Bonuses, Buy-outs, and Worker Sorting in the Public Sector: Evidence from the U.S. Military

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Abstract. Retention is a high priority for public sector organizations, where internal labor markets remain common. Yet for reasons of law, policy, and organizational culture, public sector organizations tend to be especially constrained in the tools they can use to hire, fire, and otherwise manage personnel. A prime example is the U.S. military, which also happens to be one of the world's largest employers. With few other options at their disposal, military personnel managers frequently use cash bonuses to incentivize retention or buy-out offers to incentivize exit. These same policies are widely used throughout the public sector, and while both policies are known to be effective at achieving quantitative staffing goals, little is known about how such policies affect worker sorting into and out of public service. We leverage administrative data and quasi-random exposure to both lump-sum bonuses and early retirement buy-outs in the U.S. Army to estimate their effects on the quality of retained workers. We find that low-ability soldiers are relatively more responsive to both lump-sum bonuses and early retirement offers, and both effects are large enough to alter the organization's average ability profile. We provide suggestive evidence differences in financial liquidity, time preferences, and individual taste for service may help explain the observed patterns of selection.

1. Introduction

Employee retention policies are critical for public sector organizations, where internal labor markets require managers to promote from within. Since they also lack the flexibility to hire, fire and adjust compensation on an individual basis, public sector organizations must navigate retention challenges with a limited set of policy tools. Typically, organizations rely on generous cash bonuses when shorthanded and early retirement incentives (sometimes called "buy-outs") when drawdowns are in order. While managers and organizations carefully calibrate these policies to retain the right number of workers, we know very little about how these policies affect *who* chooses to stay.

We study this question using policy variation in the nation's largest public sector organization, the U.S. Army. Since the end of the draft and the transition to an all-volunteer force, the military

has frequently used cash reenlistment bonuses and early retirement buy-outs to manage retention. Existing research documents that these policies are effective when evaluated against the narrow goal of adjusting the quantity of retained workers (see, e.g., Knapp et al. 2018; Asch et al. 2010; Clotfelter et al. 2008; Asch and Warner 2001), but as with the wider management literature, there is no evidence on how they affect worker sorting and, ultimately, the overall capability of the organizational workforce. Of note, while our setting is the U.S. Army, the policy incentives we study are widely used across the public sector (recently including the U.S. Border Patrol, the U.S. Postal Service, and the Social Security Administration). The military, moreover, is in continuous competition for high-quality workers with a variety of public and private employers.

Our empirical strategy leverages quasi-random variation in soldiers' exposure to two types of retention policies: Selective Reenlistment Bonuses (SRBs), which promise a lump sum payment to soldiers who choose to reenlist, and Voluntary Separation Incentive (VSI) "buy-outs" offers, which promise soldiers immediate (though reduced) retirement benefits in exchange for early exit from the military. SRB and early retirement 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 occupational specialty regardless of individual ability or other unobservable criteria. Since the Army has historically implemented both policies in a rigid and formulaic manner based on a limited set of observable characteristics, we can show that after conditioning on these characteristics, retention offers are extended independently of soldiers' abilities. This natural experiment enables us to leverage time-series and cross-sectional variation in bonuses and early retirement offers in a generalized difference-in-differences design.

Our analysis yields the striking result that low-ability soldiers are substantially more responsive than their high-ability peers to both types of incentives. These results persist whether we measure individual ability using cognitive test results from the Armed Forces Qualification Test (AFQT) or performance-based metrics in the form of the speed of a soldier's first-term promotions. For example, whereas a $10,000 SRB offer increases the probability of reenlistment by approximately 2.1 percentage points (3.6%) for the average soldier, the same $10,000 offer increases the probability of reenlistment by more than 2.8 percentage points (4.9%) for soldiers with AFQT scores just 10 points (approximately one-half of a standard deviation) below average. Equally striking, soldiers in the highest AFQT and speed-of-promotion quintiles are almost completely unresponsive to these SRBs. We document similar results for early retirement incentives: although buy-out offers are generally effective at inducing separation, such offers were less than half as effective at retaining

soldiers in the top tercile of the AFQT score distribution relative to soldiers in the bottom tercile, and the offers had almost no effect on the probability of remaining in the Army for soldiers in the top quartile of the speed-of-promotion distribution. We also show that the magnitude of selection induced by retention incentives is large enough to affect the average ability of the Army's enlisted labor force.

We add to both empirical and theoretical literatures on public sector workplaces, including a rich literature analyzing the sources and consequences of worker sorting into and within the public sector (Katz and Krueger 1991, Borjas 2002, Dal Bo et al. 2013, Deserranno 2019, Simon and Warner 2007, Korb and Segal 2011). Public sectors are large and important for most economies. More than 15% of U.S. workers are employed by municipal, state, or federal governments, and these workers are responsible for producing public goods that contribute to economic growth and societal well-being. More specifically, worker quality positively impacts public sector outputs in education (Chetty et al. 2014), nursing (Aiken et al. 2003), law enforcement (Rydberg and Terrill 2010), and political leadership (Besley et al. 2011). While much of the existing research focuses on how differences in public versus private sector compensation levels affect selection into government service (see, e.g., Dal Bo et al. 2013, Finan 2017, Nickell and Quintini 2002, Bacolod 2007), our study highlights the importance of the *structure* of compensation. By estimating soldiers' differential sensitivity to potential reenlistment incentives by ability level, our estimates directly inform military policymakers' goals of jointly optimizing worker quantity and quality in order to retain the "best and brightest" (Wardynski et al. 2010, Kane 2012) while increasing military productivity and reducing costs (Wardynski et al. 2010, Wallace et al. 2015).

