-E4	0.904 (0.295)	0.571 (0.495)	0.624 (0.484)	0.119 (0.323)	0.196 (0.397)
E5-E6	0.096 (0.295)	0.426 (0.495)	0.369 (0.482)	0.713 (0.453)	0.675 (0.468)
High school dropout	0.029 (0.169)	0.006 (0.078)	0.006 (0.076)	0.002 (0.047)	0.003 (0.050)
High school equivalency	0.021 (0.144)	0.013 (0.112)	0.018 (0.132)	0.085 (0.279)	0.086 (0.281)
Associate degree	0.080 (0.271)	0.051 (0.220)	0.056 (0.229)	0.187 (0.390)	0.175 (0.380)
Bachelor degree	0.160 (0.367)	0.070 (0.255)	0.063 (0.242)	0.149 (0.356)	0.144 (0.351)
Education missing	0.002 (0.039)	0.005 (0.067)	0.005 (0.068)	0.004 (0.066)	0.003 (0.057)
Upper mental group	0.006 (0.074)	0.016 (0.124)	0.028 (0.166)	0.270 (0.444)	0.285 (0.451)
Male	0.692 (0.462)	0.889 (0.314)	0.849 (0.358)	0.817 (0.386)	0.817 (0.386)
Black	0.194 (0.396)	0.184 (0.387)	0.177 (0.381)	0.149 (0.356)	0.127 (0.333)
Asian Pacific/Islander	0.067 (0.250)	0.045 (0.208)	0.034 (0.181)	0.039 (0.194)	0.039 (0.193)
Hispanic	0.125 (0.330)	0.089 (0.285)	0.075 (0.264)	0.077 (0.267)	0.082 (0.275)
Other race or ethnicity	0.084 (0.278)	0.100 (0.300)	0.105 (0.306)	0.048 (0.213)	0.052 (0.223)
Dependents	0.503 (0.500)	0.602 (0.490)	0.600 (0.490)	0.745 (0.436)	0.735 (0.441)
Age 26 to 30	0.331 (0.471)	0.303 (0.460)	0.337 (0.473)	0.128 (0.334)	0.160 (0.366)
Age 31 to 35	0.263 (0.440)	0.330 (0.470)	0.320 (0.467)	0.231 (0.421)	0.264 (0.441)
Age 36 to 40	0.157 (0.364)	0.206 (0.405)	0.179 (0.384)	0.278 (0.448)	0.246 (0.431)

Table 17. Descriptive statistics for Oct. '99-March '05 (duration model period) (continued)

Variable	Non-prior service Mean (std. dev.)	3-year enlistments Mean (std. dev.)	6-year enlistments Mean (std. dev.)	3-year reenlistments Mean (std. dev.)	6-year reenlistments Mean (std. dev.)
Age 41 up	0.005 (0.067)	0.124 (0.330)	0.107 (0.309)	0.386 (0.487)	0.340 (0.474)
Age missing	0.000 (0.017)	0.001 (0.021)	0.000 (0.021)	0.000 (0.000)	0.000 (0.000)
Administration	0.079 (0.270)	0.060 (0.237)	0.050 (0.216)	0.071 (0.256)	0.067 (0.250)
Cryptology	0.004 (0.059)	0.011 (0.103)	0.028 (0.165)	0.001 (0.118)	0.016 (0.124)
Health Protection	0.069 (0.254)	0.087 (0.281)	0.128 (0.334)	0.102 (0.303)	0.098 (0.297)
Naval Intelligence	0.037 (0.189)	0.022 (0.148)	0.027 (0.163)	0.019 (0.135)	0.031 (0.173)
Nuclear	0.000 (0.000)	0.000 (0.015)	0.000 (0.012)	0.002 (0.049)	0.003 (0.059)
Seabees	0.113 (0.317)	0 0.231 (0.421)	0.236 (0.425)	0.144 (0.351)	0.181 (0.385)
Security	0.029 (0.167)	0.037 (0.190)	0.027 (0.162)	0.015 (0.121)	0.023 (0.150)
Submarine	0.000 (0.014)	0.003 (0.056)	0.003 (0.055)	0.002 (0.040)	0.002 (0.041)
Surface Combat Systems Operations	0.063 (0.242)	0.071 (0.257)	0.070 (0.255)	0.091 (0.287)	0.084 (0.277)
Surface Operations	0.224 (0.417)	0.151 (0.358)	0.143 (0.350)	0.162 (0.369)	0.157 (0.364)
Surface Engineering	0.034 (0.180)	0.092 (0.289)	0.072 (0.259)	0.100 (0.300)	0.0946 (0.293)
Supply	0.173 (0.378)	0.107 (0.309)	0.097 (0.296)	0.138 (0.345)	0.129 (0.335)
Other rating category	0.018 (0.132)	0.004 (0.060)	0.011 (0.106)	0.001 (0.028)	0.001 (0.026)
Number of observations	19,969	13,462	6,816	7,585	10,637

