I Want You! (But Not You): Selection in Military Retention *

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Abstract

Government workers provide essential goods and services, but we know little about the determinants of their quality. We complement the existing literature, which has focused on compensation levels, by studying how the structure of common retention incentives affects employee quality in the U.S. military. We combine administrative data with quasi-random variation to find that low-ability soldiers are relatively more responsive to both lump-sum bonuses and early retirement benefits, and both effects are large enough to lower the organization's average ability level. We provide suggestive evidence that personal discount rates drive these selection patterns but that credit constraints do not.

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1 Introduction

The public sector is a large and important part of the economy. Approximately 15% of U.S. workers are employed by the federal, state, or local governments and the public sector also produces public goods that are key to economic growth. Existing studies document the impact of public sector worker quality on a variety of important public sector outputs including education (Chetty et al., 2014), nursing (Aiken et al., 2003), law enforcement (Rydberg and Terrill, 2010), and political leadership (Besley et al., 2011). However, the public sector is unusual in the constraints it imposes on the compensation and management of personnel and in its relative insulation from direct competition. As a result, the determinants of selection into the public sector has been a longstanding question in economics, spanning fields from labor and public finance (Katz and Krueger (1991); Borjas (2002)) to development and political economy (Dal Bo et al. (2013); Deserranno (2019)) and national security (Friedman (1967); Simon and Warner (2007); Korb and Segal (2011)). Existing research has focused primarily on understanding how differences in the levels of compensation across the public and private sectors affect who decides to enter government service (see, e.g., Dal Bo et al. (2013); Finan (2017); Nickell and Quintini (2002); Bacolod (2007)).[1]

In this paper, we bring new evidence to this literature and provide well-identified estimates of the effects of commonly used public sector compensation policies on the quality of public sector employees. We also expand the scope of this line of research by studying these effects in the context of retention policies, as opposed to the better-studied effect of wages on the entry margin. Because public sector personnel managers typically lack the same tools as private sector managers to individually adjust compensation, they instead frequently rely on a limited menu of retention policies and incentives, including retention bonuses and retirement incentives. These policies, almost all of which feature lump-sum cash payouts, are known to be effective at increasing the quantity of retained workers.[2] In this paper, however, we show that they also meaningfully affect the types of workers who elect to remain in the public sector. In particular, we study how key retention incentives affect worker sorting in the U.S. military. In contrast to much of the literature showing that higher levels of

[1] There is a modest related literature on military recruitment and retention, almost all of which has analyzed (Brown (1985); Warner et al. (2003); and Gelber (2007)) or modeled (Gotz and McCall (1984) and Daula and Moffitt (1995)) enlistment and retention quantities, with little attention to worker quality. Among the papers studying military personnel, our work is most closely related to Warner and Pleeter (2001) and Simon et al. (2015), who estimate personal discount rates using military drawdown policies—including those studied here. However, our paper is the first to establish the causal effects of these different types of compensation on the quality of retained workers and the implications this has for the aggregate workforce quality.

[2] See, e.g., Asch et al. (2010).

compensation induce higher quality workers to enter the public sector, we find that more generous lump-sum retention incentives actually induce lower ability workers to remain. Our findings highlight that the structure, rather than just the level, of compensation matters in determining the quality of retained public servants. We show that these effects are large enough to affect the average ability level of the organization's overall workforce, a finding that should draw increased attention to how commonly used retention policies are designed and deployed.

Our results are somewhat striking in light of both the existing empirical literature and predictions made by the simplest models of selection. In a simple model in which returns to individual ability are higher in the private sector than in the public sector,[3] and where workers differ only in their ability, one would expect any increases in public sector compensation—even those that are not specifically targeted towards higher ability workers—to increase the average ability of those who select into the public sector. Indeed, this prediction that higher wages attract higher quality workers is consistent with the selection patterns documented by Dal Bo et al. (2013) and throughout much of the literature on the personnel of the state (Finan, 2017). However, our results on the retention margin are inconsistent with this simple model of selection. Instead, we find that, because low-ability workers are more responsive than their higher ability peers to a lump sum retention bonus, generous retention incentives can actually reduce average ability levels. These results support a richer model with additional dimensions of worker heterogeneity, and they demonstrate that the design of retention policies can be crucial for retaining high-ability workers.

Our setting is the U.S. Army, where we combine rich micro-data with a policy environment that generates plausibly exogenous variation in the relative returns to continued employment in the military. Specifically, we study how soldiers of different ability levels respond to two common types of retention policies: 1) lump-sum retention bonuses and 2) offers of early retirement benefits. The U.S. military provides a useful setting in which to study questions relating to the public sector more broadly, as key features of military compensation are relatively common across the public sector but comparatively rare in the private sector. First, the military sets wages according to a highly standardized pay scale with minimal variation based on individual abilities. Second, the military offers a generous but cliff-vested (at 20 years of service) defined benefit pension, which substantially shifts compensation to the future and creates unique retention incentives.[4] Third, the military

[3] See Borjas (2002); Katz and Krueger (1991).

[4] In 2018 the military replaced its defined benefit system with a "blended" defined benefit and defined contribution system. Our data are confined to the 1992-2016 time period, when the military continued to operate a pure defined benefit system.

often uses large recruitment and retention bonuses as relatively blunt tools for either growing or shrinking the overall size of the force. These three features are prevalent across other public sector organizations at the federal and state levels. For example, defined benefit pensions remain more common today in the public than private sectors (Poterba et al., 2007), and the retention bonuses and early retirement incentives we study are frequently relied upon by other public sector organizations seeking to affect retention (e.g., the U.S. Postal Service, Social Security Administration, and the U.S. Border Patrol).[5] The military is especially intriguing because military retirement often occurs in middle age (Kamarck, 2018). In contrast to the existing retirement literature, which has been primarily concerned with workers at the very end of their careers, studies of the military may enhance our understanding of how retirement incentives affect the transitions of skilled workers in the mid-to-late parts of their careers.[6]

Not only does the military mirror many of the dynamics affecting public sector organizations at large, but given its size and economic importance,[7] the military is also worth studying in its own right. Recently, policymakers have expressed concern that the U.S. military in particular is failing to retain its best and brightest members, particularly among commissioned and non-commissioned officers, who comprise the middle and upper-level "management" of the military.[8] In fact, our own data validates their concerns and shows that the enlisted soldiers who stay in the Army the longest tend to be the ones with the lowest average scores on pre-enlistment aptitude tests (see Figure 1). Compared to soldiers who exit the Army after a single enlistment, soldiers who serve 20 years or more have an average AFQT score that is almost half of a standard deviation lower. Increasingly, analysts within the military have argued that in designing retention policies, the military should be focused not only on the quantity retained, but on optimizing the quality of those retained, as they argue retaining a more talented pool increases productivity, boosts moral, and ultimately saves costs (Wardynski et al. (2010), Wallace et al. (2015)). However, there is little concrete empirical evidence on the nature of

[5]As of January 2018, the U.S. Postal Service, Social Security Administration, Small Business Administration, and Environmental Protection Agency all offered early retirement policies to thousands of employees. See http://www.fedweek.com/fedweek/usps-offering-round-early-retirements; https://www.govexec.com/management/2017/10/agency-jobs-watch-how-will-your-agency-cut-its-workforce/137905/. Additionally, members of Congress have recently proposed greater use of recruitment and retention bonuses in the United States Border Patrol, which is said to be experiencing a "brain drain". See https://www.foxnews.com/us/border-patrol-brain-drain-agency-losing-more-agents-than-it-can-hire.

[6]Specifically, our paper contributes to a larger literature quantifying the effects of retirement programs on labor supply, which has focused primarily on the relationship between retirement decisions and pensions (e.g., Brown (2013)). We add to this literature by studying mid-career workers and by studying the heterogenous response of workers of different ability levels.

[7]Including civilian employees, the Department of Defense is the world's single largest employer. See https://www.forbes.com/sites/niallmccarthy/2015/06/23/the-worlds-biggest-employers-infographic/#78410ba5686b.

[8]See, e.g., Wardynski et al. (2010). See, also, Kane (2012).

selection in military retention. In Appendix A, we show that the key parameter to inform policy makers of how retention policies will affect the average quality of the retained soldiers is precisely the object we estimate—the differential sensitivity of soldiers of varying abilities to potential reenlistment incentives.

Our empirical strategy leverages two sources of quasi-random variation in the financial returns to reenlisting in the military. First we study Selective Reenlistment Bonuses (SRBs), which offer a lump sum payment to soldiers who choose to reenlist. SRB offers fluctuate frequently in response to changes in the Army's demand for soldiers of different ranks and skill sets, but importantly for our purposes, they are offered to all soldiers of a given rank and specialty regardless of individual ability. Second, we study early retirement incentives, which offer soldiers immediate (but reduced) retirement benefits in exchange for early exit from the military. Like the reenlistment bonuses, they were applied without regard to individual ability.

Our analysis shows that low-ability soldiers are more responsive to both types of near-term reenlistment incentives. Specifically, a 10 point decrease in a soldier's AFQT score (approximately equivalent to one-half of a standard deviation) is associated with a nearly one percentage point increase in the effect of a $10,000 SRB offer on a soldier's probability of reenlistment. Even more striking, soldiers with upper quintile AFQT scores are totally unresponsive to bonus offers. We find similar results using a soldier's speed of promotion as an alternative measure of ability. We also find that lower ability soldiers are more responsive to early retirement programs, and that of the soldiers who leave the military in direct response to early retirement programs, almost two-thirds have below-median AFQT scores.

We show that the increased sensitivity of low ability soldiers to lump-sum bonuses is not consistent with a simple model in which the return to ability is lower in the military than in the civilian sector. Rather, we show that this excess sensitivity could be due to differences in unobservable taste for the military. We also show that the excess sensitivity of low ability soldiers to lump-sum cash incentives is not driven by differences in credit constraints, as we find that that the patterns persist even after controlling for soldiers' credit access. Rather, we find indirect evidence that differences in personal discount rates may explain our results, with higher ability soldiers exhibiting more patience and choosing compensation packages that pay off in the future. Our findings suggest that retention packages with more future compensation (e.g., retirement plans), will select higher ability workers than those with immediate payoffs.

The rest of the paper proceeds as follows. Section 2 describes our institutional setting and Section 3 describes our data. We present our empirical strategies and results in Section 4. Section 5 explores explanations

for our primary finding, and Section 6 concludes

2 Institutional Background

We analyze the reenlistment decisions of enlisted members of the all-volunteer U.S. Army between 1992 and 2016. Reenlistment is uniquely important in the military given its restricted lateral entry. Unlike private firms, which are free to hire at all levels, the military cannot simply hire more Sergeants or more Generals; instead, it must promote from within. Enlisted soldiers serve for fixed terms, and the typical first term of service lasts four years. At the end of each term, soldiers deemed eligible to reenlist (based on their previous performance) meet with a counselor to discuss their options which normally include opportunities to reenlist for an additional term of between two and six years. The counselors will also discuss the monetary and other potential benefits of remaining in the Army as well as potential opportunities in the civilian labor market. While reenlistment policies have changed some over time, eligible soldiers can typically reenlist between 12 months and 90 days prior to the end of their term.[9] Just after basic training, soldiers receive their Military Occupational Specialty (MOS), which corresponds to the job they will perform in the Army. A soldier's MOS is one of the most salient and important features of her individual experience in the Army, and while mid-career changes are possible, they are the not common.

We utilize two measures of individual ability—the AFQT score and the soldier's speed of promotion in their first term. A substantial body of previous research has established that a soldier's cognitive ability affects her on-the-job performance.[10] Wigdor and Green (1991) undertook an ambitious study of U.S. military performance and found that a soldier's AFQT is highly correlated with both hands-on performance and written knowledge of her job. Appendix Table B1 presents selected correlation coefficients between individual AFQT scores and hands-on, objective performance measures. Observed correlations range from 0.10 to almost 0.70, and the highest correlations tend to be in combat occupations. Other studies have documented that AFQT scores explain individual and group performance in technical fields such as communications (Winkler et al. 1992; Fernandez 1992), air defense systems (Orvis et al., 1992), and automotive and helicopter maintenance (Mayberry and Carey, 1997). AFQT scores also predict early service attrition (Flyer and Elster 1983; Teachout

[9] Figure B2 in the appendix shows the distribution of the gap between the eligibility window and the expected end of service. For the large majority of soldiers, this is either 12, 15, or 24 months. See Appendix B.1 for more details.

[10] For a review of the literature on human capital and military performance, see Kavanagh (2005).

and Pellum 1991; Horowitz and Sherman 1980). Finally, while most of the existing studies have focused on enlisted personnel, recent military research highlights the importance of cognitive ability for military officers as well (Condly et al., 2017).

Like many public sector compensation schemes, the military pay system has some unique features that distinguish it from the private sector. Military basic pay is a function of only rank,[11] years of service, and dependents status. The military also offers generous additional benefits, such as enlistment bonuses, periodic retention bonuses, education benefits, housing allowances, and a generous retirement program. The military's pension system is especially distinctive. Prior to 2018, the U.S. military offered only a defined benefit plan to servicemembers. Active duty service members were eligible for a retirement pension only after 20 years of service, and soldiers who separated prior to 20 years received no retirement pay whatsoever. A soldier who separated with 20 years of service received an annual pension valued at approximately 50 percent of her final annual salary, and soldiers who retired after more than 40 years received up to 100 percent of their final salary. Notably, a retired soldier begins receiving her annual pension immediately upon retirement from the military, regardless of the soldier's age or employment status. Since many soldiers enlist at just 18 to 20 years of age, a soldier as young as 38 can be "retired" and receiving a military pension.[12]

2.1 Variation in Military Retention Policies

We leverage two particular military retention policies that generate quasi-random variation in the relative return to continued military service. Our first policy is the Army's Selective Reenlistment Bonus (SRB) program. SRBs are cash bonuses offered to certain reenlistment-eliglble soldiers nearing the end of an enlistment term in order to encourage reenlistment. SRB offers vary by the soldier's current rank, the MOS that the soldier chooses to fill upon reenlistment, the soldier's total years of service, certain specialty skills the soldier might possess (for example, "airborne" qualification), the number of years for which the soldier reenlists, and the location in which the soldier is willing to be stationed. Depending upon her characteristics, a soldier may be eligible for a menu of several different SRB offers, and it is up to the soldier which SRB offer (if any) she ac-

[11] Throughout this paper we refer to ranks by their corresponding pay grades. A pay grade consists of a letter—"E" for enlisted personnel, and "O" for commissioned officers—followed by a number, denoting the relative position of the rank. For example, an E-5 (Sergeant) is superior by two ranks to an E-3 (Private First Class).

[12] Although the purely defined benefit system was replaced with a "blended" defined benefit and defined contribution system in 2018, the defined benefit portion still cliff vests at 20 years, and it will likely still account for the majority of most servicemembers' retirement savings.

cepts. SRB offers generally range from $0 to as high as $20,000. In our sample, the average SRB bonus received was $1,891, but among the 11% of soldiers who received a non-zero bonus, the average was $9,150. Compared to a soldier's base pay (e.g., in 2015, an E-4 with four years of service earned just over $28,000 annually), SRBs frequently represent a sizeable share of overall compensation.

The second set of policies we consider comprises the military's early retirement programs. In the early 1990s, after the Cold War ended, the Department of Defense implemented two programs—Voluntary Separation Incentives and Special Separation Benefits (VSI/SSB), and the Temporary Early Retirement Authority (TERA) program—as part of a larger "drawdown" strategy. In addition to reducing its overall size, the Army sought to reshape its force for the post-Cold War era by directing separation and retirement incentives at certain MOS and rank combinations.

We specifically study the second wave of the TERA program (August 1994 through July 1995), which offered early retirement to soldiers with at least 18 but less than 20 years of service who also met specific service requirements within their occupation and rank. The program was small overall, with only 1,731 eligible soldiers, which reflects 0.6 percent of all soldiers serving at that time and 6.8 percent of soldiers with at least 15 years of experience (see Appendix Table B6). The benefits bestowed by TERA were generous. While soldiers are generally ineligible for retirement benefits prior to 20 years of service, TERA entitled recipients to an immediate military pension, albeit at a slightly reduced rate. Specifically, a soldier retiring under TERA had her military pension reduced by approximately 5% for each year less than 20.[13]

We also exploit variation from the VSI/SSB program, which offered inducements to mid-career soldiers who were willing to voluntarily separate from the Army pre-retirement. We focus our VSI/SSB analysis on the second wave of the program (August 1993 through June 1995). The VSI/SSB program was offered to soldiers who had 1) completed their first full term of service and 2) had accrued more than 6 but less than 20 years of service as of December 5, 1991.[14] Among that set of soldiers, eligibility was further restricted to certain occupation and rank combinations. The VSI/SSB programs were significantly larger than the TERA program—7,326 soldiers were eligible, covering 3.8 percent of all soldiers serving at that time and 11.7 percent of soldiers with at least 6 years of experience.