Our results also offer theoretical insights regarding selection into and within the public sector. Simple Roy (1951) models of worker sorting suggest that high-ability workers disfavor the public sector because of its relatively low returns to ability (Borjas 2002). Accordingly, one might reasonably imagine that cash incentives would be most impactful for high-ability workers who were previously near the margin between private and public sector work. Yet we find that the highest ability workers in our sample are, on average, unresponsive to these incentives. While our results are admittedly counterintuive, they are nonetheless consistent with recent studies from the education literature showing that bonuses targeted at high-performing teachers were only modestly effective at boosting retention (Springer et al. 2016) and that non-targeted early retirement incentives appear to have elicited a stronger response from low- versus high-performing teachers (Fitzpatrick and Lovenheim 2014). They are also consistent with studies suggesting that workers sort into the public

sector in part due to intrinsic motivation or other unobservable taste for public service (Deserranno 2019, Ashraf et al. 2020, Maczulskij and Viinikainen 2024, Cowley and Smith 2014, Banuri and Keefer 2013). Indeed, in Section 5, we provide suggestive evidence that average differences between high- and low-ability soldiers' "taste for service"—likely in addition to average differences in their personal discount rates and financial liquidity—may help to explain their differential responsiveness to cash retention incentives.

The rest of the paper proceeds as follows. Section 2 develops a simplified model—which we formalize in Appendix Section A—to show that, barring strong assumptions, the effect of cash incentives on worker sorting in the public sector cannot be established without empirical evidence. We provide our evidence on the effects of Selective Retention Bonuses in Section 3 and Voluntary Separation Incentives in Section 4. Section 5 explores potential mechanisms, and Section 6 and concludes.

2. Motivating Theory & Hypothesis Development

To fix ideas and motivate our empirical analyses, we briefly discuss the theoretical effects of lump-sum retention incentives on workers of different abilities. Personnel management in the military is rigid, mandated by law, and thus a soldier's compensation reflects her individual ability only indirectly. Higher ability individuals might be promoted more quickly, resulting in a steeper long term wage profile, but in the short term, compensation is largely independent of ability. Conversely, in the civilian labor market, higher ability workers will earn close to their full marginal product. Since returns to ability are much higher in the private versus the public sector, on average, we would expect higher average ability levels among private versus public sector workers.

What might we expect when a public sector employer like the military seeks to retain workers with across-the-board bonus offers? When reenlistment decisions depend upon relative compensation alone and the private sector promises higher returns to ability, uniform bonuses will increase the average ability level of the organization by retaining individuals who were previously at or beyond the margin of indifference between public and private sector employment. Bonuses would be most impactful among relatively high-ability workers who were previously near the indifference point, whereas bonus offers will have no impact on relatively low-ability soldiers who were already inframarginal (i.e., likely to reenlist regardless of a bonus).

But while it is generally true that the military and other public sector employers reward ability less than in the private sector, what is almost certainly not true is that reenlistment decisions depend

upon relative compensation alone. Decisions to stay in the military, like decisions to enlist in the first place, also depend on a "taste" for military service (e.g., family history, ideological beliefs, and preferences for military versus civilian lifestyles). The effect of lump-sum retention incentives like bonuses or early retirement offers may also depend upon individual factors like personal discount rates and personal financial situations.

In Appendix Section A we compare a simple compensation-only model with a richer two-factor model that includes compensation and individual taste, and we show that unambiguous theoretical predictions—with respect to both the differential responsiveness of high- and low-ability soldiers to lump-sum retention incentives and how such incentives will affect average ability levels—are no longer possible. After including additional variables like taste for military service, the direction and magnitude of selection depends upon factors such as the shape of civilian and military wage functions, how individuals trade off the economic and non-economic aspects of military compensation and the joint distributions and densities of ability and other determinants of retention. In practice, while a simple hypothesis is desirable, we require empirical evidence to estimate the overall reduced-form effects.

What sort of evidence is most helpful to the personnel manager or policymaker who would like to know how a given retention incentive is likely to affect the average ability of the organization? In the following sections we provide empirical estimates of high- and low-ability soldiers' differential responsiveness to retention bonuses and early retirement incentives. In Appendix Section A, we further show that these reduced-form estimates provide precisely the information one needs to predict the effect of these policies on an organization's average ability level.

3. Evidence from Selective Reenlistment Bonuses (SRBs)

The Army's SRB program is a primary tool for enticing reenlistment. SRBs are cash bonuses offered to soldiers in the U.S. Army in exchange for a commitment to reenlist for a fixed term. In this section, we provide empirical evidence that SRBs are more effective at retaining low- versus high-ability soldiers.

3.1. Institutional Background

Because the U.S. military relies exclusively on promotion-from-within, retention is essential for staffing leadership ranks with qualified and experienced personnel. Enlisted soldiers serve fixed terms, with a typical first term lasting four years. At the end of each term, soldiers deemed eligible to reenlist will meet with a career counselor to discuss their options, which ordinarily include

opportunities to reenlist for an additional term of between two and six years of service. While low-performing soldiers or those with disciplinary records may be deemed ineligible, the vast majority (approximately 76% in our sample) have an option to reenlist. Eligible soldiers make their choice during their reenlistment "window," which opens 12-24 months before the end of their current term and closes 90 days prior to the end of the term. Soldiers serve in a specific occupation, known as their Military Occupational Specialty (MOS), and while mid-career changes are possible, they are uncommon, with most reenlisting soldiers maintaining their MOS.

Like many public sector organizations, the military follows a rigid compensation scheme. Basic military pay is a function of only rank,[1] years of service, and whether the soldier has dependents. The military also offers generous benefits including housing allowances and educational benefits. While some benefits involve voluntary take-up, eligibility for benefits is always based on a limited set of observable characteristics.

SRB offers vary only by a soldier's current rank, the MOS the soldier has chosen to fill upon reenlistment, the soldier's total years of service, the number of years for the reenlistment term, whether a soldier possesses certain specialty skill designators (e.g., if she is "airborne" qualified), and whether the soldier has agreed to begin her reenlistment at certain location. Depending upon a soldier's characteristics, they may be eligible for a "menu" of several SRB offers, and it is up to the soldier which SRB (if any) they accept. Many soldiers are eligible for no bonus offer at all based on their characteristics and the timing of their reenlistment, but offers as high as $20,000 are not uncommon. SRB offers are continuously updated and once updated, old offers are no longer available.