Appendix B: Reenlistment findings

Reenlistment and length of contract multinomial logit regressions

We first estimate two binary discrete choice models of the decision to leave or stay, where we define stay as either reenlist or reenlist / extend (see tables 18 and 19). For each model, we estimated the effect of bonus eligibility using two different definitions: bonus eligibility 6 months prior to end of contract or eligibility at any time in the 6 months leading up to the end of a contract. Using the latter definition of bonus eligibility, we then looked at whether including activation data influenced the estimated effect of bonuses on reenlisting (see table 20) and whether activations influenced the reenlistment decision (see table 21). We then look at simultaneous decisions to leave, stay and reenlist, or stay and extend using a multinomial logit model to estimate the effect of bonuses (see table 22).

Table 18. Logit estimates of the effect of bonus eligibility on the decision to leave versus reenlisting or extending/reenlisting[a,b]

	Probability of reenlisting	Probability of reenlisting or extending
Variable	Coefficient (Std. Error) [Marginal Effect]	Coefficient (Std. Error) [Marginal Effect]
Bonus eligibility indicator	0.187* (0.027) [10.8]	0.0237--- (0.0275) [0.85]
Number of observations	52,280	52,280

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, monthly fixed effects and rating category fixed effects.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.

Table 19. Logit estimates of the effect of 6 month bonus eligibility on the decision to leave versus reenlisting or extending/reenlisting[a,b]

Variable	Probability of reenlisting Coefficient (Std. Error) [Marginal Effect]	Probability of reenlisting or extending Coefficient (Std. Error) [Marginal Effect]
6-month bonus eligibility indicator	0.277* (0.025) [16.3]	0.136* (0.025) [4.85]
Number of observations	52,280	52,280

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, rating category fixed effects, and monthly fixed effects.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.

Table 20. Logit estimates of the effect of 6 month bonus eligibility on the decision to reenlist, with and without recent deactivation data[a]

Variable	Probability of reenlisting Coefficient[b] (Std. Error) [Marginal Effect]	Probability of reenlisting Coefficient (Std. Error) [Marginal Effect]
6-month bonus eligibility indicator	0.1478* (0.0376) [8.72]	0.1552* (0.0393) [8.41]
Recently deactivated variables included	No	Yes
Number of observations	26,671	26,671

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, rating category fixed effects, and monthly fixed effects.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.

Table 21. Effect of activation and deployments experiences in the past 12 months on predicted reenlistment rates[a,b]

Measure	Effect on reenlistment rates	
	Effect of recent deactivation, no deployment	
Coefficient	-0.7139*	-0.1826*
(standard error)	(0.0509)	(0.059)
Marginal effect		
Percentage-point change	-14.5	-14.4
Percentage change	-34.4	-34.3
	Effect of recent deactivation, deployment	
Coefficient	-0.195*	-0.1826*
(standard error)	(0.0595)	(0.0593)
Marginal effect		
Percentage-point change	-4.16	-3.90
Percentage change	-9.87	-9.27
	Effect of other activation experience	
Coefficient	-1.188*	-1.179*
(standard error)	(0.0661)	(0.066)
Marginal effect		
Percentage-point change	-22.45	-22.32
Percentage change	-53.23	-52.95
6-month bonus eligibility dummy	Yes	No
Sample size	26,671	26,671

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, monthly fixed effects, and rating category fixed effects.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.