The VSI and SSB programs shared identical eligiblity rules, but the benefits provided by the two programs

[13]More specifically, the retirement pay formula for TERA is $0.025 *$ years of service $*$ final base pay $*$ reduction factor, where the reduction factor is $\frac{m}{240}$ and where m is the number of full months served as of the retirement date.

[14]Both programs also requires that the soldier enter the reserves for several years.

differed significantly, with VSI offering an annuity payment and SSB offering a single lump-sum payment upon separation. Soldiers had the option of choosing between the two programs. A soldier electing the VSI program received an annual payment equal to 2.5% of the soldier's final base annual pay multiplied by her total years of service, paid out once a year for twice the number of years of service. A soldier electing the SSB program received a single payment valued at 15% of her final base annual pay multiplied by her total years of service (i.e., a soldier with 7 years of service had a SSB payment just larger than her annual salary). For mid-career and senior soldiers, VSI/SSB and TERA eligibility had a major effect on the relative returns to continued military service.[15]

3 Data

We use the U.S. Army's Total Army Personnel Database (TAPDB) to construct a panel of enlistment spells from 1992 to 2016. Each observation (or "spell") corresponds to a single enlistment term for a soldier (e.g., a soldier who has served a single enlistment of four years will have just one observation, while a soldier in her tenth year of service will have multiple observations). We exclude all current enlistment spells (approximately 6%) since we do not observe their conclusion. We provide summary statistics for our sample in Table 1. The sample is primarily male with an average age of 28 and an average service duration of 6.33 years. For all analyses, we restrict our attention to those soldiers eligible to reenlist at the end of the term (Column 2), who look observably similar to the overall sample. The last two columns show the average characteristics of individual spells that end in the soldier choosing to leave the Army (Column 3) or with the soldier reenlisting (Column 4). Around 50 percent of soldiers never chose to reenlist, and the average number of enlistments per soldier is 2.8.[16] On average, soldiers deciding to reenlist are more likely to be married and slightly younger than those who do not.

Our primary measure of ability is a soldier's Armed Forces Qualification Test (AFQT) score, which reflects the soldier's vocabulary, reading comprehension, and mathematical skills. The military uses the AFQT for

[15]Before being granted the benefits of either TERA or VSI/SSB, eligible soldiers who decided to take up the program had to be approved by their commander. Eligible soldiers were able to apply to these programs at any time, regardless of whether they were in their reenlistment window or not. One may be concerned that although all soldiers within a rank, occupation and year of service bin were eligible, the approving commander may take the soldier's performance and aptitude into account when granting approval. While this is possible, evidence from Army archives suggest this was not the case. In fact, according to the Army's Fiscal Year 1992 "Historical Summary," 100% of on-time VSI/SSB applications were approved that year (see `http://www.history.army.mil/books/DAHSUM/1992/ch07.htm`).

[16]See Appendix Figure B1 for the full distribution of the number of enlistments per soldier.

initial selection (i.e., eligibility to join) and classification (i.e., eligibility for certain occupations), and labor economists have used it widely as a measure of individual cognitive ability (e.g., Grilliches and Mason 1972). AFQT scores range from 0-99, corresponding to the percentile of the applicant's raw test score. Table 1 shows that soldiers eligible to reenlist have higher scores than those who are ineligible (Column 1 vs. 2), and that those who choose to reenlist have lower scores than those who leave (Column 3 vs. 4).[17]

While evidence suggests that AFQT scores are good predictors of military performance, cognitive measures may not capture all dimensions of ability relevant to the military. For that reason, we complement AFQT scores with a variable related to the speed of a soldier's promotions, which is commonly used to measure military aptitude. In particular, we observe the number of months in a soldier's first term that she spent below the rank of Sergeant, with larger numbers reflecting delayed advancement. As expected, Appendix Table B2 shows that AFQT and speed of promotion are positively correlated.[18]

In addition to personnel data, we collect monthly SRB offers and eligibility criteria for the VSI/SSB and TERA programs from publicly available policy announcements ("U.S. Army Military Personnel Messages").[19] We record the amount of the offer and the eligibility requirements (i.e., MOS, rank, years of service, and any special conditions) for each SRB. We construct the SRB offer data to isolate the exogenous aspects of the program (i.e., the variation in SRB offers that is uncorrelated with soldiers' choices). Specifically, we define the soldier's SRB offer as the bonus that is available for a 4-year reenlistment with the soldier's current occupation, rank, skill level, and tenure. This assignment process abstracts from the variation in SRBs from soldiers switching occupations in order to take advantage of a high SRB offer in a different occupation.[20] We exclude SRB offers that require moving to a particular location or unit, as they might reflect endogenous location preferences.[21] Finally, since monthly bonus offers may vary throughout the reenlistment window, we expect that

[17]Note that the sample means exceed the 50th percentile because the military generally restricts enlistments to those with AFQT scores greater than 30.

[18]We have also explored several alternate specifications of soldier promotion speed and find very similar results across alternative parameterizations. We chose the time the soldier took to get to rank E-5 (Sergeant) as a baseline because it is highly predictive of future promotion speeds and has a reasonable amount of variation among first term soldiers (See Table B3).

[19]We are grateful to the authors of Greenstone et al. (2018), who shared with us the bonus offer data for the period 1997-2010. We have extended the dataset through 2016. Eligibility criteria for the VSI/SSB and TERA programs were announced in two separate Military Personnel Messages, both published in 1993. Unfortunately, these memoranda were not stored electronically, and copies of the final messages were destroyed in the Pentagon during the 9/11 attack. We therefore constructed the eligibility criteria from a pair of draft messages, which the Army had preserved. While we are are confident that the final rules were similar to the draft messages, we cannot be certain that they were identical.

[20]In fact, 23 percent of soldiers in our sample switch occupations upon reenlistment, and the average reenlistment term in the sample is 4.18 years. Appendix Table B4 shows that SRB offers are highly correlated across the length of reenlistment terms.

[21]Appendix Table B5 shows that general bonus offers and simultaneously offered location-specific bonus offers are highly correlated.

soldiers may delay reenlistment if they anticipate that a higher bonus offer is imminent, and this sort of behavior may be more common among high ability soldiers. To eliminate this strategic timing of reenlistment, we assign each soldier the SRB offer that was available in the first month of their reenlistment window.[22] Despite these abstractions, our assigned SRB offers are highly predictive of the actual received bonus amount for those who take up SRB offers.[23]

4 Empirical Strategy & Results

The following section provides evidence on the selection on ability induced by two of the Army's lump-sum retention policies—Selective Reenlistment Bonuses, which provide cash bonuses to soldiers who stay, and early-retirement programs, which provide cash bonuses to soldiers who leave. In Appendix section A, we show that the differential response of soldiers to lump-sum bonuses is the key statistic for understanding how the average ability of the military is affected by these reenlistment programs.

4.1 Evidence from Selective Reenlistment Bonuses (SRBs)

We begin by comparing the reenlistment decisions of soldiers according to the bonus amounts they are offered. In particular, we estimate the following equation:

$$\text{Stay}_{it} = \beta_0 + \beta_1 \text{SRB}_{it} + \beta_2 \text{SRB}_{it} * \text{AFQT}_i + \beta_3 \text{AFQT}_i + \gamma_{MOS,rank,yos} + \mu_t + \delta \mathbf{X}_{it} + \epsilon_{it}, \tag{1}$$

where Stay_{it} is an indicator for whether soldier i chooses to reenlist at time t; SRB_{it} represents a soldier's SRB offer as described above, and $AFQT_i$ is the soldier's raw AFQT score percentile. We expect β_1, which estimates the average effect of SRB offers on reenlistment, to be positive, since SRBs are designed to increase soldier retention. Our coefficient of interest is β_2, which reflects the differential responsiveness of high- and low-ability soldiers to reenlistment bonus offers.

The identification assumption underlying the estimation of β_2 is that SRBs are conditionally randomly assigned, and thus unrelated to both individual ability and non-monetary factors affecting the reenlistment decision. Since SRB offers vary by occupation, rank, year of service, and date, all of our specifications include

[22] We show, however, that our results are not sensitive to the timing assumption for the SRBs. See Appendix Tables B11 and B12.
[23] The coefficient of a regression of actual bonuses on SRB offers is 0.236 and is highly statistically significant ($p < 0.01$).

offer-date fixed effects and MOS×rank×years-of-service fixed effects. We also include controls for marital status, gender, race, age, and special military skills designations. While the demographic controls are not necessary for identification, they nonetheless improve the precision of our estimates. Although we are unable to test whether SRBs are correlated with unobservable soldier characteristics, such as their taste for military service, in Appendix Table C1, we document that, conditional on occupation, tenure, and rank, SRBs are not offered to cohorts of soldiers that are higher ability. This test on observables strongly supports the identifying assumption, as the finding that SRBs are uncorrelated with our rich set of observables makes it unlikely that they are correlated with the potential unobservable characteristics (Altonji et al., 2005).

Given these controls, β_2 will be identified off of relatively high-frequency variation in SRB offers that vary across MOS, rank, and years of service within a date. While it is difficult to know precisely what drives this time-series variation, anecdotal and observational evidence suggests that variation in SRBs arises from a combination of "inside" factors—namely, the military's operational and strategic requirements—and "outside factors"—namely, labor market conditions and other economic trends affecting civilian labor market opportunities. For example, SRB offers for Patriot missile operators (MOS 14T) appear to have been largely driven by operational requirements (i.e., air defense requirements during the first Gulf War) and large-scale changes to the Army's overall force structure (i.e., growth of the total air defense capability). In contrast, SRB offers for infantrymen (MOS 11B)—the largest MOS in the military—appear to vary more closely with secular trends (e.g., macroeconomic conditions, post-9/11 surges in enlistments, and increased demand to support the wars in Afghanistan and Iraq). Insofar as outside economic conditions affect SRB offers, they will only threaten our identification if they vary at a high frequency and in a manner that is specific to soldiers of a particular MOS, rank, and tenure. Appendix Section B.2 provides case studies for the time series variation driving other specific occupations.

In Figure 2 we provide descriptive evidence for the effect of SRBs on selection. Both the left and right panels depict the residualized AFQT distributions for soldiers who reenlist compared to those who stay. We residualize the AFQT scores by the soldier's occupation, rank, years of service, and the date of the reenlistment decisions—the very same variables that are used to determine a soldier's eligibility for the military's various incentive programs. This residualization removes, for example, any differences stemming from the fact that soldiers of higher ranks tend to have higher AFQT scores, are more likely to reenlist, and may also be eligible for different reenlistment incentives. Figure 2a plots the AFQT distributions for soldiers who were offered *no*

SRB at the time of reenlistment, while Figure 2b plots the distributions for soldiers who were offered an SRB of at least $8,000. In both panels the stayer distribution (drawn in dashed lines) is shifted left relative to the leaver distribution (drawn in solid lines), meaning that the average ability of the soldiers who choose to reenlist is lower than those who chose to leave the military.[24] This comports with Table 1, which indicated that soldiers who reenlist tend to have lower AFQT scores than those who leave, but the residualized distributions plotted in Figure 2 show that, even within detailed occupation, rank, and tenure bins, soldiers at the higher end of the AFQT distribution are less likely to stay in the military. What is key from Figures 2a and 2b, however, is that the disparity between stayers and leavers is even greater for soldiers who receive a large SRB offer than it is for soldiers who receive no SRB offer. This suggests that when the SRB is higher, either lower ability soldiers are even more likely to stay, or higher ability soldiers are even more likely to leave.[25]

In Table 2 we formalize this descriptive result with a regression analysis. Column 1 first shows a benchmark specification relating bonus offers to average reenlistment without including the interaction between a soldier's AFQT score and their bonus offer. The coefficient on a soldier's AFQT score in Column 1 reiterates that soldiers with higher AFQT scores are less likely to reenlist—for each additional percentile point in the raw AFQT score, soldiers are 0.1141 percentage points less likely to reenlist. The Column 1 results also show that SRBs work as intended: on average, a $10,000 bonus increases soldier retention by 1.5 percentage points (2.3 percent).[26]

However, as depicted in Figure 2, soldiers across the ability distribution are not uniformly responsive to SRBs. Column 2 of Table 2 corresponds to our baseline specification in Equation 1, and it shows that a soldier's responsiveness to the bonus offer is decreasing in her AFQT score. The point estimate on the interaction of the SRB offer and the soldier's AFQT score is negative and statistically significant – a soldier who has an AFQT score that is 10 percentiles higher is more than 0.7 percentage points less responsive to a $10,000 SRB bonus offer. Indeed, as we show in additional results below, soldiers with AFQT scores above the 80th percentile are not at all responsive to the SRB offer.

In Columns 3 and 4 of Table 2 we estimate the same model with additional fixed effects that control for potential confounders. Column 3 includes nonparametric time trends for each soldier's commuting zone of

[24] Appendix Figure B5 shows the raw distribution of AFQT scores by reenlistment status.

[25] Appendix Figure B4 shows a similar pattern using a soldier's speed of promotion in their first term as their measure of quality.

[26] Note that the average non-zero SRB offer is $9,151 in 2015 dollars. About 75% of soldiers face no SRB offer in their current MOS at the beginning of their reenlistment window. This baseline estimate of the effect of SRB offers on reenlistment probabilities is similar to those reported in Greenstone et al. (2018).

record (i.e., place of residence immediately prior to initial enlistment) to control for any reenlistment differences that are correlated with the soldier's local area. The point estimates are smaller, but the main pattern of lower responsiveness by higher-ability soldiers remains sizable and statistically significant. Column 4 includes nonparametric time trends for each occupation. This model identifies SRB effects from the differential time variation across ranks and tenures within an occupation and thus sweeps out anything that varies at the occupation level (e.g., changes in mortality risk, changes in outside employment opportunities for a given occupation). Once again, we find that soldiers with higher AFQT scores are less responsive to SRB offers. In Column 5 we measure a soldier's ability not by her AFQT score but by the number of months that the soldier spent below sergeant in her first term. Higher numbers imply slower promotion speeds and therefore lower military performance. Our results show that that soldiers who are promoted less quickly are more responsive to SRB offers, consistent with the AFQT findings in Columns 2-4. In Appendix Tables B7 and B8 we document that the Table 2 results are robust to various alternative specifications and sample restrictions, including using the log rather than the level of the SRB offer, restricting to the 10 largest occupations, and dropping the Iraq War "surge" years (2007-2009).

Equation 1 imposes a linear relationship between a soldier's ability and her responsiveness to bonus offers. We relax this assumption in Figure 3 and depict the effects of an SRB offer throughout the ability distribution. The left panel presents results using the AFQT scores, where we interact the SRB offer with dummies for each AFQT score decile. We use equally sized decile bins to reflect the soldier's relative position among those eligible to reenlist. The figure reveals that that the relationship is close to linear and decreasing throughout the distribution. Soldiers in the bottom decile are almost 5 percentage points more likely to reenlist when offered a $10,000 SRB versus no SRB, while soldiers in the middle of the distribution are only about 1 percentage point more likely to reenlist when facing the same incentive. Beginning at the 80th percentile of this AFQT distribution, we can no longer reject the hypothesis that SRBs have no effect on reenlistment rates. We find similar results in the right panel of Figure 3, which uses our speed-of-promotion-based ability measure. The effect of SRBs on reenlistment is almost entirely driven by soldiers in the highest three deciles (i.e., those with the slowest promotions).

4.1.1 Effect Magnitudes

So far we have compared how bonuses affect the reenlistment decisions of individual soldiers at different ability levels, but an alternative method for assessing the magnitude of the selection induced by SRBs is to ask how the "marginal" reenlisters differ from the average reenlisters, and how these two groups vary with bonus offers. This approach mirrors that of Gruber et al. (1999), who analyzed the effects of legalized abortion on children's average living standards.

Figure 2 shows that on average, the soldiers who choose to leave the military are of higher ability than those who choose to reenlist. Therefore, if the effect of SRBs on reenlistment were constant across the ability distribution, offering higher SRBs would *increase* the average quality of soldiers in the military. However, as we explore at length in Appendix C, the pattern of self-selection that we document in Table 2 is large enough that increasing SRB offers actually *decreases* the average quality of retained soldiers. Specifically, the estimates in Figure 3 imply that if the Army offered an average cohort a $10,000 SRB, it would retain an additional 195 soldiers. However, of those retained soldiers, about 150 (77 percent) would come from below the 50th percentile of the AFQT distribution, and the average AFQT percentile of those marginally retained soldiers would be 46, a full 10 points lower than the average AFQT score of the average reenlisting cohort in our data (where most soldiers receive no SRB, and the average SRB offer is just $1,891).