3.2. Data & Empirical Approach

How do soldiers' reenlistment decisions respond to SRB offers, and how does the response vary based on relative ability? We leverage a generalized difference-in-difference framework to compare the reenlistment decisions of soldiers according to their SRB offers and ability levels.

Our primary dataset is an extract of the U.S. Army's Total Army Personnel Database (TAPDB) from which we construct a panel of individual enlistment spells ending between 1997 and 2015, which are the years for which we also have SRB offer data. Each observation (or "spell") corresponds to a single enlistment term for a soldier (e.g., a soldier with a single four-year enlistment appears once while a soldier who reenlisted twice will appear three times). We exclude all current enlistment spells (approximately 6% of all spells) as of the end of the sample since we do not observe their conclusion, and we further exclude spells ending in ineligibility for reenlistment (24% of all spells).

Table 1 Spell- and Soldier-level Summary Statistics (SRB Sample)

Panel A: All Spells	All Spells	Spells Ending with Eligibility to Reenlist	Spells Ending with No SRB Offer	Spells Ending with Non-Zero SRB Offer
N (total spells)	2,359,520	1,805,770	1,288,792	516,978
% ending in reup	0.50	0.65	0.65	0.66
Avg. years of service at spell end	6.23 (5.44)	6.87 (5.65)	7.82 (6.27)	4.52 (2.45)
Median rank at spell end	E-4	E-5	E-5	E-4
Avg. age at spell end	28.35 (6.51)	28.98 (6.60)	29.99 (7.09)	26.47 (4.26)
% with non-zero SRB offer	0.26	0.29	0	1
Avg. SRB offer	2.48 (4.92)	2.82 (5.21)	0	9.86 (5.02)
Total unique soldiers	1,404,597	1,034,715	809,993	411,187
Avg. spells per soldier in data	1.77 (1.13)	1.90 (1.21)	2.05 (1.29)	1.42 (0.75)
Avg. reenlistments per soldier at separation	1.10 (1.53)	1.37 (1.71)	1.65 (1.82)	0.49 (0.81)
Avg. total years of service at separation	6.35 (6.11)	7.81 (6.79)	8.87 (7.37)	4.47 (2.35)
Median final rank at separation	E-4	E-5	E-5	E-4
% Male	0.84	0.85	0.84	0.89
% Nonwhite	0.38	0.40	0.43	0.29
% Married	0.53	0.57	0.61	0.43
Avg. AFQT	58.95 (19.26)	60.25 (19.78)	58.93 (19.64)	64.41 (19.66)
Avg. Months Sergeant or above in first term	2.59 (7.12)	3.65 (8.18)	3.38 (7.96)	4.43 (8.74)
% College or more	0.06	0.09	0.09	0.07
% Less than high school	0.10	0.07	0.06	0.08

Note. Column 1 displays summary statistics for the full sample of spells for which we have SRB offer data (ending in years 1997–2015). Column 2 displays summary statistics for spells at the end of which the soldier was eligible to reenlist. Column 3 displays summary statistics for spells ending with eligibility to reenlist but without a reenlistment bonus offer, and column 4 displays summary statistics for spells ending with eligibility to reenlist and a non-zero SRB offer. AFQT scores are measured at the time of initial accession into the Army; all other variables are measured at the end of the spell (for spell-level statistics) or the end of a soldier's career (for soldier-level statistics). Standard deviations are shown in parentheses.

We summarize the full dataset and our analysis sample in Table 1, with column (2) showing our primary sample for analysis. Soldiers choose to reenlist in approximately 65% of spells ending with an option to do so, and the average number of enlistment spells per soldier in our sample is approximately 1.88.

The data also provides two measures of individual ability. First, we observe Armed Forces Qualification Test (AFQT) scores, which the military uses for personnel selection (i.e., suitability for service) and classification (i.e., occupational qualification). AFQT scores range from 0-99, corresponding to the percentile of the applicant's raw test score, and labor economists have long used these scores as a measure of general cognitive ability (Grilliches and Mason 1972). Table 1 shows that soldiers eligible to reenlist have higher average AFQT scores than ineligible ones, and those who reenlist have lower average scores than those who leave (see Figure B6).

While evidence suggests that AFQT scores are good predictors of military performance (Wigdor and Green 1991), cognitive measures may not capture all relevant dimensions of individual ability related to job performance. We therefore consider a second measure based on the speed of a soldier's promotions during their first term, which is commonly used by military officials to measure performance and potential. This measure encompasses cognitive and non-cognitive skills that

contribute to success in a soldier's given job.[2] Specifically, we use the number of months that a soldier spent at or above the rank of Sergeant (E-5) during their first term of enlistment; like AFQT, higher numbers suggest higher ability. We choose this measure given its salience to military officials and because it exhibits a reasonable amount of variation among first-term soldiers.[3] As expected, Appendix Figure B4 shows that AFQT and speed of promotion are strongly correlated overall ($\rho = 0.24$, $p < 0.0001$) and within individual occupational specialties.

In addition to personnel data, we collect monthly SRB offers according to publicly available policy announcements known as "U.S. Army Military Personnel Messages." From these announcements, we record the amount of the bonus offer and the eligibility criteria.