Table 22. Multinomial logit estimates of the decision to leave, stay and reenlist, or stay and extend (reference category is stay and reenlist)[a,b]

	Probability leave	Probability extend
Variable	Coefficient (std. error)	Coefficient (std. error)
6-month bonus eligibility indicator	-0.251* (0.028)	-0.329* (0.033)
Number of observations	52,281	52,281

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, monthly fixed effects, and rating category fixed effects.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.

In the context of staying, we then look at the decision to sign a contract over 6 years. We use a multinomial logit model to estimate the effect of bonus eligibility on the decision to leave, stay and obligate for 3 or 4 years, or stay and obligate for at least 6 years (see table 23). Full regression results are available from the author on request.

Table 23. Multinomial logit estimates of the decision to leave, stay and obligate for less than 6 years, or stay and obligate for 6 years (reference category is stay and obligate for 3 or 4 years)[a,b]

	Probability leave	Probability stay and obligate for at least 6-year contract
Variable	Coefficient standard error	Coefficient standard error
6 month bonus eligibility indicator	0.0631** (0.0275)	0.671* (0.0340)
Number of observations	52,281	52,281

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, monthly fixed effects, and rating category fixed effects.
b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.

Appendix C: Continuation results

In this section, we model 12- and 24- month continuation probabilities in a multivariate framework. Because the dependent variable is binary, we use a logit model, discussed in the text. For tables 23, 25, 27, 29 and 31, we report the effect of receiving a bonus on continuation behavior. In tables 24, 26, 28, 30, and 32 we present the effect of expected bonus amounts on continuation behavior. Full regression results are available from the author.

Table 24. 12- and 24-month continuation model estimates, 6-year non-prior-service enlistments[a,b]

	12-month continuation			24-month continuation		
Variable	Coefficient (std. error) [Marginal effect]			Coefficient (std. error) [Marginal effect]		
Bonus recipiency	0.581***	0.659**	0.559***	0.601**	0.645*	0.607**
	(0.315)	(0.316)	(0.313)	(0.250)	(0.250)	(0.248)
	[11.8]	[13.2]	[8.63]	[25.8]	[27.9]	[26.3]
Fixed effects						
Month	YES	NO	YES	YES	NO	YES
Year	NO	YES	NO	NO	YES	NO
Rating	YES	YES	NO	YES	YES	NO
Observations	19,329	19,340	19,333	17,354	17,354	17,358

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, years of service and unemployment rate in home state.

b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance. The marginal effect is the percent change in predicted continuation rates from bonus recipiency.

Table 25. 12- and 24-month continuation model estimates, 6-year non-prior-service enlistments[a,b]

Variable	12-month continuation		24-month continuation	
	Coefficient (standard error)	Elasticity	Coefficient (standard error)	Elasticity
Expected bonus amount	0.0001***	0.000	0.0001**	0.001
	(0.0001)		(0.0001)	
Observations	19,329		17,354	

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, monthly fixed effects, and rating category fixed effects.

b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance. The elasticity is the predicted percent change in continuation rates given a 1-percent increase in the present discounted bonus amount.