4.2 Evidence from early retirement incentives

While SRBs offer cash to those who choose to stay in the military, early retirement programs offer lump-sum payouts to those who choose to leave the military. Our analysis of the Army's early retirement programs is conceptually similar to our preceding SRB analysis, but the program details and structure of the data require a slightly modified approach. Rather than evaluating whether a soldier reenlists at the end of her spell, we evaluate whether or not she remained in the Army for the duration of the drawdown program eligibility window. This modification pools together soldiers who actively decide to reenlist with those who were not up for reenlistment during the program window but who nonetheless declined to take-up the early retirement program and leave the Army. We restrict our sample to spells that are active 6 months before the introduction of the early retirement program, thus counting each individual soldier only once. We make a few additional sample restrictions (described below) to isolate soldiers that are most similar to the eligible soldiers.

We first document that the program accomplished its objective of encouraging eligible soldiers to exit the military by estimating Equation (2):

$$\text{Stay}_{i,t_T} = \beta_0 + \beta_1 \text{ELIG}_i + \beta_4 YOS_{i,t_0} + \gamma_{MOS,rank} + \delta \mathbf{X}_i + \epsilon_i, \tag{2}$$

where ELIG_i is an indicator for soldier i's eligibility for either VSI/SSB or TERA, YOS_{i,t_0} is the soldier's years of service as of the program eligibility date t_0, and Stay_{i,t_T} is an indicator for the solider remaining in the Army T months after the early retirement program went into effect (t_T). For example, the estimate for β_1 at 3 months shows the relative probability of being in the military, by program eligibility, 3 months after the program went into effect. We include occupation$\times$rank fixed effects to capture any average differences in retention probabilities, and we control for the soldier's tenure since reenlistment probabilities generally decrease with tenure. We identify the effect of program eligibility by comparing soldiers of different service tenures within an occupation-by-rank bin and by comparing soldiers with the same years of service across different occupation-by-rank bins. The basic identifying assumption is that, after controlling for these observable determinants of program eligibility, eligibility for an early retirement program is correlated with neither an individual's ability level nor with the various unobservable determinants of her reenlistment decision. This assumption implies that, absent program implementation, reenlistment rates for eligible and ineligible groups would have followed parallel trends.

We present our regression results in Figure 4. In Panel A, we first document the effects of the retirement programs on average retention. The left graph depicts the results for the VSI/SSB programs, which offered separation incentives to mid-career soldiers. Note that the small and statistically insignificant coefficient left of the zero-month threshold shows that, prior to the implementation of the VSI/SSB program, soldiers who were eventually eligible for the program had the same probability of staying in the military as those who would never be eligible, validating the primary parallel trends assumption underlying this specification. However, once the program comes into effect, eligible soldiers are more likely to leave the military, and by the time the VSI/SSB program expires, eligible soldiers were almost 15 percentage points less likely to remain in the military compared to ineligible soldiers. The right graph in Panel A depicts a similar analysis for TERA (which affected late-career soldiers). While the results are noisier because the program was significantly smaller, the

overall pattern is similar—retention rates for eligible and ineligible soldiers moved in parallel prior to the program, but after implementation, TERA induced eligible soldiers to retire at higher rates.

In Panel B of Figure 4 we present the retirement program effects by ability levels (specifically, upper and lower AFQT score terciles).[27] The left panel depicts the results for the VSI/SSB program. As before, there are no pre-program differences in reenlistment probabilities for each ability group, and both groups are more likely to leave the Army when offered early retirement. However, higher ability soldiers responded less to the early retirement offer than lower ability soldiers, as demonstrated by the coefficients for the bottom-tercile soldiers lying below the coefficients for top-tercile soldiers at all times after program implementation. The right panel documents similar results for the TERA program. Soldiers with lower AFQT scores are more responsive to the program than soldiers with comparatively higher scores..[28] In Appendix Figure B6, we show that patterns are similar when we split not by AFQT score but instead by soldiers' speed of promotion in their first term. Appendix Tables B13 and B14 provides regression estimates from a version of Equation (2) where VSI/SSB or TERA program eligibility is interacted with a soldier's ability, further documenting that high ability soldiers are less responsive to these programs.

The Figure 4 estimates imply that a VSI offer to 1,000 soldiers would induce an additional 90 soldiers to retire. Almost two-thirds of those soldiers would be below the median AFQT score. Thus, in contrast to the SRB result, the self-selection induced by this policy is large enough to *increase* the average quality of retained soldiers, since the lowest ability soldiers disproportionately take up the cash offer to leave the military. See Appendix C for a more formal analysis of the effect of both retirement programs on average soldier ability levels.

5 Explanatory Mechanisms

The previous sections document that the reenlistment decisions of high-ability soldiers are less responsive to near-term cash incentives. These results are perhaps surprising. First, this selection pattern is different

[27] The estimates from these two groups were jointly estimated in a single regression, with soldiers belonging to the middle AFQT tercile as the omitted category.

[28] There are several reasons why the results would be stronger for the VSI/SSB program than the TERA program. As shown in Table B6, the VSI/SSB program affected more soldiers. Additionally, the VSI/SSB program ran for longer than the TERA program, perhaps giving soldiers more time to react. However, the programs also differed in the type of benefit—soldiers eligible for the VSI/SSB program had the option to get a large lump sum payment while soldiers in TERA were only entitled to the retirement annuity. Indeed, most soldiers who took up the VSI/SSB program chose the lump sum payment rather than the annuity.

from the positive effect of base wages on the quality of recruited civil servants documented throughout much of the literature (e.g., Dal Bo et al. 2013). Furthermore, in Appendix A, we demonstrate that this pattern of selection is not consistent with a simple workhorse model of selection in which soldiers differ only along one dimension—their ability—and in which the wage profile in the military is less sensitive to ability than in the private sector.

In this section, we empirically explore the degree to which the selection patterns we document are driven by the specific lump-sum structure of the retention payments, which, unlike changes in base wages, alter both the level and timing of compensation. First, we assess whether low-ability soldiers are more credit constrained and thus value the liquidity provided by the lump-sum payments more than their higher-ability peers. Second, we explore whether higher ability soldiers are more patient (as measured by lower personal discount rates) and consequently less responsive to promises of immediate lump-sum transfers. Our results reject the importance of liquidity while offering suggestive evidence in support of the role played by low-ability soldiers' relative impatience.[29]

5.1 Selection on Ability and Credit Constraints

Low-ability soldiers may exhibit differential sensitivity to cash incentives because they are more credit constrained than their high-ability peers. Given that family resources account for a large share of the variation in AFQT scores (Neal and Johnson, 1996) and that AFQT scores are themselves strongly correlated with future labor market outcomes (Heckman et al., 2006), access to credit—which is a function of both current assets and future income—is likely to be correlated with cognitive ability. These differences in liquidity by ability may cause lower ability soldiers to respond to near term incentives for several reasons. First, they may place a higher value on cash for precautionary savings or to finance a larger household expenditure. In the case of the early retirement programs, more credit-constrained households may also value the liquidity as it enables them

[29]Of course, the selection pattern that we document could be driven by features of the programs other than the timing of their payments. Indeed, we show formally in Appendix A that this selection on ability may result from an idiosyncratic "taste for service" that is distributed such that high-ability soldiers tend to be inframarginal relative to their low-ability peers. In other words, high-ability soldiers may be either very likely or very unlikely to reenlist, regardless of their cash compensation. It could also be that low-ability soldiers have lower expected permanent incomes and thus any fixed nominal payment represents a larger relative income shock for them. Low-ability soldiers would have lower average permanent incomes if the civilian sector features a positive return to skill, meaning that the expected lifetime income outside the military is higher for high-skill individuals. Our data are not well suited to test this possibility, so we leave this for future research.

to prolong and optimize their job search in the civilian market.[30]

We explore the degree to which differences in liquidity across the ability distribution explain our main results by adding controls for a soldier's credit access to our exploration of SRBs in Section 4.1. If differences in credit access drive the differential responses by ability, directly including measures of credit access and allowing the response to SRBs to vary with them will kill the interaction between SRBs and our measures of ability. We match individual credit scores and balances, obtained from one of the major credit reporting agencies, for most soldiers who were eligible for reenlistment at any point between April 2007 and March 2015.[31]

Soldier ability is indeed positively correlated with access to credit—the correlation between credit score and AFQT and months spent below sergeant is 0.21 and -0.14, respectively. In Table 3 we incorporate credit scores into our main analysis of SRBs. Column 1 replicates our main result in the subsample of soldiers with non-missing credit scores and reaffirms that high-ability soldiers are less responsive to SRBs. Column 2 shows that the coefficient on the SRB $*$ AFQT interaction is robust to a credit score control, and Column 3 shows that the coefficient is also robust to including two-way interactions for SRB $*$ Credit Score and AFQT $*$ Credit Score. As theory would predict, soldiers with more credit are indeed less responsive to SRBs, but the coefficient on the SRBs$*$AFQT interaction remains unchanged, showing that credit constraints are not driving our main finding.

5.2 Selection on Ability and Discount Rates

The differential sensitivity of soldiers of different abilities to cash incentives may reflect behavioral differences in decision making between high- and low-ability individuals. Previous research has demonstrated that cognitive ability is strongly correlated with a variety of decision-making characteristics, such as greater patience and higher risk tolerance (see, e.g., Frederick (2005) and Benjamin et al. (2013)). Importantly, similar relationships have been documented previously for the military. Warner and Pleeter (2001) estimate servicemembers' personal discount rates (PDRs) using take-up of early 1990s military drawdown programs (namely, VSI and SSB, discussed above). Their estimates suggest average discount rates as high as 17%, and they document higher rates for enlisted members, less educated members, and those with lower AFQT scores. Simon et al.

[30] A few recent papers have addressed the important role that worker liquidity constraints can play in labor markets. For example, Giannetti (2011) find that liquidity constraints can also affect occupational choice; individuals with a higher probability of facing liquidity constraints are less likely to be self-employed, and they are more likely to be employed in the public vs. private sector (see, also, Bianchi and Bobba 2013).

[31] Our match rate is high (nearly 90%) for our main sample of reenlistment-eligible soldiers.

(2015) estimate PDRs using more recent military retirement programs and find smaller PDRs of around 7% for enlisted soldiers and 2-4% for officers. Both studies document a negative correlation between AFQT scores and PDRs.

We do not attempt to replicate these analyses, but we do confirm similar patterns in our sample, which is restricted to the Army enlisted force given our desire to exploit variation in SRBs (which were not offered to officers) and early retirement incentives. In Table 4 we provide OLS estimates from regressions of VSI/SSB take-up on soldier ability. The estimates in Column 1 show that for each 10 additional points of AFQT score a soldier is approximately 2% less likely to select the SSB lump-sum payment over the VSI annuity, which has a higher net present value for standard discount rates. The relationship is robust, albeit smaller, after including various demographic controls and MOS and rank fixed effects (Columns 2-3). Similarly, in Columns 4-6 we document a qualitatively similar pattern for those with slower promotions, who are also more likely to take the lump sum over the annuity.

This exercise, when combined with our main results, shows that policymakers in the military and elsewhere in the public sector may be wise to take into account workers' relative patience when designing optimal compensation schemes. For example, for policymakers seeking to recruit and retain a high-quality workforce, optimal compensation will likely include future-oriented benefits like pensions, 401(k) matching contributions, and educational benefits for children of employees. Alternatively, if a policymaker's primary goal is to meet recruitment and retention quotas, and the quality of personnel is of only second-order importance, then the policymaker may minimize budget expenditures by replacing long-term benefits with lower-valued near-term benefits. Our results further suggest that the military's new blended retirement system—which replaced many of the future-oriented aspects of the traditional military retirement system with a variety of nearer-term benefits[32]—could adversely affect the average ability of retained soldiers.[33]

[32] See Kamarck (2018) for a comparison of the new and old retirement systems.

[33] By replacing long-term benefits with relatively near-term benefits, it is possible that the military's new blended retirement system will improve average ability levels among newly enlisted soldiers (who may be attracted by the opportunity to earn partial retirement benefits without having to serve an entire 20-year career) while simultaneously compromising the quality of retained soldiers. Additional research on the initial enlistment margin will be necessary in order to assess the overall effects of the blended retirement system on soldier quality.

6 Conclusion

This paper explores the nature of selection in public sector employee retention with evidence from the U.S. Army. Our paper extends the literature on worker sorting between the public and private sectors. Relative to the existing research, which has tended to emphasize differences in the levels of compensation at the initial entry margin, our paper brings new attention to the retention margin, and in particular to the structure of commonly used retention incentives. Using variation in reenlistment bonuses and early retirement programs, we have shown that low-ability soldiers are more sensitive to immediate lump-sum transfers than their higher-ability peers. Specifically, we have shown that, on the margin, lump sum bonus offers induce lower-ability soldiers to reenlist, while early retirement programs induce lower-ability soldiers to leave the Army. We provide suggestive evidence that these patterns may arise from personal discount rates (which are higher for low-ability soldiers), but we find no evidence that they are driven by differences in credit constraints across the ability distribution. We estimate that these effects are large enough to affect the average ability level of the military. Insights from this project are relevant not only to the U.S. military but also to the many other public sector organizations that, while lacking the private sector's ability to target incentives to high-performing workers, are nonetheless tasked with recruiting and retaining a high-quality workforce.

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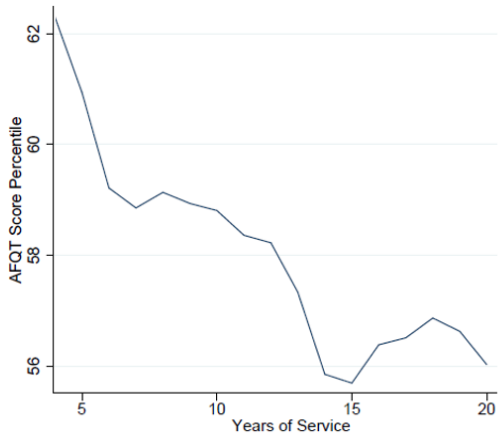
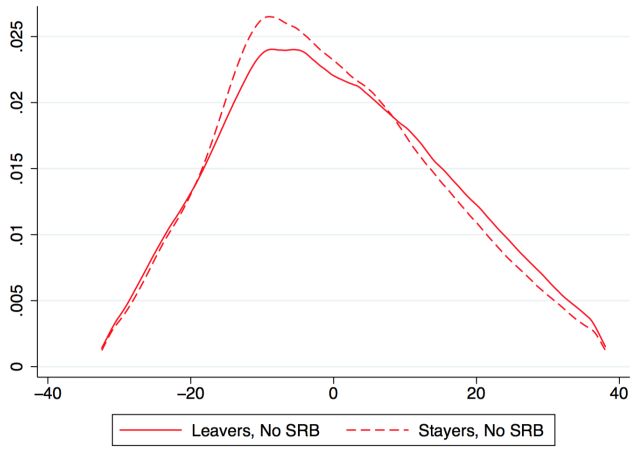
Figure 1: Average AFQT Score Percentile by Tenure with the Army

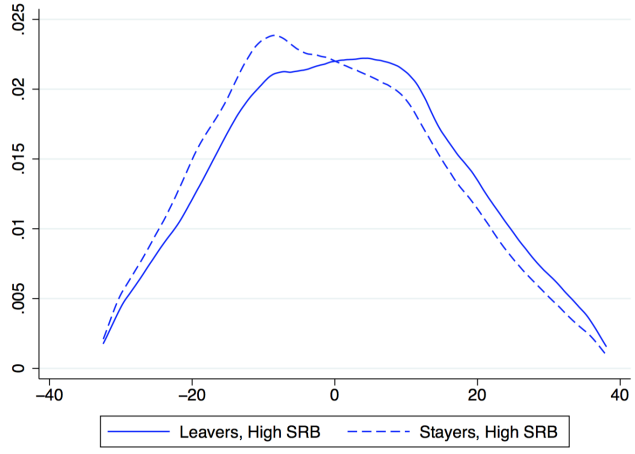


Notes: The figure plots the average AFQT Score Percentile of enlisted soldiers in the Army from 1992-2016, excluding soldiers who are currently serving. Years of service is defined as a soldier's total tenure with any branch of the military. Years of service is measured at the time of separation, or, for soldiers still serving, in the current period.