A soldier's eligibility for a bonus offer can depend on fixed criteria (i.e., MOS, rank, years-of-service, and specialty skills) and endogenous choices (e.g., a soldier's willingness to reenlist for a longer term, a different MOS or to move to a certain location). To isolate the exogenous aspects of the program, we assign each soldier a single SRB offer for each enlistment spell. The generic SRB offer we assign is the highest non-location-specific bonus to which a soldier is entitled for a 4-year reenlistment given the soldier's current MOS, rank, years-of-service, and specialty skills designations. This method abstracts from the endogenous choices described above. Since SRBs can vary throughout the reenlistment window, we assign each soldier the SRB offer that was available on the first day of the first month of their window. This addresses potential strategic timing, if for example a soldier tried to delay her reenlistment due to the belief that SRB offers are likely to rise during her reenlistment window. Together, these assumptions enable us to isolate the exogenous determinants of SRB eligibility. To address concerns about endogeneity, we show that our assigned generic SRB offers are highly correlated with the other SRBs a soldier might unlock through endogenous choices (i.e., we show that our SRB offers are highly correlated with both length-of-contract-specific offers in Table B3 and with location-specific offers in Table B4). To mitigate concerns over endogenous timing, we show that our results are not sensitive to when during a reenlistment window we assign SRB offers (Tables C5 and C6).

3.3. Identification

Our empirical strategy compares soldiers' reenlistment decisions according to their individual ability and the bonus amounts they are offered by estimating the following equation:

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

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 Ability_i is one of our two measures of individual ability (i.e., the soldier's AFQT score percentile or else the number of months the soldier spent at or above the rank of Sergeant in their first term of service). 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 our estimation of β_2 is that SRBs are effectively randomly assigned, conditional on our observable controls, and thus unrelated to both individual ability and non-monetary factors affecting a soldier's reenlistment decision. Since SRB offers vary by occupation, rank, years-of-service, and date, all of our specifications include offer-date (i.e. year*month) fixed effects as well as MOS*rank*years-of-service fixed effects. By including fixed effects for the same key variables that determine SRB eligibility, we account for the basic fact that the military adjusts SRBs according to its retention needs.[4] In addition, by controlling for MOS, we account for the fact that differences in SRB levels across military occupations may be correlated with ability due to the fact that a new recruit's eligibility for each MOS is partially determined by her AFQT score. By controlling for years-of-service, we also ensure that the effect of SRBs will not be confounded by a soldier's distance to retirement. We control for additional individual characteristics including marital status, race, gender, and age in $\mathbf{X}_{it}$. While not necessary for identification, they may improve the precision of our estimates.

Although we are unable to test whether SRBs are correlated with unobservable characteristics, such as a soldier's taste for military service, we can test whether SRB offers are correlated with ability within our sample. In Columns 1 and 5 of Appendix Table D1 we document that, conditional on our interactions of occupation, tenure, and rank, higher SRBs are not offered to soldiers with either higher AFQT scores or faster promotions. That SRBs are uncorrelated with observables like ability tends to support our identifying assumption that they are similarly uncorrelated with unobservables (Altonji et al. 2005). Moreover, extensive research into the history of the SRB

program gives us additional confidence that Army officials generated new SRB offers based on a limited set of considerations, none of which related to individual ability.[5] Rather, Army regulations indicate that the program's sole objective was to retain a sufficient quantity of personnel without regard to ability.[6] Additionally, career counselors who administer SRBs do not observe individual ability.

Given these controls, our coefficient of interest β_2 will be identified off of high-frequency variation in SRB offers within an MOS, rank, and years-of-service cell and within a date, thereby resembling a generalized difference-in-difference design. In Appendix Section B.4 we present case studies of the time-series variation for two specific MOSs to illustrate some of the factors that might influence SRB offers. In general, however, we have confirmed through interviews with Army officials responsible for the SRB program that SRB offers were determined through a combination of "inside" factors (i.e., the military's operational and strategic requirements and force levels) and "outside" factors (i.e., economic trends affecting civilian labor market opportunities).[7] Our main specifications include date fixed effects as well as MOS*rank*years-of-service fixed effects, so outside economic conditions will only threaten our identification insofar as they vary at a high frequency and in a manner that is specific to soldiers of a particular MOS, rank, and tenure and that correlates with both ability and reenlistment. Since a soldier's individual reenlistment decision is unlikely to meaningfully affect the time series of SRB offers even within his MOS, rank, or cohort (all large groups), reverse causality is unlikely. Overall, it seems reasonable to think of individual soldiers as "price takers" with respect to SRB offers.

Still, a key challenge to our identification is that, while the Army's SRB program was never intended to directly account for soldiers' ability levels, SRB offers did vary in at least indirect response to various types of supply and demand shocks both inside and outside the military, and the effects of these shocks could themselves depend upon a soldier's ability. For example, to the extent that retention may fall and SRBs may rise when military service becomes physically riskier (e.g., during the wars in Iraq and Afghanistan), our results could be biased if the effects of mortality risk on reenlistment were themselves correlated with ability, perhaps due to different outside employment options of high- and low-ability soldiers. Similarly, to the extent that SRBs reflected labor market slack amidst the Great Recession, our results could be biased if the private labor market opportunities for high- and low-ability soldiers worsened differentially.

To confront these challenges, we estimate regression models with a variety of different high-dimensional fixed effects to account non-parametrically for unique time-specific shocks that may

vary across our standard controls. In our preferred specification, for example, we include time-varying MOS fixed effects (specifically, MOS*year*month) to address concerns about differential responses to mortality risk, which varies by time and military occupation. These same time-varying MOS fixed effects also address concerns that changes to MOS-specific SRBs may be correlated with changes over time to the Army's minimum AFQT standards for each MOS or that there is any time-varying private labor market demand for skills particular to a military job. Similarly, in other specifications we include time-varying fixed effects for the commuting zone in which a soldier resided immediately before enlisting in the Army. Because this "home of record" is likely to represent the most salient local labor market for soldiers, we believe that these fixed effects are likely to do a good job of controlling for shocks to a soldier's private labor market opportunities. As we discuss further below, our results are qualitatively similar across specifications, lending further credibility to our identification strategy.