Table 26. 12- and 24-month continuation model estimates, 3-year prior-service enlistment contracts[a,b]

Variable	12-month continuation			24-month continuation		
	Coefficient (std. error) [Marginal effect]			Coefficient (std. error) [Marginal effect]		
Bonus recipiency	0.761*	0.764*	0.824*	0.776*	0.765*	0.813*
	(0.093)	(0.092)	(0.091)	(0.077)	(0.076)	(0.075)
	[17.4]	[17.5]	[18.7]	[36.0]	[35.8]	[37.9]
Fixed effects						
Month	YES	NO	YES	YES	NO	YES
Year	NO	YES	NO	NO	YES	NO
Rating	YES	YES	NO	YES	YES	NO
Observations	13,090	13,090	13,093	10,937	10,937	10,937

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, years of service and unemployment rate in home state.

b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.The marginal effect is the percent change in predicted continuation rates from bonus recipiency.

Table 27. 12- and 24-month continuation model estimates, 3-year prior-service enlistment contracts[a,b]

	12-month continuation		24-month continuation	
Variable	Coefficient (standard error)	Elasticity	Coefficient (standard error)	Elasticity
Expected bonus amount	0.0003* (0.000)	0.010	0.0003* (0.0000)	0.029
Observations	13,090		10,937	

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, monthly fixed effects, and rating category fixed effects.

b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.The elasticity is the predicted percent change in continuation rates given a 1-percent increase in the present discounted bonus amount.

Table 28. 12- and 24-month continuation model estimates, 6-year prior-service enlistment contracts[a,b]

	12-month continuation			24-month continuation		
Variable	Coefficient (std. error) [Marginal effect]			Coefficient (std. error) [Marginal effect]		
Bonus recipiency	0.899* (0.076) [21.7]	0.908* (0.073) [22.2]	0.888* (0.073) [21.5]	0.673* (0.065) [33.5]	0.680* (0.062) [34.3]	0.660* (0.062) [33.0]
Fixed effects						
Month	YES	NO	YES	YES	NO	YES
Year	NO	YES	NO	NO	YES	NO
Rating	YES	YES	NO	YES	YES	NO
Observations	6,688	6,688	6,689	6,181	6,181	6,182

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, years of service, and unemployment rate in home state.

b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.The marginal effect is the percent change in predicted continuation rates from bonus recipiency.

Table 29. 12- and 24-month continuation model estimates, 6-year prior-service enlistment contracts[a,b]

	12-month continuation		24-month continuation	
Variable	Coefficient (standard error)	Elasticity	Coefficient (standard error)	Elasticity
Expected bonus amount	0.0002 (0.000)	0.053	0.0001* (0.0000)	0.108
Observations	6,688		6,181	

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, monthly fixed effects, and rating category fixed effects.

b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.The elasticity is the predicted percent change in continuation rates given a 1-percent increase in the present discounted bonus amount.

Table 30. 12- and 24-month continuation model estimates, 3-year reenlistment contracts[a,b]

	12-month continuation			24-month continuation		
Variable	Coefficient (std. error) [Marginal effect]			Coefficient (std. error) [Marginal effect]		
Bonus recipiency	0.4747** (0.231) [2.74]	0.514** (0.221) [3.14]	0.490** (0.226) [2.82]	0.369** (0.177) [5.27]	0.405** (0.171) [6.05]	0.321*** (0.173) [4.65]
Fixed effects						
Month	YES	NO	YES	YES	NO	YES
Year	NO	YES	NO	NO	YES	NO
Rating	YES	YES	NO	YES	YES	NO
Observations	7,118	7,118	7,124	5,644	5,644	5,644

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, and years of service.

b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.The marginal effect is the percent change in predicted continuation rates from bonus recipiency.

Table 31. 12- and 24-month continuation model estimates, 3-year reenlistment contracts[a,b]

	12-month continuation		24-month continuation	
Variable	Coefficient (standard error)	Elasticity	Coefficient (standard error)	Elasticity
Expected bonus amount	0.0002** (0.0001)	0.002	0.0002** (0.0001)	0.003
Observations	7,118		5,644	

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, monthly fixed effects, and rating category fixed effects.

b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.The elasticity is the predicted percent change in continuation rates given a 1-percent increase in the present discounted bonus amount.