Figure 2: The Distribution of AFQT Scores for Soldiers, Split by Reenlistment Decisions and SRB Offers



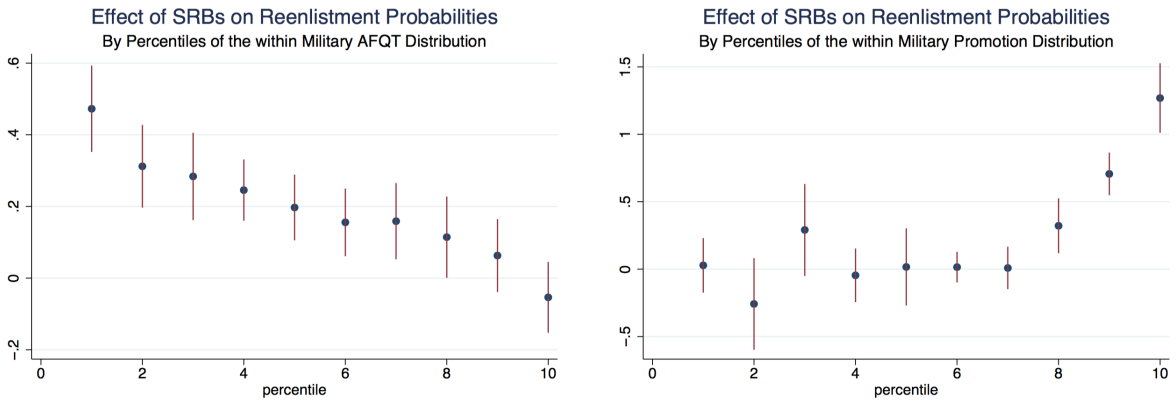
(a) Soldiers without an SRB offer



(b) Soldiers offered an SRB of at least $8,000

Notes: Figures 2a and 2b plot the residuals of a regression of AFQT score on MOS*rank*YOS dummies as well as date dummies. The sample includes only those soldiers who have a choice to reenlist. The left panel plots the distributions for the set of soldiers who do not have a SRB available at the start of their reenlistment window. The right panel shows the distributions for the set of soldiers who have an offered SRB of at least $8,000. The left figure includes 1.7 million observations (75% of the sample) while the right panel includes 300,000 observations (13% of the sample). Each distribution is truncated at the top and bottom 1%.

Figure 3: The Effect of Selective Reenlistment Bonuses on Soldier Retention by Soldier Quality: Nonlinear Specifications

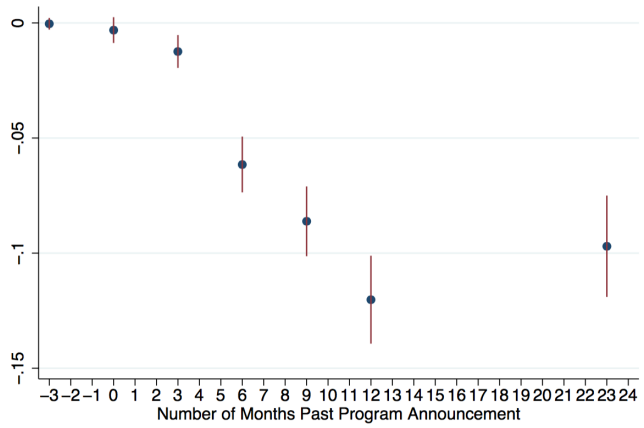


Notes: The left panel of this figure plots the coefficient estimates on the interaction of SRB offers and a dummy for each percentile of the AFQT score distribution. These are 10 equallly sized percentile bins, and correspond to the distribution of those soldiers who are eligible to reenlist, not the overall distribtuion of AFQT percentiles. The right panel plots similar regressions using the distribution of soldier's promotion speeds instead of AFQT scores. The promotion speed is measured by the number of months the soldier spend at a rank below a sergeant. In both panels, the red bars show 95 percent confidence intervals, clustering the standard erros at the MOS*rank*yos level. Reenlistment probabilities (the y-axis) are scaled by 100 and SRB values are in terms of thousands of U.S. dollars.

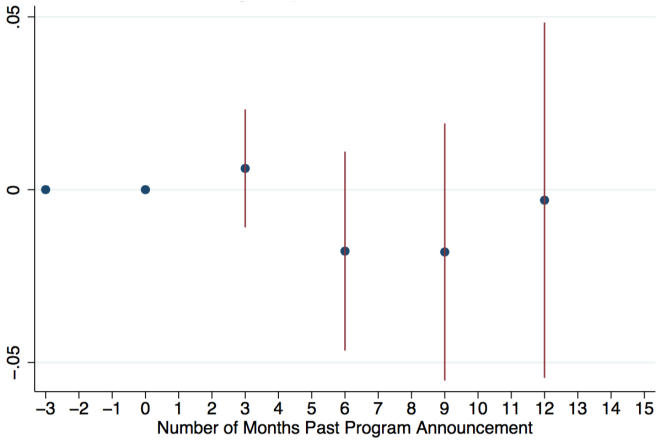
Figure 4: The Effect of Early Retirement Programs on Soldier Selection

Panel A: The Effect of Early Retirement Programs on Soldier Retention

(a) VSI/SSB

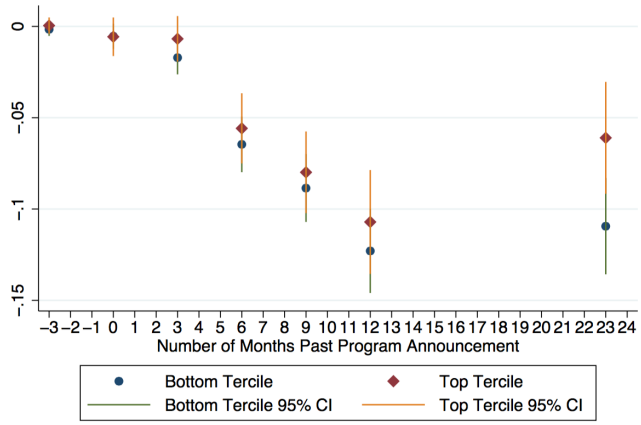


(b) TERA

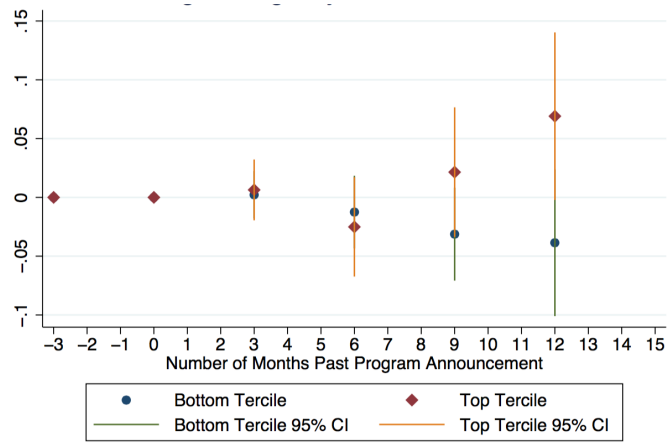


Panel B: The Effect of Early Retirement Programs on Retention by AFQT Scores

(c) VSI/SSB



(d) TERA



Notes: The left graph of each panel (VSI/SSB) shows the probability of remaining in the Army for each month relative to August 1, 1993, the start of the VSI/SSB program and includes soldiers with at least 6 years of experience. In Panel A, blue dots show the coefficient estimate on program eligibility from separate regressions on the probability of remaining in the military in period t. In Panel B, we split soldiers into terciles of the AFQT score distribution. In each time period, we run a regression of program eligibility interacted with the soldier's AFQT tercile on the probability of remaining in the military in period t. The right figures shows similar specifications, but defines the sample and the time period relative to August 31, 1994, the day the TERA program was introduced and includes only soldiers in the affected ranks and occupations, who have tenures that put them within 1 year of being eligible. In panel B, blue circles plot the coefficient on program eligibility interacted with the bottom tercile, and red diamonds plot the coefficient on program eligibility interacted with the top tercile. The middle tercile was also included in the regression but is not plotted here. Across all figures, regressions also includes occupation and rank fixed effects, a control for the soldier's tenure as of the program start date, dummies for the soldier's AFQT score tercile, and demographic controls (age, marital status, gender and race). Lines show the 95% confidence intervals, with standard errors clustered at the occupation*rank*year of service bin.

Table 1: Summary Statistics

	(1) Full Sample	(2) Soldiers with Reenlistment Choice	(3) Spells ending in exit	(4) Spells ending in Reenlistment
Fraction Male	0.85	0.85	0.85	0.86
Age	28.37	29.02	29.71	28.66
Years of Service	6.33	6.98	7.96	6.46
Fraction Married	0.57	0.60	0.52	0.64
AFQT Percentile	57.94	58.25	59.68	57.48
Months as Sergeant in First Term	2.51	2.99	1.95	3.55
Number of Soldiers	1,626,298	1,180,179	726,930	715,153
Number of Spells	2,765,755	2,102,206	734,972	1,367,234

Notes: Sample in Column 1 includes the enlistment spells for all enlisted soldiers from1992-2016. Column 2 restricts to the enlistment spells at the end of which soliders have the option to reenlist. Column 3 includes the set of spells at the end of which the soldier decides to exit the military. Column 4 includes the set of spells that are followed by another term in the Army. Years of service are defined as of the end of the spell, and AFQT scores are measured at the time of entrance into the Army.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: The Effect of Selective Reenlistment Bonuses on Soldier Retention by Soldier Quality

*Dependent Variable: Indicator for Reenlisting*100*					
	(1)	(2)	(3)	(4)	(5)
Ability Measure:	AFQT Score				Months below Sergent in first term
SRB	0.158***	0.615***	0.327***	0.359***	-0.607***
	(0.042)	(0.078)	(0.066)	(0.085)	(0.108)
SRB*Ability		-0.710***	-0.281***	-0.745***	0.015***
		(0.116)	(0.102)	(0.117)	(0.002)
Ability	-11.411***	-9.347***	-14.312***	-9.127***	0.309***
	(0.873)	(0.868)	(0.648)	(0.914)	(0.024)
R-squared	0.157	0.157	0.189	0.195	0.171
Observations	1761615	1761615	1422783	1757584	1708425
Year * Month FE	x	x			x
Year * Month * CZ FE			x		
Year * Month * MOS FE				x	
MOS*Rank*YOS FE	x	x	x	x	x
Demographic Controls	x	x	x	x	x
Average Dep. Var	65.1	65.1	66.72	65.13	66.3
Average SRB	2.89	2.89	3.26	2.9	3.02

Note: Standard errors are reported in parentheses. They are twoway clustered at the MOS*Rank*YOS and individual level. Sample is restricted to the soldiers who are eligible to reenlist in spells ending between 1997-2015. SRBs are in $1000s of 2015 dollars. Demographic controls include gender, age, marital status, race, and special skill dummies.``Ability'' is defined as AFQT score for columns (1)-(4) and months below Sergeant for column (5). AFQT is on a scale from 0-1.

Table 3: The Effect of SRBs and Credit Scores on Soldier Retention, by AFQT

	(1)	(2)	(3)
SRB	0.477***	0.472***	1.488***
	(0.145)	(0.145)	(0.221)
SRB * AFQT	-0.847***	-0.839***	-0.707***
	(0.188)	(0.186)	(0.179)
AFQT	-9.652***	-8.511***	-3.126
	(0.955)	(0.884)	(3.585)
Credit Score		-0.248***	-0.161***
		(0.020)	(0.041)
SRB * Credit Score			-0.017***
			(0.002)
AFQT * Credit Score			-0.088
			(0.056)
R^2	0.207	0.209	0.209
Year * Month FE	Y	Y	Y
MOSxRankxYOS FE	Y	Y	Y
MOS*Date	Y	Y	Y
Demographic Controls	Y	Y	Y
Dep. mean	68.28	68.42	68.42
Ind. Mean	2.06	2.06	2.06
Observations	606,350	600,688	600,688

Standard errors are reported in parentheses. They are twoway clustered at the MOS*Rank*YOS and individual level. Sample is restricted to the soldiers who are eligible to reenlist in spells ending between 1997-2015. Samples for columns (1)-(3) are further restricted to soldiers with non-missing credit scores. SRBs are in $1000s of 2015 dollars. Demographic controls include gender, age, marital status, race, and special skill dummies. AFQT is on a scale from 0-1.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Relationship Between Soldier Ability and Take-Up of SSB vs. VSI

	(1)	(2)	(3)	(4)	(5)	(6)
	Ind. Var.: AFQT			Ind. Var.: Months E-4 or Below		
AFQT	-0.154***	-0.094***	-0.065**			
	(0.021)	(0.023)	(0.026)			
Months E-4 or below				0.082***	0.028	0.042**
				(0.016)	(0.017)	(0.019)
R^2	0.012	0.085	0.096	0.006	0.087	0.101
MOS FE	N	Y	Y	N	Y	Y
Rank FE	N	Y	Y	N	Y	Y
Demographic Controls	N	N	Y	N	N	Y
Dep. mean	.91	.91	.91	.92	.92	.92
Ind. Mean	53.81	53.78	53.94	88.23	88.35	87.57
Observations	5,620	5,573	5,323	4,970	4,928	4,753

Standard errors are reported in parentheses. Sample is restricted to the soldiers who were eligible for the second wave of the VSI/SSB programs and who chose to separate under one of the two programs. Demographic controls include gender, age, marital status, race, and special skill dummies. AFQT is on a scale from 0-1.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX NOT FOR PUBLICATION

A Theoretical Framework for Public Sector Retention

The goal of this section is twofold. First, we demonstrate the importance of the parameter that we estimate, the differential sensitivity of soldiers to lump-sum bonuses by ability, for capturing how the quality of the military will change with various retention policies. Second, we show that in the simplest model of public sector retention, this key parameter is unambiguously positive – retention policies that increase the financial return should attract higher ability soldiers and increase the average quality of soldiers in the military. However, we show that away from that simple case, the theoretical predictions are ambiguous and depend on the underlying distribution of preferences across the population.

First, we relate the parameter that we estimate in Section 4 to the effect of retention policies on the average quality of the military $\overline{A}$, a parameter that analysis in the military is key for designing retention policies. Mechanically, the total quality of retained soldiers is

$$\overline{A} = \sum_{u} p_i(R) * a_i$$

where $p_i(R)$ is the probability that individual i reenlists and a_i is the ability of soldier i. The response of this average to a reenlistment bonus K is

$$\frac{d\overline{A}}{dK} = \sum_{i} \frac{dp_i(R)}{dK} * a_i = \sum_{i} \gamma_i a_i$$

where $\gamma_i = \frac{dp_i(R)}{dK}$. Using expectations, you can rewrite this as:

$$\frac{d\overline{A}}{dK} = \overline{\gamma}\,\overline{a} + cov(\gamma_i, a_i) = \overline{\gamma}\,\overline{a} + \beta Var(a_i)$$

where $\overline{\gamma}$ is the average response of soldiers to the bonus and $\overline{a}$ is average ability in the military. The key parameter that needs to be estimated to inform the effect of retention policies on average soldier quality is β, which is precisely the parameter we focus on estimating in Section 4.

Having established the importance of this parameter for the design of retention policies, we now explore

a simple model of selection that underpins this parameter. Consider a soldier choosing whether to reenlist in the military for a fixed term. As discussed above, personnel management is notoriously rigid in the military. Although individual ability can indirectly influence compensation – for example, higher ability individuals might be promoted more quickly, entitling them to a steeper wage profile – at least in the short term, military compensation is largely independent of individual ability. Alternatively, in a competitive civilian labor market, higher ability individuals earn their full marginal product. Therefore, in our simplified model, military compensation is independent of individual ability, whereas civilian wages are increasing in ability.

We will write the individual's military payoff as:

$$U_i(military) = W^m(\mathbf{X}_i), \tag{A1}$$

where W^m is the military wage function and $\mathbf{X}$ is a vector of individual characteristics affecting compensation (for example, rank, years of service, and military occupational specialty). Should she choose not to reenlist, the same individual earns a payoff of:

$$U_i(civilian) = W^c(\mathbf{X}_i, a_i), \tag{A2}$$

where W^c is the civilian wage function, and a reflects individual ability, and $\frac{\partial W^c}{\partial a} \geq 0$.

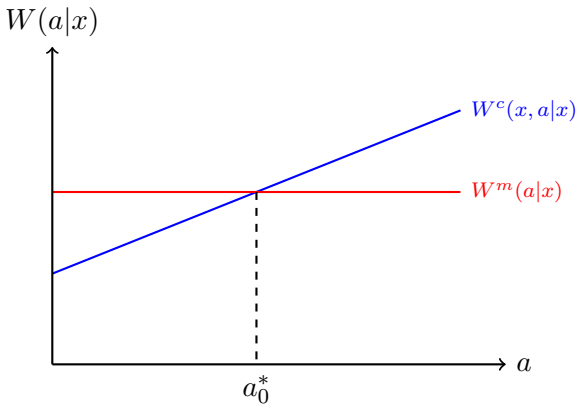
Figures A1a and A1b depict the military and civilian wage functions and the distribution of ability types, respectively. In this setting, there exists a threshold ability type a_0^*, such that soldiers of ability $a_i < a_0^*$ will always choose to reenlist, and soldiers of ability $a_i > a_0^*$ will always choose to separate from the military.