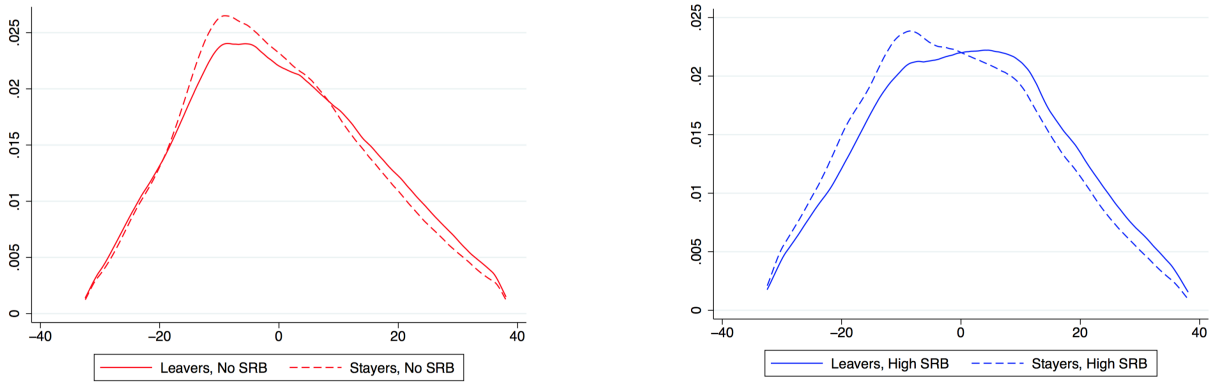
3.4. Selective Reenlistment Bonus Results

In Figure 1, we provide summary, albeit 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 same variables that determine a soldier's eligibility for the incentive programs. Figure 1a plots the AFQT distributions for soldiers who were offered no SRB at the time of reenlistment, while Figure 1b plots the distributions for soldiers who were offered an SRB of at least $8,000. In both panels the stayer distribution (dashed lines) is shifted left relative to the leaver distribution (solid lines), meaning that the average ability of the soldiers who reenlist is lower than those who chose to leave. The key takeaway from Figures 1a and 1b, 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. Figures 1c and 1d show a similar pattern when ability is measured by a soldier's speed of promotion.

In Table 2 we formalize this result with regression estimates from Equation 1. Starting with column 1, where we proxy for ability with a soldier's AFQT score, we see that for each one point increment AFQT soldiers are 0.112 percentage points less likely to reenlist on average. The Column 1 results also suggests that SRBs work as intended: on average, a $10,000 bonus offer (close to our

Figure 1 Distribution of AFQT Scores, Split by Reenlistment Decisions and SRB Offers.

(a) Soldiers receiving no SRB offer. (b) Soldiers receiving positive SRB offer.



Note. Figures 1a and 1b plot the residuals of a regression of AFQT score on MOS*rank*YOS dummies as well as date dummies. Sample restricted to soldiers with eligibility to reenlist. Figure 1a plots separate distributions for stayer and leavers, conditional on having received no SRB offer at the start of their reenlistment window. Figure 1b plots separate distributions for stayers and leavers, conditional on having received an SRB offer of $8,000 or more.

Table 2 The Effects of SRB Offer Amounts and Individual Ability on Soldier Retention

	AFQT Score				Months Sergeant in First Term			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SRB	0.017***	0.062***	0.033***	0.038***	0.018***	0.029***	0.026***	0.000
	(0.004)	(0.007)	(0.006)	(0.008)	(0.004)	(0.004)	(0.004)	(0.005)
SRB * Ability		-0.070***	-0.027***	-0.073***		-0.002***	-0.002***	-0.002***
		(0.011)	(0.010)	(0.011)		(0.000)	(0.000)	(0.000)
Ability	-0.112***	-0.092***	-0.141***	-0.091***	0.002***	0.003***	0.003***	0.003***
	(0.009)	(0.009)	(0.006)	(0.010)	(0.001)	(0.001)	(0.001)	(0.001)
Adjusted R^2	0.155	0.155	0.139	0.176	0.149	0.149	0.137	0.169
Year*Month FE	✓	✓	✓	✓	✓	✓	✓	✓
MOS*Rank*YOS FE	✓	✓	✓	✓	✓	✓	✓	✓
Year*Month*CZ FE			✓				✓	
Year*Month*MOS FE				✓				✓
Demographic Controls	✓	✓	✓	✓	✓	✓	✓	✓
Avg. Reenlistment Rate	0.65	0.65	0.67	0.65	0.66	0.66	0.67	0.66
Avg. SRB	0.28	0.28	0.32	0.28	0.29	0.29	0.32	0.29
Avg. Ability	0.58	0.58	0.59	0.58	3.53	3.53	3.71	3.53
Observations	1,804,326	1,804,326	1,463,546	1,800,355	1,750,220	1,750,220	1,473,794	1,746,355

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note. Table shows the effects of SRB offer amounts and individual soldier ability on soldiers' reenlistment decisions. Standard errors are two-way clustered at the MOS*Rank*YOS and individual level and reported in parentheses. Sample is restricted to spells ending with eligibility for reenlistment and with reenlistment windows opening between 1997–2015. SRBs are in $10,000s of 2015 dollars. Demographic controls include gender, age, marital status, race, and special skill dummies. Ability is defined as AFQT percentile (on a scale from 0-1) for columns (1)-(4) and months at or above Sergeant for columns (5)-(8).

sample average of $9,867 for the 29% of soldiers with non-zero offers) increases retention by 1.7 percentage points (2.6 percent), relative to no bonus offer.[8]

Our key result, however, is in column 2, which reveals that a soldier's responsiveness to the bonus offer is decreasing in her AFQT score. Specifically, a soldier who has an AFQT score that is 10 percentile points higher is approximately 0.7 percentage points less responsive to a $10,000 SRB bonus offer, and the result is statistically significant. As we show below, soldiers with AFQT scores above the 80th percentile are effectively unresponsive to SRB offers. While the sum of our point estimates implies a negative overall effect of SRBs on reenlistment for soldiers at the highest AFQT percentiles, the combined estimate is not significantly different from zero (see Figure 2).