Table 32. 12- and 24-month continuation model estimates, 6-year reenlistment contracts[a,b]

	12-month continuation			24-month continuation		
Variable	Coefficient (std. error) [Marginal effect]			Coefficient (std. error) [Marginal effect]		
Bonus recipiency	0.700*** (0.141) [3.88]	0.838*** (0.133) [5.05]	0.698*** (0.138) [3.86]	0.453* (0.100) [6.00]	0.536* (0.096) [7.58]	0.420* (0.096) [7.58]
Fixed effects						
Month	YES	NO	YES	YES	NO	YES
Year	NO	YES	NO	NO	YES	NO
Rating	YES	YES	NO	YES	YES	NO
Observations	10,108	10,108	10,160	8,570	8,570	8,570

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, years of service, and unemployment rate in home state.

b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.The marginal effect is the percent change in predicted continuation rates from bonus recipiency.

Table 33. 12- and 24-month continuation model estimates, 6-year reenlistment contracts[a,b]

	12-month continuation		24-month continuation	
Variable	Coefficient (standard error)	Elasticity	Coefficient (standard error)	Elasticity
Expected bonus amount	0.0002* (0.0000)	0.006	0.0001* (0.0000)	0.011
Observations	10,108		8,570	

a. All models also include the following covariates: paygrade, dependent status, race/ethnicity, gender, education level, age, AFQT, unemployment rate in home state, years of service, monthly fixed effects, and rating category fixed effects.

b. The statistical significance of the estimates is indicated as follows: --- not statistically significant, *** 10% significance, ** 5% significance, and * 1% significance.The elasticity is the predicted percent change in continuation rates given a 1-percent increase in the present discounted bonus amount.

Appendix D: Duration model results

In table 34, we present the proportional hazard estimates for each of our samples. The reference dummy variables are E1-E4, no dependents, HS graduate, female, 25 or younger, AFQT score less than 50 or unknown, white, and Aviation community.

Table 34. Proportional hazard estimation results of duration of contract completion

Variable	Non-prior-service 6-year enlistment contract Coefficient (std. error)	Prior-service 3-year enlistment contract Coefficient (std. error)	Prior-service 6-year enlistment contract Coefficient (std. error)	3-year reenlistment contract Coefficient (std. error)	6-year reenlistment contract Coefficient (std. error)
Expected bonus amount	-.0000638 (.0000226)	-.0003192 (.0000164)	-.0000654 (0.00000)	-.000052 (.0000272)	.0000242 (0.00000)
Years of service		-.0063379 (.0032736)	-.0173216 (.0039744)	.037441 (.0044135)	.0314336 (.0033772)
Male	.0303662 (.0164414)	.0584856 (.032218)	.0770017 (.0356022)	.0453843 (.0395243)	.0207128 (.0278554)
Dependents	-.0038725 (.014776)	.025565 (.0200442)	-.0356084 (.0254522)	-.0012473 (.0333813)	-.0055489 (.023213)
HS dropout	.2470339 (.042401)	.1029431 (.1221498)	.3903013 (.1593562)	.2805975 (.2899596)	.1438443 (.193522)
HS equivalent	-.1093298 (.0496615)	-.1041765 (.0897159)	.0684111 (.0938207)	-.098545 (.0507621)	-.1530688 (.0359251)
Associate degree	-.1371804 (.0266525)	-.1024876 (.0447353)	-.0313946 (.0537405)	-.1668163 (.0377968)	-.1924475 (.027369)
Bachelor's degree	-.1174731 (.0208657)	-.0375491 (.0399874)	-.0760652 (.051537)	-.2777846 (.0431506)	-.1454209 (.0309514)
Education missing	-.7099807 (.186307)	-.1344483 (.1690958)	-.4076841 (.1821642)	-.2447167 (.200501)	-.0306378 (.1709619)
Age 26 to 30	-.5642282 (.0199153)	-.1236944 (.0377165)	-.155975 (.0471448)	-.2002228 (.0762625)	-.0495541 (.0514289)
Age 31 to 35	-.6640723 (.0213744)	-.309129 (.0384579)	-.2033689 (.0484203)	-.2252622 (.0678449)	-.0902737 (.0484931)
Age 36 to 40	-.5816797 (.0241124)	-.351222 (.0388214)	-.2321243 (.048863)	-.1276447 (.0576255)	-.0091732 (.0435606)
Age 41 and up	.0612716 (.1068188)	-.3695815 (.0428151)	-.230358 (.0538053)	-.0196883 (.0601532)	.0534153 (.0449481)
Age missing	.4046892 (.4244432)	-.5611364 (.6024383)	.1985328 (.5869859)	----------	----------
E1-E4	----------	.7347406 (.2201735)	.2888627 (.1487047)	.2921951 (.0691943)	.1471663 (.0494833)
E5-E6	-.1751469 (.025465)	.3739764 (.2194753)	.1071859 (.1462008)	.0370196 (.0423374)	-.0178725 (.0355934)
Upper mental group	.236209 (.1209278)	-.0618836 (.0799266)	-.2085303 (.0773777)	-.1489253 (.032647)	-.1256948 (.022542)
Black	.0689508 (.0192833)	.1374469 (.025988)	.1739632 (.0335843)	-.036602 (.0412397)	-.0089172 (.0307275)