Now suppose that the military wants to attract more workers and therefore offers a lump-sum reenlistment bonus of K. The new military payoff is:

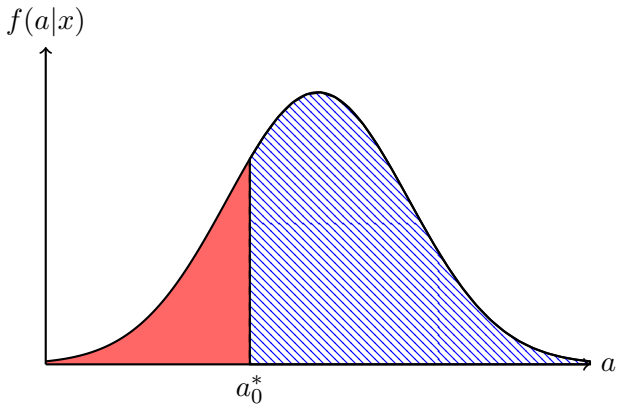
$$U_i(military) = W^m(\mathbf{X}_i) + K \tag{A3}$$

Figure A2a depicts the military and civilian wage functions subsequent to the level shift in military wage. As illustrated by the figure, a level shift in the military wage generates a corresponding increase in the threshold ability type, a_1^*. Intuitively, as military wages increase, the military will tend to retain more service mem-

Figure A1: Simple Case



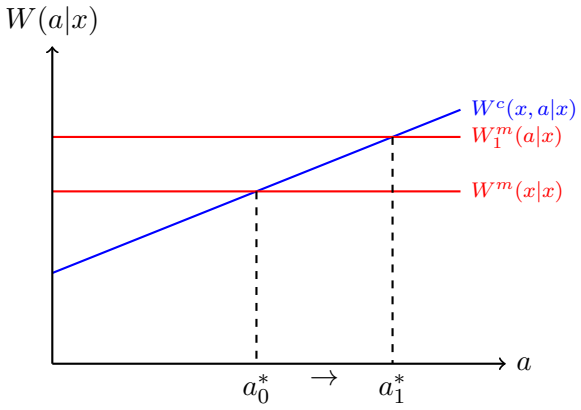
(a) Military and Civilian Wage Functions



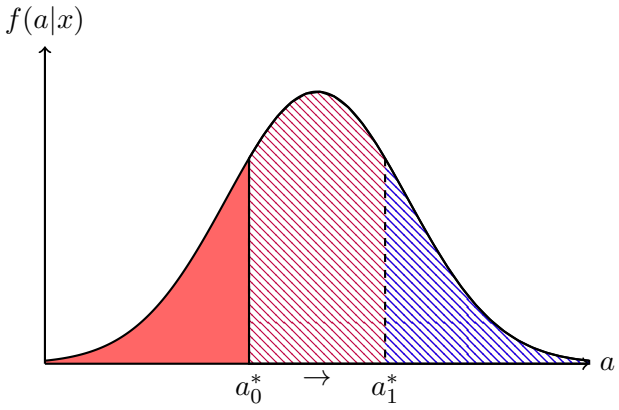
(b) PDF of Soldier Ability

bers. Only the most productive soldiers will be able to command a comparable wage in the civilian labor market. Figure A2b depicts the new cutoff rule. In this simple case, an increase to the relative military payoff generates an increase in the marginal ability type a^*, and implies that higher ability soldiers are more responsive to reenlistment bonuses than their lower-ability peers. It is only the higher-ability workers who are on the margin and thus affected by lump-sum bonuses. It also increases the average ability of the soldiers who the military retains, which is likely a key statistic that the policy-maker cares about.

Figure A2: Exogenous Shift in Relative Military Compensation



(a) Military and Civilian Wage Functions



(b) PDF of Soldier Ability

While this simple model generates an unambiguous counterfactual prediction, a setting with richer soldier heterogeneity will produce theoretically ambiguous responses. Suppose that soldiers have heterogeneous

"taste" for military service c_i drawn from a continuous distribution $F(\cdot)$. In particular, rewrite the military payoff function as

$$U_i(military) = W^m(\mathbf{X}_i) + c_i, \tag{A4}$$

Given heterogenous taste for service, a soldier i reenlists if her military payoff exceeds her civilian payoff, or $W^m(\mathbf{X}_i)+c_i > W^c(\mathbf{X}_i, a)$. This yields a cutoff rule for the soldier's reenlistment decision with respect to ability type a_i. Namely, conditional on individual characteristics $\mathbf{X}$, a soldier reenlists if

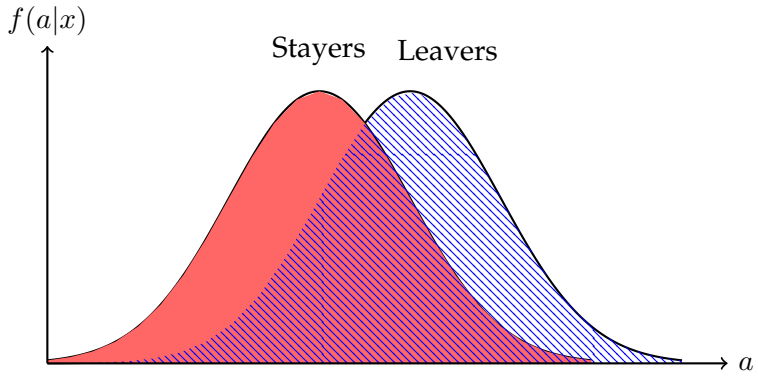
$$a_i < g(c_i), \tag{A5}$$

where $g(c_i) = W^{c^{-1}}\left(W^m(X_i) + c_i\right)$ and $g'(c_i) > 0$.

Figure A3 depicts stylized baseline ability distributions of stayers and leavers in this continuous-type setting. As Equation (A5) demonstrates, conditional on a soldier's taste for the military (c_i), the sorting of stayers and leavers looks identical to our simple case in Figure A1b. However, in the continuous-type setting, we have to aggregate across values of taste-for-service types c_i in order to obtain the full distribution of ability types among either stayers or leavers. In other words, we obtain the "stayer" distribution in Figure A3 by adding up the areas left of the cutoff value $g(c_i)$ for each taste-for-service type c_i. Consistent with the preliminary prediction that those who reenlist are of lower average ability than those who do not reenlist, we draw the PDFs so that the stayer ability distribution peaks to the left of the leaver ability distribution. In this more general case, there are many ability types for which soldiers will either reenlist *or* separate, depending upon their individual taste for service. Stayers on the far right-hand tail of their ability distribution – that is, those who reenlist despite highly marketable private-sector job skills – have a very high taste for military service. Conversely, leavers on the far left-hand tail of their ability distribution – that is, those who separate from the military despite relatively low private-sector job skills – have a very low taste for military service.

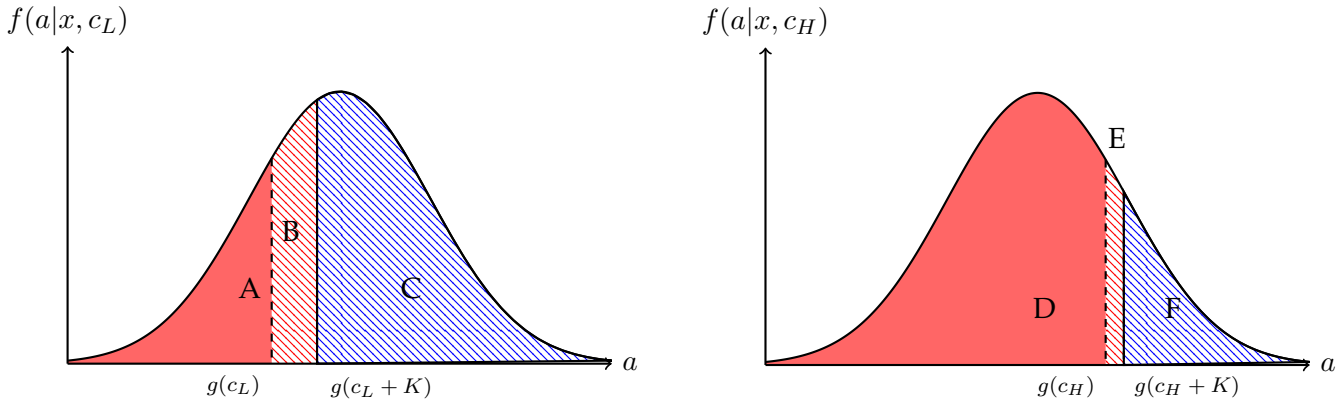
Now consider the introduction of lump-sum bonuses K, again in the form of a positive level shift in the military wage, so that the military payoff is $W^m(\mathbf{X}_i) + c_i + K$. Under the new cutoff rule, a soldier reenlists if $a_i < g(c_i + K)$. Conditional on taste for service, the stark predictions depicted in Figure A2 from the simple case still hold. That is, for each value of c_i, an increase to the relative military payoff generates an increase in

Figure A3: Stayer and Leaver Ability Distributions,
Continuous Taste Types (c_i)



the marginal ability type a^* and increases in the average abilities of those who chose to reenlist. However, in aggregating the changes across soldier types, the predictions for how soldiers of different abilities respond to the bonus become ambiguous. What the differential elasticity to bonuses by ability will be will depend upon at least three factors: 1) the shape of the function $g(\cdot)$ (which incorporates both how individuals trade off taste for military service with other types of compensation and how civilian employers reward ability), 2) the density of the ability distribution around cutoff values and 3) the correlation between ability a and taste for service c.[34]

Figure A4: Change in Relative Return to Military Service, Two-Type Case



(a) Low Taste for Military Service (c_L)

(b) High Taste for Military Service (c_H)

[34]In the dynamic version of this static problem where soldiers consider the expected future stream of compensation, this would also depend on the correlation between discount factors and ability a.

To fix intuitions, suppose there are just two types of taste for military service, $c_i \in \{c_L, c_H\}$, denoting either a low or high taste for military service. Figure A4a shows the new cutoff rule after the bonus K for individuals with a low taste for service c_L, and Figure A4b shows the new cutoff rule for individuals with a high taste for service c_H. Soldiers in areas A and D were always going to reenlist in the military, and soldiers in areas C and F were never going to reenlist. Areas B and E, on the other hand, correspond to soldiers who were induced to stay in the military due to the change in the compensation policy. The estimated differential response to the bonuses by ability will depends on the size and placement of these two areas. Specifically, the size of area B and E is going to depend on the distance between $g(c_L)$ and $g(c_L + K)$ or between $g(c_H)$ and $g(c_H + K)$. This is determined by the shape of the g function. The size of area B and E is also going to depend on the density of soldiers around these cutoffs (i.e the height of the distribution). Affecting parts of the ability distribution where there are more soldiers will have a bigger effect on the average quality of the group. Even in this simple two-type case, without further assumptions, there is no clear prediction for whether higher or lower skill soldiers will be more responsive to reenlistment bonuses. In this simple model, our empirical finding that lower ability soldiers are more responsive to these lump-sum bonuses corresponds to the case where B is larger than E.

B Data Appendix

B.1 Data Details

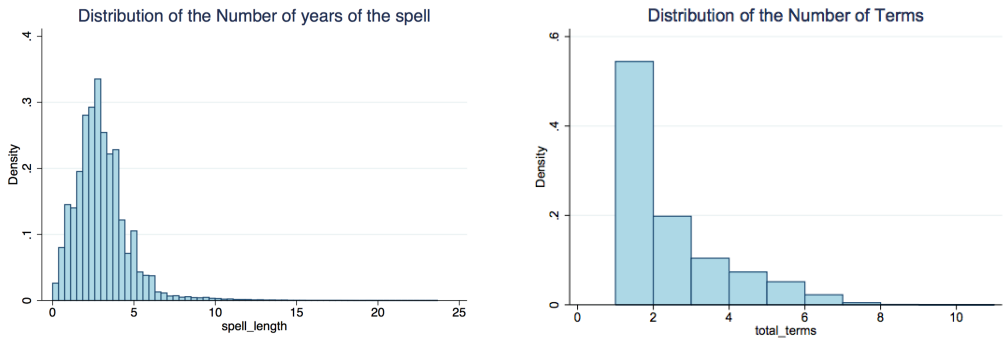
The data for this analysis comes from the U.S. Army's Total Army Personnel Database (TAPDB), from which we have constructed a panel of enlistment spells between 1992 and 2016. We exclude from the analysis all current spells. For our analysis, the date of entry into the military is identified for each soldier according to the first month in which they received payments. This captures military service that the soldier may have preformed in the past either in nonconsecutive spells or in other branches of the military. We drop all observations where we observe only 1 spell for the soldier that is less than 3 months. These spells are likely soldiers who did not complete basic training. We also drop spells that are are the end of the soldier's tenure, are less than 3 months, and result in the soldier entering officer training. We code that soldier as reenlisting in our analysis.

In addition to making the choice of whether to reenlist at the end of their spell, some soldiers have the option of extending their contract by up to a year. We identify spells as extension if the entry date of the spell is the same as the extension date of the previous spell. Since we are interested in major reenlistment decisions,

we absorb all extensions into the previous spell. For example, if a soldier served for 3 years and extended their spell for 1 year, but then left the military, we code the soldier as having 1 four year spell and then choose not to reenlist. The left panel of Figure B1 shows the distribution of spell length in the resulting sample, and the right panel of Figure B1 shows the distribution of enlistment terms in our sample.

In addition to knowing the date at which the soldier decided to reenlist and the date at which the term of service was due to end, we need to identify the date at which the soldier entered the reenlistment window. We use this date to assign the unemployment rate and SRB offer that the soldier faces. When in the reenlistment window the soldier decided to reenlist is the soldier's choice, and we want to abstract from variation in the relative military wage that are the result of strategic timing of the market. For each fiscal year, the Army announces in MILPER messages the date at which the soldier is eligible to enter their reenlistment window. Before fiscal year 2007, soldiers entered their reenlistment window 12 months before the end of their contracted service. However, for 2007, 2008 and 2009, the army extended this to 24 months. In the following years, all soldiers with terms expiring in the following year became eligible for reenlistment window on a given date. Figure B2 plots the distribution of the number of months in advance the end of service (ETS) date that the soldier enters their reenlistment window. Most soldiers enter 12 months in advance, with additional masses at 15 and 24 months. Most soldiers also reenlist at some point in that window.

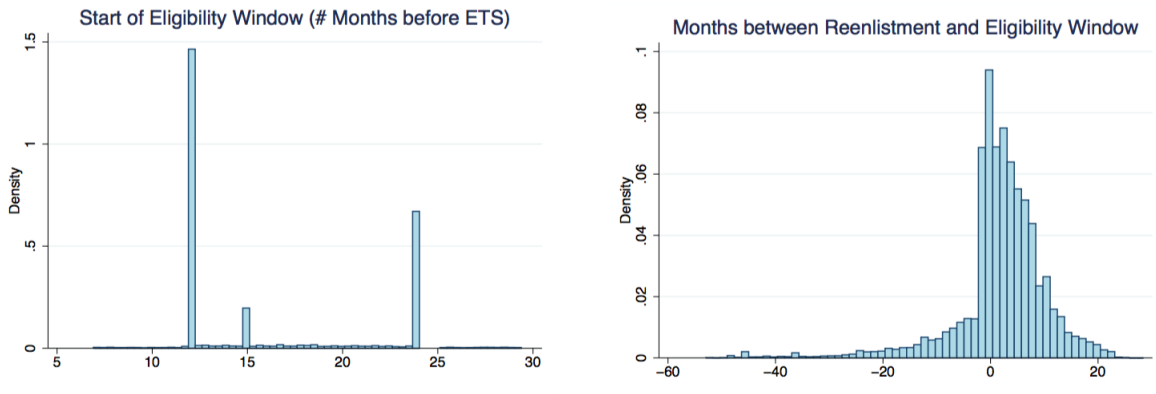
Figure B1: Distribution of the Number of Terms amoung Enlisted Soldiers (1992-2017)



Notes: Sample includes all enlisted soldiers from 1992-2016 and excludes soldiers currently serving in the Army.

We use two main measures of soldier quality through our analysis – the soldier's AQT score at entry and the number of months in their first term that the soldier spends below Sergeant (E-5). Table B1 shows estimates from Wigdor and Green (1991) showing that AFQT score are highly correlated with within-military hands on

Figure B2: The Timing of Reenlistment Decisions and the Eligibility Window



Notes: Sample includes all enlisted soldiers from 1992-2016 and excludes soldiers currently serving in the Army. The left panel plots the distribution of the time between the beginning of the reenlistment window and the end of the soldier's term The right panel plots the distribution of the difference between the start of the reenlistment window and the date that the soldier actually reenlists.

performance metrics. Table B2 also shows that AFQT scores are highly predictive of being promoted quickly within the military. We chose the number of months below sergeant as our measure of military performance because it is highly correlated with future performance in the military. Table B3 shows the pairwise correlations for the number of months that it takes soldiers to get to each rank. The speed of promotion to E-3 or E-4 is not highly correlated with strong performance later in the soldier's career, as those promotions are more defaulted, so we use the speed of promotion to E-5.