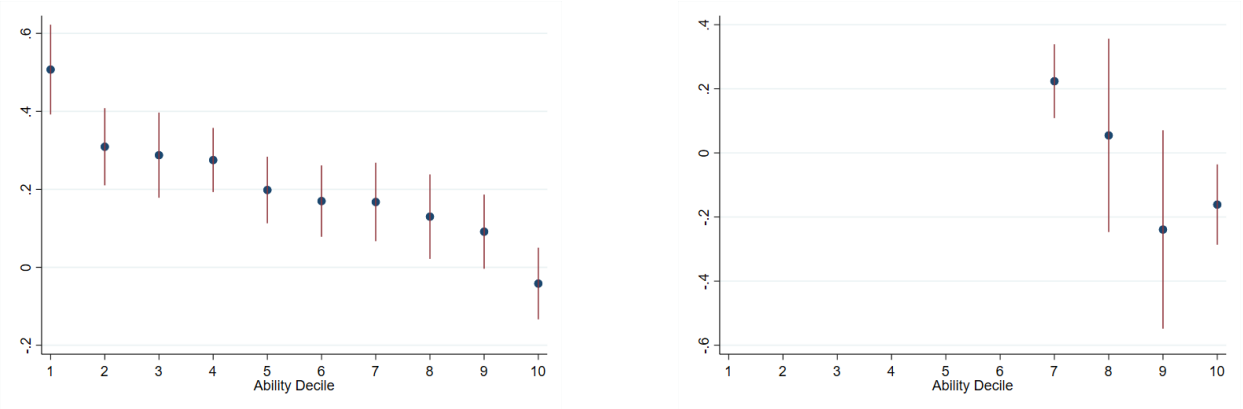
In Columns 3 and 4, we augment our model with high-dimensional fixed effects that control for potential confounding variables. Column 3 includes nonparametric time trends for each soldier's commuting zone at time of initial enlistment to control for any reenlistment differences that are correlated with the soldier's local area. The point estimates are smaller, but we show in Appendix Table C1 (Column 3) that this difference is primarily driven by changes in the sample induced by these fixed effects. Even so, the main pattern of lower responsiveness by higher-ability soldiers remains sizable and statistically significant. Our Column 4 model includes nonparametric time trends for each MOS, thereby controlling for anything that time-varies at the occupation level (e.g., changes in mortality risk, changes in outside employment opportunities). Our results are qualitatively consistent with the previous results.

We analyze our second measure of performance, promotion speed, in Columns 5-–8. Recall that high-ability soldiers receive faster promotions and therefore spend more months in their first term of service at or above the rank of Sergeant. The results show that, just like soldiers with higher AFQT scores, soldiers with faster promotion speeds are less responsive to SRBs. On average, soldiers are approximately 1.2 percentage points less responsive to a $10,000 SRB offer for each additional six months they spend at or above the rank of Sergeant in their first term (i.e., 6x0.002). These results are consistent with the AFQT findings above.[9]

Finally, in Figure 2 we relax the imposed linear relationship between a soldier's ability and her responsiveness to bonus offers. In the left panel we interact the SRB offer with indicators for ten equally sized AFQT score bins. The estimated relationship is roughly 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. 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, which uses our speed-of-promotion ability measure. The results are noisy and we are only able to plot interaction terms for four deciles (since soldiers

Figure 2 The Effect of Selective Reenlistment Bonuses on Soldier Retention, by Soldier Ability Deciles.

(a) By Within-Military AFQT Score Decile. (b) By Speed-of-Promotion Decile.



Note. Panels plot non-parametic estimates of the marginal effect of SRBs on the probability of reenlistment within each decile of either the within-military AFQT score distribution or speed-of-promotion (measured as months below Sergeant in first term) distribution. Reenlistment probabilities (the y-axis) are scaled by 100 and SRB values are in thousands of 2015 U.S. dollars.

below the 75th percentile all spent exactly zero months at or above the rank of Sergeant in their first term), but the results nonetheless show that soldiers with the slowest promotion speeds were the most responsive to SRB offers, and SRBs appear to have almost no effect at all on soldiers above the 80th percentile of promotion speed.

While the estimates in Table 2 may seem small, the magnitude of selection they entail is substantial, especially from the perspective of military planners. In Appendix D we develop a strategy for testing how SRBs affect the military in the aggregate. Our estimates imply that if the Army were to counterfactually increase average SRB offers by $10,000 it would retain more than 1,600 additional soldiers per year. However, the average AFQT score of marginally-retained soldiers would be just 41—nine tenths of a standard deviation below the historical average AFQT score for a reenlisting cohort in our data.

4. Evidence from the Army's Early Retirement programs

Like many firms, the Army occasionally finds itself with too many workers, at least within specific MOSs and ranks, and it leverages early retirement offers to reduce the size of its workforce. In this section we provide empirical evidence that low-ability soldiers are more responsive to these early retirement offers, as they were with SRBs. We briefly describe one specific early retirement program from the early 1990s before discussing our identification strategy, data, and results from our analysis of that program.

4.1. Institutional Background

Throughout the period of our study the military offered a generous defined benefit pension to workers who completed 20 or more years of service. Qualifying soldiers received a perpetuity immediately upon their retirement from the military, meaning that soldiers who enlisted at 18 could be earning a life-long-pension as early as age 38. The pension started at 40% of the average of the soldier's highest three annual salaries for soldiers who retired after exactly 20 years of service and grew to 100% of final annual salary for soldiers who served 40 years or more, but importantly, it was "cliff vested," meaning that soldiers who separated with fewer than 20 years of service received no retirement benefit whatsoever.

During occasional drawdowns, however, Congress authorized the military to grant early retirement benefits to those with fewer than 20 years of service and who met certain eligibility criteria (often based on rank, years-of-service, and MOS). To take up the benefits, eligible soldiers were required to immediately separate from the military.