Table 34. Proportional hazard estimation results of duration of contract completion (continued)

Variable	Non-prior-service 6-year enlistment contract Coefficient (std. error)	Prior-service 3-year enlistment contract Coefficient (std. error)	Prior-service 6-year enlistment contract Coefficient (std. error)	3-year reenlistment contract Coefficient (std. error)	6-year reenlistment contract Coefficient (std. error)
Asian Pacific/Islander	.0455569 (.0292626)	.159691 (.0458418)	.0187938 (.0682052)	.2362862 (.0689459)	.1672936 (.0514081)
Hispanic	-.0784097 (.022515)	.0124659 (.0347238)	.0248013 (.04732)	.0460926 (.0528384)	.143219 (.0365218)
Other race or ethnicity	.0640911 (.0265764)	-.0188879 (.0338559)	.0499484 (.0417851)	.1287122 (.0636999)	.1831293 (.0446954)
Seabee	-.0174933 (.0287266)	-.0509706 (.0341092)	.1103967 (.0457062)	.1032214 (.0538765)	-.1130888 (.0385321)
Surface Operations	.0234513 (.0234127)	-.1050193 (.0368429)	-.0636067 (.0493565)	.0657743 (.0517557)	-.0136666 (.0386646)
Surface Combat Systems Operations	.0058259 (.0335622)	-.0468414 (.0457757)	.0209444 (.0592163)	.1574212 (.0590365)	-.0349233 (.0452279)
Administration	-.0708775 (.0315124)	-.0672231 (.0488716)	-.0066634 (.0668156)	.2363047 (.0657498)	.0577329 (.0495621)
Nuclear	-------	.0408843 (.5795348)	.0463064 (1.003594)	-.2295603 (.3046399)	.415559 (.1698886)
Force Health Protection	-.0544348 (.0330295)	.0600885 (.0424168)	.1286522 (.0509781)	.0145277 (.0598256)	.0603841 (.0436296)
Intelligence	-.1780289 (.042603)	-.1850975 (.074394)	-.0379441 (.0837725)	.5321301 (.1040927)	.0735922 (.0653539)
Cryptology	.0153581 (.1216929)	-.0645157 (.1001112)	-.0379333 (.0838462)	.2880346 (.1180276)	.0984153 (.0841071)
Security	.1481143 (.0461388)	.0204278 (.0559201)	.1719474 (.0831394)	.3684513 (.1152091)	.3887263 (.0716818)
Submarine	.2253236 (.5005701)	-.0931343 (.1791123)	.1159197 (.222123)	.3478519 (.3206977)	.0376606 (.2379903)
Surface Engineering	.2745761 (.0431002)	-.0587665 (.0417429)	.0830048 (.058572)	.0460843 (.0581686)	-.0129245 (.0436955)
Supply	.0731925 (.0248922)	-.182554 (.0404739)	-.0212242 (.0540734)	.1210499 (.0541175)	.0361149 (.0407312)
Other category	.1393085 (.061887)	-.273947 (.1671602)	-.3456372 (.1415786)	-.4888279 (.5026902)	.6649363 (.37975)
Number observations	19,969	13,460	6,787	7,507	10,551