Table B1: Correlations of Armed Forces Qualifications Test (AFQT) and Job-Specific Hands-On Performance Measure

Specialty	AFQT w/ Performance
Administrative specialist	0.35
Air traffic control operator	0.10
Rifleman	0.40
Machinegunner	0.49
Mortarman	0.33
Motor transport operator	0.24
Radio operator	0.22
Median Correlation	0.26

Source: Wigdor and Green (1991)

Table B2: The Correlation of Soldier Ability Measures

	(1)			
	Average	AFQT Score	First Term Sergeant	Months as Sergeant
AFQT Score	57.9	1		
First Term Sergeant	0.23	0.126***	1	
Months as Sergeant	51.4	-0.118***	-0.326***	1

Notes: Sample includes all enlisted soldiers from 1992-2016. Correlations are pairwise.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B3: Correlation of Promotion Speeds Across Ranks

	(1)						
	Time to E-2	Time to E-3	Time to E-4	Time to E-5	Time to E-6	Time to E-7	Time to E-8
Time to E-2	1						
Time to E-3	0.758***	1					
Time to E-4	0.598***	0.686***	1				
Time to E-5	0.0764***	0.128***	0.298***	1			
Time to E-6	0.0526***	0.0876***	0.213***	0.620***	1		
Time to E-7	0.0812***	0.112***	0.241***	0.565***	0.803***	1	
Time to E-8	0.112***	0.144***	0.256***	0.505***	0.653***	0.774***	1

Notes: Sample includes all enlisted soldiers from 1992-2016. Correlations are pairwise.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B4: Correlation of SRB offers Across Chosen Reenlistment Term

	(1)
	4 Year Term
2 Year Term	0.593***
3 Year Term	0.986***
5 Year Term	0.988***
6 Year Term	0.964***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: Sample includes all SRB offers from 1997-2016. Correlations are pairwise.

Table B5: Correlations of Unconditional and Conditional (Location-Specific) SRB Offers (4-year terms)

	(1)
	Regular Offer
Continental US 1	0.372***
Continental US 2	0.510***
Continental US 3	0.585***
Continental US 4	0.698***
Continental US 5	0.722***
Continental US 6	0.846***
Continental US 7	0.831***
Non-continental 1	0.586***
Non-continental 2	0.608***

Notes: Sample includes all SRB offers from 1997-2016. Correlations are pairwise. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B6: Eligibility for Early Retirement Programs

	Panel A: TERA Program		
	All Soldiers	15+ Years of Service	Within 1 year of cutoff
Total Soldiers	259,998.00	25,441.00	3,114.00
Eligible Soldiers	1,731.00	1,731.00	1,731.00
Fraction Eligible for TERA	0.67	6.80	55.59
	Panel B: VSI/SSB Program		
	All Soldiers	6+ YOS	–
Total Soldiers	194,017.00	62,420.00	–
Eligible Soldiers	7,326.00	7,326.00	
Fraction Eligible for VSI	3.78	11.74	

Notes: In Panel A, Column 1 includes sample is all enlisted solders serving in the military on August 31, 1994, the start date for the TERA program. In Panel A Column 2, the sample is restricted to those with at least 15 years of service. In Column 3, the sample is restricted to those in eligible occupations and ranks with service that puts them within 1 year of eligibility. In Panel B, Column 1 includes all enlisted soldiers serving in August 1, 1993, the start date of the VSI program. Column 2 further restricts the sample to those soldiers with at least 6 years of service.

B.2 Case Studies: Time Series Variation in SRBs

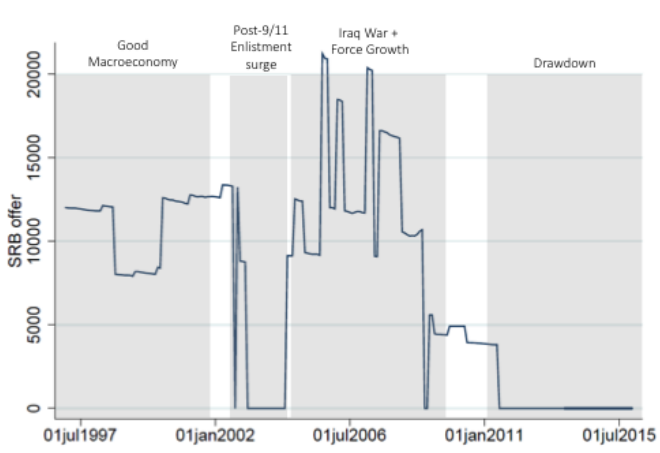
While it is difficult to know precisely what drives the high-frequency variation in SRB offers, anecdotal and observational evidence suggests that variation in SRBs is driven largely by a combination of "inside" factors – namely, the military's operational and strategic requirements – and "outside factors" – namely, labor market conditions and other economic trends affecting civilian labor market opportunities.[35] We study how these factors may have driven time-series variation in SRB offers across two separate MOSs in Figure B3. The left-most panel plots the time series of SRB offers for infantrymen. This MOS is the largest in the Army (11% of our sample) and is the most representative of the Army as a whole. Infantry SRBs remained moderately high throughout the period preceding the September 11, 2001 attacks. Although operational requirements were relatively minimal during this period, pre-war SRBs might reflect positive macroeconomic conditions, which forced the military to compete with civilian employers for qualified workers. Infantry SRBs dipped dramatically in early 2002 and remained low throughout much of the 2002-2004 period. This was a period of surging enlistment, which many attribute to heightened patriotism in the aftermath of the 9/11 attacks. However, SRBs increased again in 2004, and despite considerable volatility, they remained high through approximately 2008, reflecting the military's growing operational requirements in Iraq and Afghanistan. Though we might be concerned that this period also had higher casualties than other periods (a negative job amenity), we control for month fixed effects in all regressions and occupation by month fixed effects in others. Infantry SRBs have remained low since approximately 2011, likely reflecting the military's gradual exit from Iraq and its overall drawdown of personnel.

In contrast to infantry SRBs, SRB offers for Patriot missile operators, plotted in the right panel of Figure B3, appear to be largely driven by operational requirements and large-scale changes to the Army's overall force structure. SRB offers to Patriot missile operators were highest between 1997 and 2002 – precisely the period during which the Army was expanding its number of Patriot missile battalions from 13 to 15. The Army's focus on Patriot missiles was likely influenced by a period of perceived threat by Iraqi Scud missiles, against which Patriot missiles were intended to defend. The Patriot missile operator SRBs illustrate how exogenous changes in Army force structure – due to the standing-up of a new unit or perhaps the introduction of new

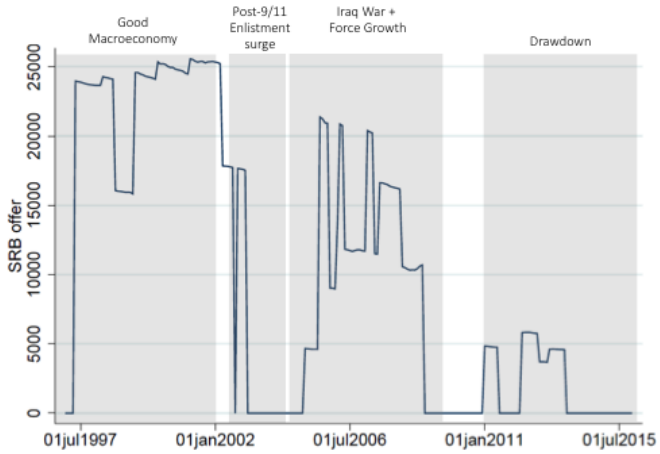
[35] While the Army process does not directly measure civilian economic opportunities, they do track the personnel inventories and adjust SRBs accordingly. So current labor market conditions may affect individual choices regarding reenlistment, which then affect the *future* SRBs offered to service members to maintain desired personnel inventories.

military technology – can be an important driver of variation in SRBs over time.

Figure B3: Selective Reenlistment Bonus (SRB) Case Studies
SRB offers by MOS (E-4), 1997-2015



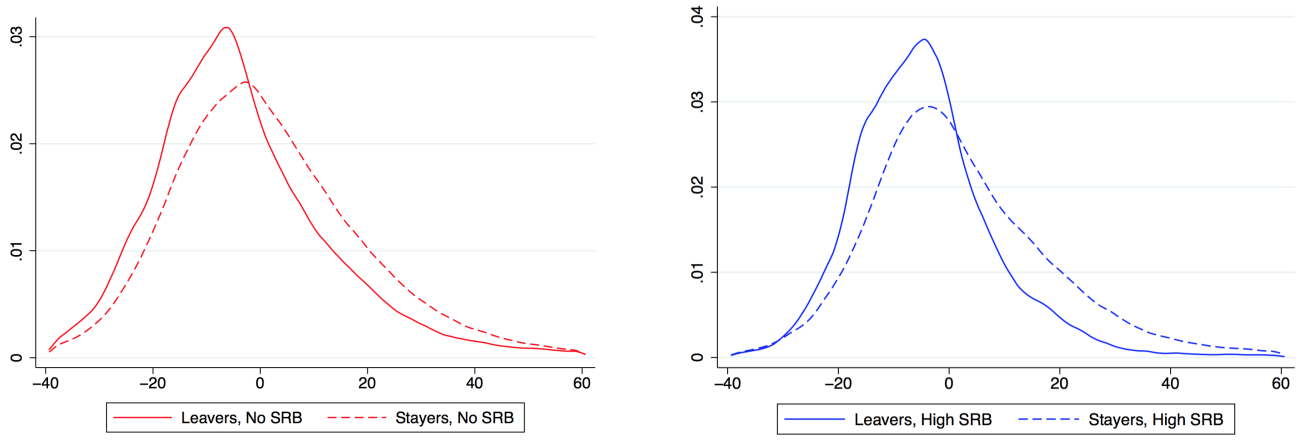
(a) MOS: 11B (Infantry)



(b) MOS: 14T (Patriot Missile Operator)

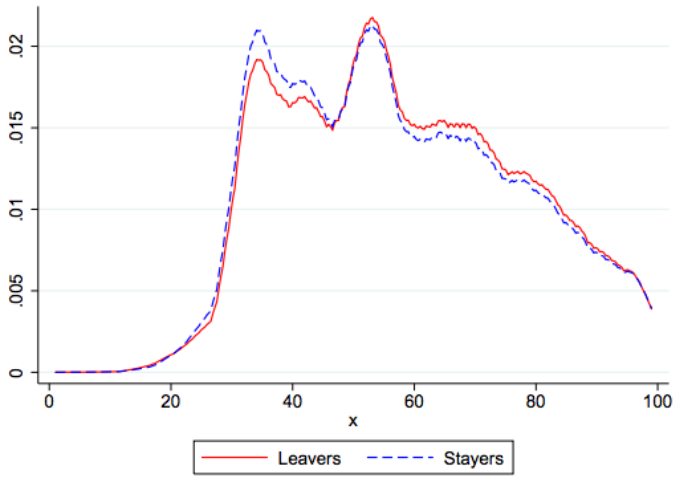
B Robustnes of Empirical Results

Figure B4: The distribution of first term promotion speeds, split by reenlistment decisions.



Notes: The figure plots the residuals of a regression of the number of months the soldier spent below sergent (rank E4 of below) on MOS*rank*YOS dummies as well as date dummies. The sample includes those soldiers who have a choice to reenlist. The left panel plots the distributions for the set of soldiers who do not have a SRB available at the start of their reenlistment window. The right panel shows the distributions for the set of soldiers who have an offered SRB of at least $8,000. The left figure includes 1.7 million observations (75% of the sample) while the right panel includes 300,000 observations (13% of the sample). Each distribution is truncated at the top and bottom 1%.

Figure B5: The raw distribution of AFQT scores for soldiers, split by reenlistment decisions.



Notes: The figure plots the raw AFQT score distribution for soldiers by their reenlistment decision. The sample includes those soldiers who have a choice to reenlist.

Table B7: Soldier's Reenlistment Probabilities by AFQT Score and Offered Bonuses (SRBs): Alternate Specifications

*Dependent Variable: Indicator for Reenlisting*100*	(1)	(2)	(3)	(4)	(5)	(6)
			Subsamples			
	Baseline	SRB in logs	Main MOS only	High-Corr. MOS only	No Surge Years	Positive SRB Offer
SRB	0.615***		0.465**	0.600***	0.527***	0.216**
	(0.078)		(0.207)	(0.221)	(0.076)	(0.109)
SRB*AFQT	-0.710***		-0.646*	-0.574	-0.648***	-0.224*
	(0.116)		(0.335)	(0.366)	(0.113)	(0.117)
AFQT	-9.347***		-11.889***	-10.195***	-9.201***	-17.428***
	(0.868)		(1.950)	(2.765)	(0.938)	(1.669)
log(SRB)		0.752***				
		(0.098)				
log(SRB)*AFQT		-0.850***				
		(0.184)				
R-squared	0.157	0.157	0.127	0.142	0.155	0.114
Observations	1761615	1761615	627775	382301	1457868	516754
Year * Month FE	x	x	x	x	x	x
MOS*Rank*YOS FE	x	x	x	x	x	x
Demographic Controls	x	x	x	x	x	x
Average Dep. Var	65.1	65.1	63.92	63.25	63.92	66.35
Average SRB	2.89	2.66	2.72	3.5	2.72	9.86

Note: Standard errors are reported in parentheses. They are twoway clustered at the MOS*Rank*YOS and individual level. Sample is restricted to the soldiers who are eligible to reenlist in spells ending between 1997-2015.Demographic controls include gender, age, marital status, race, and special skill dummies. SRBs are in $1000s of 2015 dollars and AFQT is on a scale from 0-1. The ``main MOS only'' column restricts to the 10 largest occupations in our sample. The ``high corr. mos'' column restricts to MOSs identified by Wigdor and Green (1991) as exhibiting a high correlation between AFQT score and hands-on job performance. The ``no surge years'' specification excludes soldiers entering their reenlistment window during the Iraq qurve years (2007-2009). The ``positive SRB offer'' column incldues only soldiers who were offered a positive SRB.

Table B8: Soldier's Reenlistment Probabilities by Months E-4 or Below and Offered Bonuses (SRBs): Alternate Specifications

*Dependent Variable: Indicator for Reenlisting*100*	(1)	(2)		(3)	(4)
		Subsamples			
	Baseline	Main MOS only	High-Corr. MOS only	No Surge Years	Positive SRB Offer
SRB	-0.607***	-0.877***	-0.952***	-0.672***	0.461***
	(0.108)	(0.295)	(0.326)	(0.116)	(0.111)
SRB*Months E4 or Below	0.015***	0.019***	0.024***	0.016***	-0.009***
	(0.002)	(0.005)	(0.005)	(0.002)	(0.002)
Months E4 or Below	0.309***	0.334***	0.273***	0.288***	0.599***
	(0.024)	(0.054)	(0.067)	(0.024)	(0.030)
log(SRB)					
log(SRB)*AFQT					
R-squared	0.171	0.150	0.155	0.167	0.150
Observations	1708425	619066	376659	1403790	522354
Year * Month FE	x	x	x	x	x
MOS*Rank*YOS FE	x	x	x	x	x
Demographic Controls	x	x	x	x	x
Average Dep. Var	66.3	65.24	63.92	65.24	66.4
Average SRB	3.02	2.86	3.59	2.86	9.86

Note: Standard errors are reported in parentheses. They are twoway clustered at the MOS*Rank*YOS and individual level. Sample is restricted to the soldiers who are eligible to reenlist in spells ending between 1997-2015. Demographic controls include gender, age, marital status, race, and special skill dummies. SRBs are in $1000s of 2015 dollars. ``Months E4 or Below'' is defined as the number of months spent in a rank below Sergeant during the soldier's first enlistment. The ``main MOS only'' column restricts to the 10 largest occupations in our sample. The ``high corr. mos'' column restricts to MOSs identified by Wigdor and Green (1991) as exhibiting a high correlation between AFQT score and hands-on job performance. The ``no surge years'' specification excludes soldiers entering their reenlistment window during the Iraq qurve years (2007-2009). The ``positive SRB offer'' column incldues only soldiers who were offered a positive SRB.