We specifically study a program known at the time as the Voluntary Separation Incentive (VSI), which remains one of the military's largest drawdown initiatives in recent decades.[10] While the overall program lasted from 1992 to 1995, we study a particular wave of early retirement offers extended to early-to-mid-career soldiers between August 1993 and June 1995.[11] Specifically, the offers were extended to non-first term soldiers in certain overstaffed MOS/rank combinations who had accrued more than 6 but fewer than 20 years of total service as of a program cutoff date (December 5, 1991). While prior research has documented the effectiveness of the VSI program at drawing down the military to the desired quantity of workers (Asch and Warner 2001), we focus instead on how early retirement inducements may have sorted workers by ability level.[12] As with SRBs, the military made these offers solely based on eligibility criteria and without regard to individual ability or performance.[13] The Army offered sizable benefits and a choice in form between a reduced annuity (relative to a full pension) and a single lump-sum payment. For example, for an eligible soldier with 7 years of service in 1993, the annuity offered a soldier annual payments equal to 17.5% of her final salary and the lump-sum benefit offered a single payment slightly larger than her final year's salary.

4.2. Data & Empirical Approach

The Army left early retirement offers open for a specified period of time and extended them to any qualifying soldier, regardless of whether the soldier was nearing the end of her current enlistment. In the case of the VSI program, early retirement offers were left open from August 1, 1993, to June

Table 3 Soldier-level Summary Statistics (VSI Sample)

	Soldiers Serving on Feb. 1, 1993	Soldiers with 6–20 YOS Prior to VSI	Serving Feb. 1, 1993 but Not Eligible for VSI	Serving Feb. 1, 1993 and Eligible for VSI
N (total soldiers)	135,579	45,647	129,099	6,480
% remaining after 24 months	0.77	0.80	0.77	0.64
Years of service at program start	6.48 (6.04)	13.23 (3.69)	6.12 (5.95)	13.54 (2.73)
Median rank at program start	E-4	E-6	E-4	E-5
Avg. age at program start	26.62 (6.53)	33.14 (4.63)	26.29 (6.45)	33.32 (3.88)
% eligible for early retirement	0.05	0.14	0	1
Avg. total years of service at separation	12.21 (8.00)	18.88 (4.57)	11.96 (8.06)	17.14 (4.47)
Median final rank at separation	E-5	E-7	E-5	E-6
% Male	0.86	0.89	0.86	0.87
% Nonwhite	0.42	0.51	0.41	0.55
% Married	0.61	0.85	0.60	0.84
Avg. AFQT	58.57 (19.72)	54.69 (20.86)	58.95 (19.59)	50.95 (20.71)
Avg. Months Sergeant or above in first term	1.49 (5.18)	0.54 (3.47)	1.55 (5.25)	0.47 (3.53)
% College or more	0.04	0.05	0.04	0.03
% Less than high school	0.04	0.06	0.04	0.09

Note. Column 1 displays summary statistics for the full sample of soldiers who were eligible for reenlistment and actively serving in Feb. 1993, six months prior to the VSI program rollout date. Column 2 restricts that sample to soldiers meeting the basic years-of-service eligibility requirements for VSI (with between 6 and 20 years of service as of Dec. 5, 1991). Column 3 shows the full sample but restricts to soldiers not eligible for VSI, and column 4 restricts to soldiers meeting all VSI eligibility criteria. AFQT scores and educational attainment are measured at the time of initial accession into the Army.

30, 1995—a period of approximately 23 months. Accordingly, rather than evaluating whether a soldier reenlists at the end of her current spell, as we did in our SRB analysis, here we evaluate whether the soldier remained in the Army for the duration of the early retirement program window, comparing that outcome across early retirement eligibility status and ability levels.

We collect soldiers' retention outcomes and code their eligibility for early retirement using the same Total Army Personnel Database we used to study SRBs. Whereas the SRB analysis relied on a panel of potentially multiple enlistment spells per soldier, here we compile just a sample of one observation per soldier. We combine that data with historical U.S. Army Military Personnel Messages, which specify eligibility criteria (i.e., rank, MOS, and years-of-service) for the VSI and other early retirement programs. Our method identifies 6,480 soldiers who satisfied all eligibility requirements for early retirement under the VSI program. To assess the effect of program eligibility on a soldier's probability of remaining in the Army, we compare the retention rates of eligible soldiers to all other non-first-term soldiers who were serving in the Army on February 1, 1993, which was six months prior to the VSI program's implementation date of August 1, 1993. Alternative specifications further restrict the sample to soldiers who met the VSI program's basic years-of-service requirement by having between 6 and 20 years of service upon program implementation. We summarize our early retirement analysis samples in Table 3.

4.3. Identification

Here our empirical strategy compares soldiers' retention decisions according to their individual ability and their eligibility for a buy-out under the VSI program by estimating Equation 3 below:

$$\begin{aligned} \text{Stay}_{i,t=T} = \beta_0 &+ \beta_1 \text{VSI}_i + \beta_2 \text{VSI}_i * \text{Ability}_i \\ &+ \beta_3 \text{Ability}_i + \beta_4 YOS_{i,t_0} \\ &+ \gamma_{MOS,rank} + \delta \mathbf{X}_i + \epsilon_i \end{aligned} \tag{2}$$

where VSI_i is an indicator for soldier i's eligibility for the Army's VSI program, YOS_{i,t_0} is the soldier's years of service as of program start date t_0, and $\text{Stay}_{i,t=T}$ is an indicator for whether the soldier has remained in the Army at T months since the program first went into effect. By running separate regressions for different values of T, we can evaluate the VSI's effects on retention upon the program's conclusion ($\overline{T}$, approximately 23 months for the VSI program), and we can also evaluate how retention rates evolved over time before and after the program's initial roll-out. In all regressions we include MOS*rank fixed effects to capture any average differences in retention probabilities across ranks and occupations, and we control for the soldier's years of service, since reenlistment probabilities generally decrease with tenure after a soldier's first enlistment.