References

[1] Neil Carey et al. *Employing Navy Reservists: Making an Impact on Force Capabilities,* Aug 2002 (CNA Information Memorandum D0006806)

[2] Glenn Gotz. "Restructuring Reserve Compensation." In Cindy Williams (ed.), *Filling the Ranks: Transforming the U.S. Military Personnel System*. Cambridge, Mass.: MIT Press, 2004

[3] John T. Warner and Beth J. Asch. "The Economics of Military Manpower." In Keith Hartley and Todd Sandler (eds.), *Handbook of Defense Economics, Vol. 1.* New York: Elsevier Press, 1995 (pp. 349–398)

[4] P. Kostiuk and J. Grogan. *Enlistment Supply into the Naval Reserve,* Dec 1987 (CNA Research Memorandum 87-239)

[5] M. Susan Marquis and Sheila Nataraj Kirby. *Reserve Accessions Among Individuals with Prior Military Service: Supply and Skill Match,* 1989 (RAND Corporation, R-3892-RA)

[6] Hong Tan. *Non-Prior Service Reserve Enlistments: Supply Estimates and Forecasts,* 1991 (RAND Corporation, R-3786-FMP/RA)

[7] M. Hansen and J. Wenger, "Is the Pay Responsiveness of Enlisted Personnel Decreasing?" *Defence and Peace Economics*, Vol. 16, Issue 1, 2005: 29-43

[8] Jim Garamone. "Army Reserve Concerned About Prior-Service Recruiting." *American Forces Press Service*, 9 Aug 2004

[9] D. Lien and M. Hansen. *Compensation and Voluntary Participation in a Continuum of Service,* Mar 2006 (CNA Research Memorandum D0013215)

[10] J. Hosek, J. Kavanagh, and L. Miller. *How Deployments Affect Service Members,* 2006 (RAND Corporation, MG-432-RC)

[11] Federico E. Garcia with David L. Reese. *Monetary Incentives in the Selected Marine Corps Reserve,* Oct 1996 (CNA Research Memorandum 96-82)

[12] Beth Asch with David Reese. *The Effect of Pay and Bonuses on Selected Reserve Supply: A West Coast Prototype Analysis,* Jul 1986 (CNA Research Memorandum 86-0390)

[13] John T. Warner and Saul Pleeter. "The Personal Discount Rate: Evidence From Military Downsizing Programs." *The American Economic Review* 91(1), 2001: 33-53

[14] Aline O. Quester and Robert W. Shuford. *Get Paid Now or Get Paid Later: What Are Sailors Deciding?* Nov 2005 (CNA Research Memorandum D0013312)

[15] Shane Frederick, George Loewenstein, and Ted O'Donoghue. "Time Discounting and Time Preference: A Critical Review." *Journal of Economic Literature,* 20, Jun 2002: 351-401

[16] Anita U. Hattiangadi et al. *SelRes Attrition and the Selected Reserve Incentive Program in the Marine Corps Reserve,* Mar 2006 (CNA Research Memorandum D0013618)

[17] Michelle A. Dolfini-Reed et al. *Determining Patterns of Reserve Attrition Since September 11, 2001,* Jun 2005 (CNA Research Memorandum D0011483)

List of figures

List of tables


CNA