Table B9: Selective Reenlistment Bonuses (SRBs) and Average AFQT: Alternate Specifications

Dependent Variable: AFQT Score Percentile									
	(1)	(2)	(3)	(4)	(5)		(6)	(7)	(8)
					Subsamples				IV Spec
	Baseline	CZ Trends	MOS Trends	SRB in Logs	Main MOS only	High-Corr. MOS only	No Surge Years	Positive SRB Offers	Actual SRBs
SRB*Stay	-0.048***	-0.056***	-0.018		-0.166***	-0.059	-0.042**	-0.020	-0.038
	(0.015)	(0.016)	(0.012)		(0.035)	(0.056)	(0.019)	(0.020)	(0.065)
SRB*Leave	0.066***	-0.000	0.108***		-0.047	0.074	0.061**	0.024	
	(0.022)	(0.023)	(0.016)		(0.063)	(0.071)	(0.024)	(0.020)	
log(SRB)*Stay				-0.064***					
				(0.016)					
log(SRB)*Leave				0.087***					
				(0.028)					
Stay	-1.216***	-1.817***	-1.183***	-1.132***	-1.544***	-1.250***	-1.173***	-2.195***	
	(0.118)	(0.089)	(0.121)	(0.124)	(0.248)	(0.381)	(0.126)	(0.279)	
R-squared	0.304	0.351	0.326	0.304	0.251	0.226	0.302	0.313	0.290
Observations	1761615	1422783	1757584	1761615	627775	382301	1457868	516754	913070
Year * Month FE	x			x	x	x	x	x	x
Year * Month * CZ FE		x							
Year * Month * MOS FE			x						x
MOSxRankxYOS FE	x	x	x	x	x	x	x	x	x
Demographic Controls	x	x	x	x	x	x	x	x	x
Mean Dep. Var	58.26	59.08	58.25	58.26	54.83	59.83	58.17	61.17	56.61
Mean SRB	2.89	3.26	2.9	2.66	2.96	3.5	2.72	9.86	3.36

Note: Standard errors are reported in parentheses. They are twoway clustered at the MOS*Rank*YOS and individual level. Sample is restricted to the soldiers who are eligible to reenlist in spells ending between 1997-2015. SRBs are in $1000 of 2015 dollars. Demographic controls include gender, age, marital status, race, and special skill dummies. The dependent variable is a soldier's AFQT score. AFQT is on a scale from 0-100. The ``main MOS only'' column restricts to the 10 largest occupations. The ``high corr. mos'' column restricts to MOSs identified by Wigdor and Green (1991) as exhibiting a high correlation between AFQT score and hands-on job performance. The ``no surge years'' specification excludes soldiers entering their reenlistment window during the Iraq qurve years (2007-2009). The ``positive SRB offer'' column incldues only soldiers who were offered a positive SRB. The ``IV Specification'' restricts to only those who chose to reenlist and uses the offered SRB as an instrument for the actual SRB offer that the soldier receives. The first stage F-statistic for the IV regression is 460.

Table B10: Selective Reenlistment Bonuses (SRBs) and Average Months Below Sergeant: Alternate Specifications

Dependent Variable: Months E4 or Below								
	(1)	(2)	(3)	(4)		(5)	(6)	(7)
				Subsamples				IV Spec
	Baseline	CZ Trends	MOS Trends	Main MOS only	High-Corr. MOS only	No Surge Years	Positive SRB Offers	Actual SRBs
SRB*Stay	0.022	-0.007	0.051*	0.073	0.054	0.021	0.013	0.076
	(0.030)	(0.031)	(0.030)	(0.091)	(0.106)	(0.032)	(0.029)	(0.082)
SRB*Leave	-0.076***	0.037	-0.055	-0.079	-0.134	-0.116***	0.428***	
	(0.027)	(0.023)	(0.043)	(0.061)	(0.086)	(0.028)	(0.052)	
log(SRB)*Stay								
log(SRB)*Leave								
Stay	6.693***	8.416***	6.652***	7.115***	5.396***	5.974***	13.041***	
	(0.505)	(0.451)	(0.529)	(1.074)	(1.132)	(0.492)	(0.962)	
R-squared	0.342	0.391	0.361	0.305	0.316	0.336	0.327	0.343
Observations	1708425	1433249	1704497	619066	376659	1403790	522354	897384
Year * Month FE	x			x	x	x	x	x
Year * Month * CZ FE		x						
Year * Month * MOS FE			x					x
MOSxRankxYOS FE	x	x	x	x	x	x	x	x
Demographic Controls	x	x	x	x	x	x	x	x
Mean Dep. Var	54.4	53.1	54.4	53.57	52.16	54.41	51.93	58.77
Mean SRB	3.02	3.27	3.02	3.04	3.59	2.86	9.86	3.46

Note: Standard errors are reported in parentheses. They are twoway clustered at the MOS*Rank*YOS and individual level. Sample is restricted to the soldiers who are eligible to reenlist in spells ending between 1997-2015. SRBs are in $1000 of 2015 dollars. Demographic controls include gender, age, marital status, race, and special skill dummies. The dependent variable ``Months E4 or Below'' is defined as the number of months spent in a rank below Sergeant during the soldier's first enlistment. The ``main MOS only'' column restricts to the 10 largest occupations. The ``high corr. mos'' column restricts to MOSs identified by Wigdor and Green (1991) as exhibiting a high correlation between AFQT score and hands-on job performance. The ``no surge years'' specification excludes soldiers entering their reenlistment window during the Iraq qurve years (2007-2009). The ``positive SRB offer'' column incldues only soldiers who were offered a positive SRB. The ``IV Specification'' restricts to only those who chose to reenlist and uses the offered SRB as an instrument for the actual SRB offer that the soldier receives. The first stage F-statistic for the IV regression is 460.

Table B11: Selective Reenlistment Bonuses (SRBs) and Average AFQT: Alternative SRB Offer Windows

Dependent Variable: AFQT Score Percentile						
	(1)	(2)	(3)	(4)		(5)
		Alternative SRB Offer Windows				
	Baseline	6-mo. Avg. SRB	12-mo. Avg. SRB	6-mo. Max. SRB	12-mo. Max. SRB	Final SRB Offer
SRB*Stay	-0.048***	-0.061***	-0.072***	-0.055***	-0.059***	-0.063***
	(0.015)	(0.017)	(0.018)	(0.014)	(0.014)	(0.011)
SRB*Leave	0.066***	0.055**	0.044*	0.055***	0.050**	-0.001
	(0.022)	(0.024)	(0.025)	(0.021)	(0.021)	(0.015)
Stay	-1.216***	-1.227***	-1.247***	-1.189***	-1.163***	-1.530***
	(0.118)	(0.118)	(0.118)	(0.119)	(0.119)	(0.117)
R-squared	0.304	0.304	0.304	0.304	0.304	0.304
Observations	1761615	1761615	1761615	1761615	1761615	1761615
Year * Month FE	x	x	x	x	x	x
MOS*Rank*YOS FE	x	x	x	x	x	x
Demographic Controls	x	x	x	x	x	x
Average Dep. Var	58.26	58.26	58.26	58.26	58.26	58.26
Average SRB	2.89	2.71	2.53	3.21	3.45	.4

Note: Standard errors are reported in parentheses. They are twoway clustered at the MOS*Rank*YOS and individual level. Sample is restricted to the soldiers who are eligible to reenlist in spells ending between 1997-2015.Demographic controls include gender, age, marital status, race, and special skill dummies. SRBs are in $1000s of 2015 dollars and AFQT is on a scale from 0-100. The ``Baseline'' column uses soldiers' highest SRB offer on the first day of their reenlistment eligibility window. The ``6-mo. Avg.'' column uses the average of the high SRB offer on the first day of the first six months of a soldier's reenlistment eligibility window. The ``12-mo. Avg.'' column averages the high SRB offers across the first 12 months of the soldier's reenlistment eligibility window. The ``6-mo. Max.'' column uses the highest SRB offer from the first six months of the reenlistment eligibility window. The ``12-mo. Max.'' column uses the highest SRB offer from the first 12 months of the reenlistment eligibility window. The ``Final SRB Offer'' uses the highest SRB offer available on the last day of a soldier's reenlistment eligibility window, which is generally 90 days prior to the end of the soldier's current enlistment.

Table B12: Selective Reenlistment Bonuses (SRBs) and Average Months Below Sergeant: Alternative SRB Offer Windows

Dependent Variable: AFQT Score Percentile						
	(1)	(2)	(3)	(4)		(5)
		Alternative SRB Offer Windows				
	Baseline	6-mo. Avg. SRB	12-mo. Avg. SRB	6-mo. Max. SRB	12-mo. Max. SRB	Final SRB Offer
SRB*Stay	0.022	0.012	0.003	0.019	0.017	0.010
	(0.030)	(0.031)	(0.031)	(0.028)	(0.026)	(0.016)
SRB*Leave	-0.076***	-0.083***	-0.089***	-0.077***	-0.080***	-0.016
	(0.027)	(0.030)	(0.033)	(0.027)	(0.027)	(0.022)
Stay	6.693***	6.718***	6.742***	6.668***	6.637***	6.987***
	(0.505)	(0.506)	(0.507)	(0.508)	(0.512)	(0.475)
R-squared	0.342	0.342	0.342	0.342	0.342	0.342
Observations	1708425	1708425	1708425	1708425	1708425	1708425
Year * Month FE	x	x	x	x	x	x
MOS*Rank*YOS FE	x	x	x	x	x	x
Demographic Controls	x	x	x	x	x	x
Average Dep. Var	54.4	54.4	54.4	54.4	54.4	54.4
Average SRB	3.02	2.83	2.64	3.35	3.6	.42

Note: Standard errors are reported in parentheses. They are twoway clustered at the MOS*Rank*YOS and individual level. Sample is restricted to the soldiers who are eligible to reenlist in spells ending between 1997-2015.Demographic controls include gender, age, marital status, race, and special skill dummies. SRBs are in $1000s of 2015 dollars, and the dependent variable ``Months E4 or Below'' is defined as the number of months spent in a rank below Sergeant during the soldier's first enlistment. The ``Baseline'' column uses soldiers' highest SRB offer on the first day of their reenlistment eligibility window. The ``6-mo. Avg.'' column uses the average of the high SRB offer on the first day of the first six months of a soldier's reenlistment eligibility window. The ``12-mo. Avg.'' column averages the high SRB offers across the first 12 months of the soldier's reenlistment eligibility window. The ``6-mo. Max.'' column uses the highest SRB offer from the first six months of the reenlistment eligibility window. The ``12-mo. Max.'' column uses the highest SRB offer from the first 12 months of the reenlistment eligibility window. The ``Final SRB Offer'' uses the highest SRB offer available on the last day of a soldier's reenlistment eligibility window, which is generally 90 days prior to the end of the soldier's current enlistment.

Table B13: Soldier's Survival Probabilities by Soldier Quality and VSI Program Eligibility

Dependent Variable: Indicator for Remaining in Military through VSI Period								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Quality Measure:	AFQT Score Percentile				Months below Sergent in first term			
	All Soldiers		6+ Years of Service		All Soldiers		6+ Years of Service	
VSI/SSB Eligibility	-0.099***	-0.196***	-0.097***	-0.151***	-0.198***	0.411***	-0.174***	0.047*
	(0.014)	(0.032)	(0.016)	(0.032)	(0.014)	(0.031)	(0.012)	(0.026)
VSI/SSB*Quality		0.193***		0.106***		-0.006***		-0.002***
		(0.030)		(0.029)		(0.000)		(0.000)
Quality	-0.099***	-0.107***	-0.022***	-0.034***	0.005***	0.005***	-0.001***	-0.000
	(0.011)	(0.011)	(0.008)	(0.008)	(0.000)	(0.000)	(0.000)	(0.000)
R-squared	0.154	0.155	0.168	0.168	0.230	0.240	0.176	0.182
Observations	189243	189243	60678	60678	161364	161364	32356	32356
Average Dep. Var	0.83	0.83	0.84	0.84	.84	.84	.85	.85
Fraction Eligible	.04	.04	.12	.12	.03	.03	.17	.17

Note: Standard errors are reported in parentheses. They are clustered at the MOS*Rank*YOS. Sample in column 1, 2, 5 and 6 is restricted to all soldiers serving on August 31, 1994 (the start of the sample period). Sample in Column 3, 4,79 and 8 is further restricted to those soldiers with between 6 an 20 years of service as of August 31, 1994. All regressions include occupation and rank fixed effects, a control for the years of service as of August 31, 1994, as well as controls for gender, age, marital status, and race. ``Ability'' is defined as AFQT score for columns (1)-(4) and months below Sergeant for columns (5)-(8). AFQT is on a scale from 0-1.

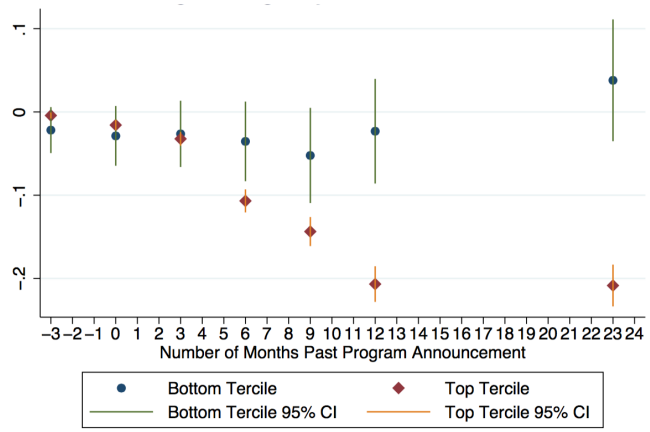
Table B14: Soldier's Survival Probabilities by Soldier Quality and TERA Program Eligibility

Dependent Variable: Indicator for Remaining in Military through TERA Period								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Quality Measure:	AFQT Score Percentile						Months below Sergent in first term	
	All Soldiers		15+ Years of Service		Around Cutoff		All Soldiers	
TERA Eligibility	-0.046***	-0.088***	-0.021	-0.053	-0.024	-0.089**	-0.145***	0.264*
	(0.014)	(0.032)	(0.016)	(0.032)	(0.021)	(0.040)	(0.032)	(0.152)
TERA*Ability		0.078		0.061		0.122*		-0.003***
		(0.056)		(0.057)		(0.067)		(0.001)
Ability	-0.060***	-0.060***	-0.022*	-0.026**	-0.023	-0.066*	0.003***	0.003***
	(0.008)	(0.008)	(0.012)	(0.012)	(0.035)	(0.037)	(0.000)	(0.000)
R-squared	0.107	0.107	0.115	0.115	0.078	0.079	0.148	0.148
Observations	254274	254274	24589	24589	4387	4387	219156	219156
Average Dep. Var	.91	.91	.87	.87	.84	.84	.92	.92
Fraction Eligible	.01	.01	.07	.07	.33	.33	<.01	<.01

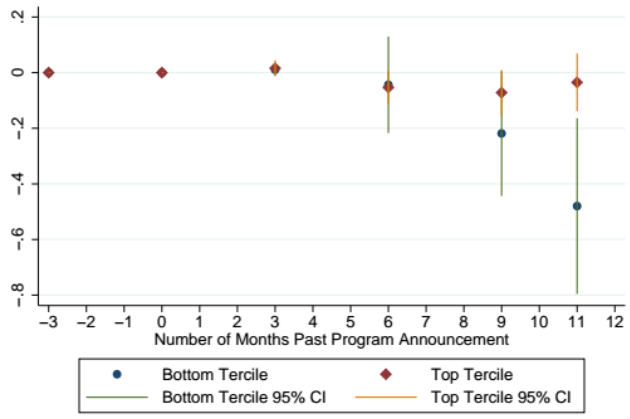
Note: Standard errors are reported in parentheses. They are clustered at the MOS*Rank*YOS. Sample in column 1, 2, 7 and 8 is restricted to all soldiers serving on August 31, 1994 (the start of the sample period). Sample in Column 3 and 4 is further restricted to those soldiers with between 15 an 20 years of service as of August 31, 1994. Columns 5 and 6 restrict the sample to those soldiers in an eligible occupation/rank but within 2 years (above or below) the mininmum years of service for program eligibility. All regressions include occupation and rank fixed effects, a control for the years of service as of August 31, 1994, as well as controls for gender, age, marital status, and race. ``Ability'' is defined as AFQT score for columns (1)-(6) and months below Sergeant for columns (7) and (8). AFQT is on a scale from 0-1.

Figure B6: The Effect of Early Retirement Programs on Retention by Soldier Promotion Speeds

(a) The probability of surviving by VSI/SSB Eligibility



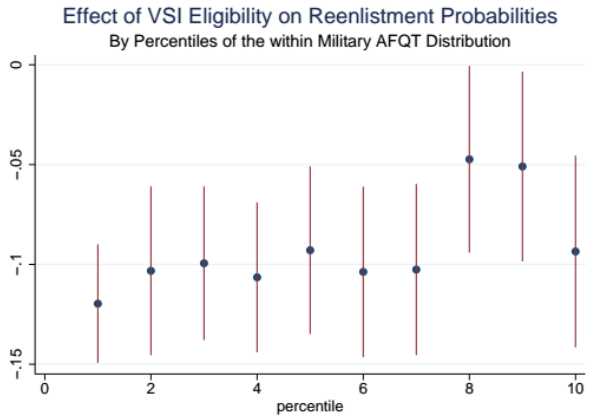
(b) The probability of surviving by TERA Eligibility



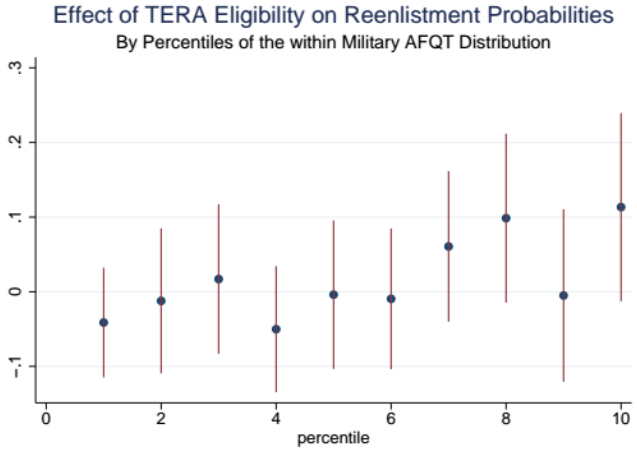
Notes: The left panel shows the probability of remaining in the Army for each month relative to August 1, 1993, the start of the VSI/SSB program, split by the soldier's promotion speed in his first term. We split soldiers into terciles of the months spent below sergeant in their first term. In each time period, we run a regression of program eligibility interacted with the soldier's promotion tercile on the probability of remaining in the military in period t. Each regression also includes occupation and rank fixed effects, a control for the soldier's tenure as of the program start date, dummies for the soldier's promotion speed tercile, and demographic controls (age, marital status, gender and race). Blue circle plot the coefficient on program eligibility interacted with the top tercile, and red triangles plot plot the coefficient on program eligibility interacted with the bottom tercile. The middle tercile was also included in the regression but is not plotted here. Lines show the 95% confidence intervals, with standard errors clustered at the occupation*rank*year of service bin. The sample includes the set of soldiers in the military on February 1, 1993, 6 months prior to the VSI program. The right panel shows similar specifications, but defines the sample and the time period relative to August 31, 1994, the day the TERA program was introduced. The right panel further restricts the sample to include only soldiers in the affected ranks and occupations, who are within 1 year of being eligible.

Figure B7: The Effect of Early Retirement Programs on Soldier Retention by Soldier Quality: Nonlinear Specifications

(a) The probability of remaining in the military by VSI/SSB Eligibility



(b) The probability of remaining in the military by TERA Eligibility



Notes: Each blue dot shows the estimate of program eligibility interacted with the soldier's AFQT score percentile from a regression where the dependent variable is an indicator for the solider still being in the military at the end of the program period. The regression also includes occupation and rank fixed effects, a control for the year of service, dummies for the soldier's AFQT score percentile, and demographic controls (age, marital status, gender and race). Standard errors are clustered at the occupation*rank*year of service bin. The left panel includes the sample of soldiers who were serving on August 1, 1993, the start of the VSI/SSB period, and the right panel includes the set of soldiers who were serving on August 31, 1994, the start of the TERA program. Additioally, the left panel also restricts the sample to those soldiers with at least 6 years of experience. The right panel restricts the sample to include only soldiers in the affected ranks and occupations, who have tenures that put them within 1 year of being eligible.

C Selection and Average Ability Levels

In this section, we present empirical specifications and results demonstrating how the offer of either reenlistment bonuses or early retirement benefits affects the average quality of soldiers who are retained.

C.1 Empirical Results: Average Soldier Quality and Cash Bonuses

The results in Section 4 showed that soldiers of higher ability are both less likely to reenlist in the military on average and are less responsive to both SRB offers and a pair of early early-retirement programs. The above section demonstrated that the effect this has on the average quality of retained soldiers is ambiguous and depends on the magnitude of the selection on ability. In this section, we show that our individual-level effects are large enough to generate changes in average soldiers ability-levels. This second analysis also enables us to characterize the quality of the marginal soldiers, i.e. the soldiers who were induced to reenlist when offered higher compensation.

Starting with the Army's SRBs, we estimate the change in the *average* quality of the "stayers" and the "leavers" using the following specification:

$$\text{AFQT}_i = \alpha_0 + \alpha_1 \text{SRB}_{it} * \text{Stay}_{it} + \alpha_2 \text{SRB}_{it} * \text{Leave}_{it} + \alpha_3 \text{Stay}_{it} + \gamma_{MOS,rank,yos} + \mu_t + \delta \mathbf{X}_{it} + \epsilon_{it}, \qquad \text{(C1)}$$

The coefficients of interest are α_1 and α_2, which estimate the effect of higher reenlistment bonus offers on the average ability of stayers or leavers, respectively. A positive value on α_1 would indicate that higher bonus offers tend to retain soldiers of higher average ability. As discussed in Section A, our basic conceptual framework offers ambiguous predictions regarding the effect of a change in relative military compensation on the average ability of either stayers or leavers. As in Equation 1, we include MOS×rank×years-of-service fixed effects.

Table C1 shows estimates from Equation C1, showing how the average ability of soldiers who chose to stay varies with the offered bonus. The identifying assumption underlying this analysis is that SRB offers are not systematically offered to cohorts of soldiers that are of higher quality. If this were the case, then we would observe that higher SRB offers are associated with higher quality reenlisted soldiers, but it would not

reflect soldier selection.[36] The first column shows that this assumption is indeed satisfied – once we control for the set of fixed effects that determine the SRB offer, there is no correlation between the average ability of the soldiers eligible for reenlistment and their SRB offer. Columns 2 and Column 3 then split the sample by the soldier's reenlistment decision. Column 2 shows that when the SRB offer is $10,000 dollars, the average ability of those soldiers who endogenously chose to stay in the military is 0.2 percentage points lower, although the estimate is noisy. As with the results in Table 2 and Figure 3, this shows that lower ability soldiers are more responsive to SRB offers, and enough so that they bring down average soldier quality. Column 3 shows, conversely, that when the SRB is higher, the average ability of those who leave the military is higher, although the estimate is also noisy. Column 4 pools the two samples and jointly estimates how the quality of the two groups endogenously changes as the bonus offer changes. The only difference between this specification and the split-sample specification in columns 2 and 3 is that the fixed effects are restricted to be the same, which gives us more power. When we do this, the results are qualitatively similar but even stronger – when an SRB of $10,000 i is offered, the average AFQT score of the soldiers who reenlist is 0.48 percentage points lower and the average AFQT score of those who exit the military is 0.66 percentage points higher.

While at first glance these magnitudes look small, these are in fact quantitatively large effects. The average difference in quality between the stayers and the leavers is 1.2 percentage points. A $10,000 SRB bonus increases the difference between the two groups by an additional 1.1 percentage points, a 92 percent increase over the average difference between the two groups. Additionally, this reflects a difference in the *average* quality of the two groups. We can also examine the effect of SRBs on the quality of the *marginal* soldier – the soldier who would not have reenlisted but for the bonus offer. We can benchmark this with a simple back of the envelope calculation.[37] Column 1 of Table 2 shows that an SRB offer of $10,000 makes soldiers 1.5 percentage points more likely to reenlist. On average, 22,000 soldiers are eligible to reenlist each period, meaning that this SRB retained 330 additional soldiers. These marginally retained soldiers compose 2 percent of the reenlisted soldiers. Thus, in order for them to bring down the average of the reenlisted soldiers by 0.48 percentage points, the average AFQT score of the marginal soldiers must have been around the 32nd percentile. This would put the marginal soldier around the enlistment cutoff for AFQT scores, the lowest scores at which a person is

[36] Note that on average, in the raw data, soldiers of higher ability are offered higher bonus offers. This reflects the fact that soldiers of higher ability tend to be in higher skill occupations with more outside options. However, once we control for the soldiers occupation, tenure and rank, this positive correlation goes away.

[37] We also plan to characterize this more formally following Gruber, Levine and Staiger (1999).

eligible to join the Army.

The last 2 columns of Table C1 repeat the analysis using our within-military measures of soldier quality. We see results here that are largely consistent with the AFQT results – when the SRB if higher, the average quality of the leavers is higher, in that they spent on average 4 more days as Sergeant in their first term when the SRB offered is $10,000 higher. While the selection along this dimension goes in the same direction as the selection across AFQT scores, the magnitude of the difference is smaller. For this measure of soldier quality, there is only an increase in the difference between the stayers and the leavers of 1.5 percent. Appendix Tables B9 and B10 show that these patterns are largely robust to alternative specifications and sample restrictions, including when we instrument for *actual* reenlistment bonuses with SRB offers.[38]

As before, we also examine the effect of these programs on average quality of retained soldiers by running the regression described in Equation C1.

$$\text{AFQT}_i = \alpha_0 + \alpha_1 \text{ELIG}_i * stay_{i,t_T} + \alpha_2 * \text{ELIG}_i * leave_{i,t_T} + \alpha_3 stay_{i,t_T} + \gamma_{MOS,rank} + \delta \mathbf{X}_i + \epsilon_i, \qquad \text{(C2)}$$

The coefficients of interest from Equation C2 are α_1 and α_2, which estimate the effect of drawdown program eligibility on the average ability among either stayers or leavers, respectively. Stayers are those who remain in the military at the end of the program eligibility window (t_T), and leavers are those who separate from the military at any point during the program eligibility window.

Table C2 presents estimates from Equation C2, showing how the average ability of those who chose to stay in the Army at the end of the program and those who chose to leave the Army varies with eligibility for the program. The first column shows that even after controlling for soldier rank, occupation, tenure and demographics, the average AFQT score of VSI/SSB-eligible soldiers is lower than that of ineligible soldiers. This is not a problem for identification, but it means that the coefficients in Column 2, which show the relative ability of the stayers and the leavers by the end of the VSI sample period, must be interpreted in relation to the coefficient on VSI/SSB eligibility in Column 1, rather than relative to 0 as in the earlier analysis.

[38] Because the actual SRB offer is only observed for the set of people who reenlist, we restrict the sample to the stayers only. The actual SRB and the offered SRB can vary for several reasons—for example, the soldier may decide to reenlist for a term that is longer or shorter than 4 years, she may wait to reenlist until later in her enlistment window when the initial SRB offer is no longer available, or she may choose to switch occupations, thereby becoming eligible for an alternative SRB offer. Even so, the SRB offer available at the beginning of a soldier's reenlistment window is highly predictive of the actual SRB offer received. The IV estimates are noisier but similar in magnitude to the OLS regressions.

Table C1: Selective Reenlistment Bonuses (SRBs) and Average Soldier Ability

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable:	AFQT Score Percentile				Months below Sergent in first term	
	Full Sample	*Stayers Only*	*Leavers Only*	*Full Sample*		
SRB	-0.015				0.004	
	(0.015)				(0.020)	
SRB*Stay		-0.021		-0.048***		0.022
		(0.015)		(0.015)		(0.030)
SRB*Leave			0.014	0.066***		-0.076***
			(0.019)	(0.022)		(0.027)
Stay				-1.216***		6.693***
				(0.118)		(0.505)
R-squared	0.302	0.313	0.293	0.304	0.326	0.342
Observations	1761615	1146584	614559	1761615	1708425	1708425
Year * Month FE	x	x	x	x	x	x
MOSxRankxYOS FE	x	x	x	x	x	x
Demographic Controls	x	x	x	x	x	x
Mean Dep. Var	58.26	57.5	59.67	58.26	54.4	54.4
Mean SRB	2.89	2.98	2.73	2.89	3.02	3.02

Note: Standard errors are reported in parentheses. They are twoway clustered at the MOS*Rank*YOS and individual level. The full sample is restricted to the soldiers who are eligible to reenlist in spells ending between 1997-2015. Column 2 restricts to the spells in which the soldier decides to renlist in the Army Column 3 restricts to the enlistment spells where the soldier decides to leave the Army. SRBs are in $1000 of 2015 dollars. Demographic controls include gender, age, marital status, race, and special skill dummies. The dependent variable is defined as AFQT score for columns (1)-(4) and months below Sergeant for columns (5)-(6).AFQT is on a scale from 0-100.

Column 2 shows that by the end of the VSI period, the average AFQT score of the eligible stayers is about 1.2 percentage points higher and the average AFQT score of the eligible leavers is 1.6 percentage points lower than the average for the eligible population, shown in Column 1. Columns 3 and 4 show similar results on a more restricted sample of soldiers (namely, those with enough tenure to be among the general group of soldiers targeted by the early retirement program). Finally, Columns 5 through 8 show that the patterns are similar when considering the soldier's speed of promotion – by the end of the VSI period, the average ability of the soldiers still in the Army increased with program eligibility and the average ability of those outside the Army decreased with eligibility. Stayers spent 14.4 fewer months below the rank of sergeant than leavers – a large difference, equivalent to 18.7 percent of the average in the population. Appendix Table C3 shows comparable results for the TERA program, which are qualitatively similar but statistically weaker.

Table C2: Average Soldier Ability and VSI/SSB Eligibility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	AFQT Score Percentile				Months below Sergent in first term			
	All Soldiers		6+ Years of Service		All Soldiers		6+ Years of Service	
VSI/SSB Eligibility	-1.705***		-1.760***		4.390***		-3.903***	
	(0.343)		(0.365)		(0.816)		(0.528)	
VSI/SSB Eligibility*Stay		-0.529		-0.616		-9.812***		-10.653***
		(0.444)		(0.438)		(0.833)		(0.730)
VSI/SSB Eligibility*Leave		-3.346***		-3.134***		23.914***		3.768***
		(0.445)		(0.462)		(0.927)		(0.628)
Stay		-2.433***		-0.901***		20.752***		0.854**
		(0.248)		(0.224)		(0.584)		(0.361)
R-squared	0.281	0.283	0.320	0.321	0.370	0.439	0.641	0.650
Observations	189243	189243	60678	60678	161364	161364	32356	32356
Mean Dep. Var	58.57	58.57	54.74	54.74	59.24	59.24	81.06	81.06
Fraction Eligible	.04	.04	.12	.12	.03	.03	.17	.17

Notes: Sample in Column 1, 2, 5 and 6 is restricted to all soldiers serving on August 31, 1994 (the start of the sample period). Sample in Column 3, 4, 7 and 8 is further restricted to those soldiers with between 6 and 20 years of service as of August 31, 1994. All regressions include occupation and rank fixed effects, a control for the years of service as of August 31, 1994, as well as controls for gender, age, marital status, and race. Stay is defined as being in the Army at the end of the VSI/SSB period. The dependent variable is defined as AFQT score for columns (1)-(4) and months below Sergeant for columns (5)-(8). AFQT is on a scale from 0-100.

Table C3: Average Soldier Quality and TERA Eligibility

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	AFQT Score Percentile						Months below Sergent in first term	
	All Soldiers		15+ Years of Service		Around Cutoff		All Soldiers	
TERA Eligibility	1.450***		-0.211		0.529		31.700***	
	(0.528)		(0.559)		(1.127)		(1.945)	
TERA Eligibility*Stay		2.518***		1.436		0.153		14.569***
		(0.885)		(0.879)		(1.441)		(3.802)
TERA Eligibility*Leave		0.834		-0.922		0.310		44.929***
		(0.611)		(0.622)		(1.110)		(1.645)
Stay		-2.296***		-0.681**		0.440		18.480***
		(0.271)		(0.334)		(0.816)		(0.639)
R-squared	0.277	0.278	0.347	0.347	0.336	0.361	0.334	0.367
Observations	254274	254274	24589	24589	4387	4377	219156	219156
Mean Dep. Var	58.62	58.62	53.75	53.75	52.15	52.13	59.15	59.15
Fraction Eligible	.01	.01	.07	.07	.33	.33	<.01	<.01

Notes: Sample in Column 1, 2, 7 and 8 is restricted to all soldiers serving on August 31, 1994 (the start of the sample period). Sample in Column 3 and 4 is further restricted to those soldiers with between 15 an 20 years of service as of August 31, 1994. Columns 5 and 6 restrict the sample to those soldiers in an eligible occupation/rank but within 2 years (above or below) the mininmum years of service for program eligibility. All regressions include occupation and rank fixed effects, a control for the years of service as of August 31, 1994, as well as controls for gender, age, marital status, and race. Stay is defined as being in the Army at the end of the VSI/SSB period. The dependent variable is defined as AFQT score for columns (1)-(6) and months below Sergeant for columns (7) and (8). AFQT is on a scale from 0-100.