Given these controls, we identify the effect of program eligibility from within-years-of-service variation in MOS and rank and from within-MOS*rank-bin variation in years of service. Our key 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 nor with the various unobservable determinants of her reenlistment decision. In other words, absent program implementation, we assume that reenlistment rates for eligible and ineligible groups of soldiers would have followed parallel trends. In fact, Figure 3 shows that the effect of VSI eligibility on a soldier's probability of retention was indistinguishable from zero in the months prior to the VSI program's rollout, suggesting that retention rates for eligible and ineligible soldiers were previously moving in close tandom. Further, while Table 3 shows that soldiers eligible for VSI tended to have lower AFQT scores and slower promotion speeds than non-eligible soldiers, in Appendix Table **??** we use regression results to show that the association between eligibility and ability largely disappears after controlling for the program's official eligibility criteria of MOS, rank, and years of

Table 4 The Effects of VSI Eligibility and Individual Ability on Soldier Retention

	AFQT Score				Months Below Sergeant in First Term			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VSI/SSB Eligibility	-0.121***	-0.186***	-0.107***	-0.132***	-0.153***	-0.156***	-0.141***	-0.144***
	(0.009)	(0.018)	(0.009)	(0.018)	(0.011)	(0.011)	(0.011)	(0.011)
VSI/SSB Eligibility * Ability		0.128***		0.048*		0.006***		0.005***
		(0.029)		(0.029)		(0.002)		(0.002)
Ability	-0.056***	-0.063***	-0.006	-0.013	-0.000	-0.000	0.001**	0.000
	(0.009)	(0.009)	(0.010)	(0.010)	(0.000)	(0.000)	(0.001)	(0.001)
Adjusted R^2	0.183	0.183	0.190	0.190	0.165	0.165	0.146	0.146
Sample	All Active	All Active	6–20 YOS	6–20 YOS	All Active	All Active	6–20 YOS	6–20 YOS
MOS FE	✓	✓	✓	✓	✓	✓	✓	✓
Rank FE	✓	✓	✓	✓	✓	✓	✓	✓
Demographic Controls	✓	✓	✓	✓	✓	✓	✓	✓
Avg. Retention Rate	0.79	0.79	0.82	0.82	0.80	0.80	0.84	0.84
Share Eligible	0.05	0.05	0.14	0.14	0.05	0.05	0.22	0.22
Avg. Ability	0.59	0.59	0.55	0.55	1.51	1.51	0.57	0.57
Observations	135,497	135,497	45,598	45,598	114,107	114,107	24,213	24,213

Note. Table shows the effect of VSI program eligibility and individual soldier ability on soldier's likelihood of remaining in the Army at program expiration. Standard errors are two-way clustered at the MOS*Rank and YOS level and reported in parentheses. Columns 1–2 and 5–6 samples include all soldiers actively serving on February 1, 1993 (that is, six months prior to the VSI/SSB program start date of August 1, 1993). Columns 3–4 and 7–8 samples are further restricted to soldiers meeting the basic years-of-service eligibility requirement (with between 6 and 20 years of service prior to program implementation). All regressions include occupation and rank fixed effects and control for years-of-service, gender, age, marital status, race, and special skill dummies. Ability is defined as AFQT percentile (on a scale from 0–1) for columns (1)–(4) and months below Sergeant for columns (5)–(8).

service. Our identifying assumption is also consistent with our review of contemporaneous Army policy documents and our more recent interviews with Army officials, who described the early retirement programs as "blunt" policy tools that deliberately ignored soldiers' individual ability.

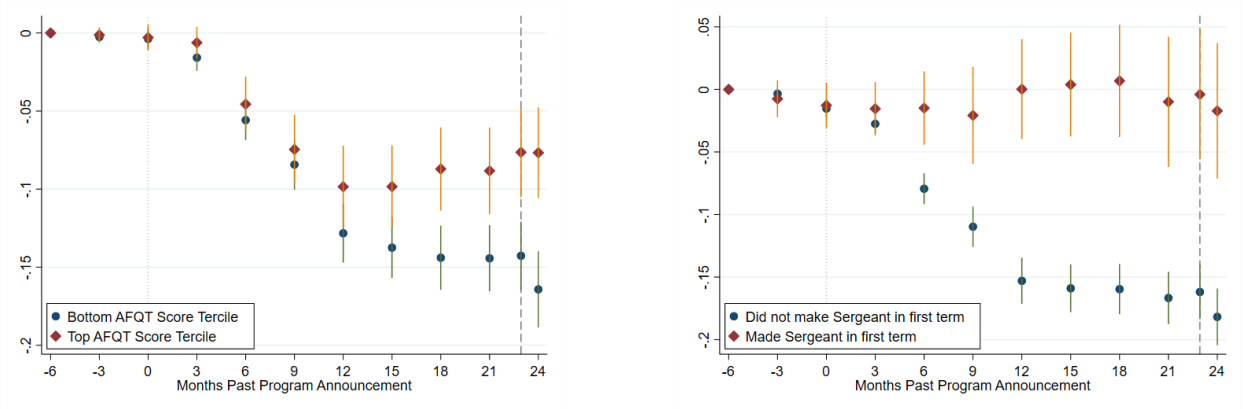
4.4. Early Retirement Results

We present the main results of our early retirement analysis in Table 4, which reports regression results from Equation 3 showing the effect of the VSI program on soldiers' probability of remaining in the Army at the conclusion of the VSI program (i.e., $t = \overline{T}$, approximately 23 months after the program's rollout), and Figure 3, which shows how the VSI program's effects on retention evolved before and after its initial rollout. Table 4

Our key finding is easy to state: the VSI program achieved its intended purpose of enticing soldiers to separate from the Army, but the effects were much larger among the lowest ability soldiers. For example, using our preferred sample of all non-first-term soldiers who were serving in the Army on February 1, 1993 (reflected in Table 4 columns (1)–(2) and (5)–(6)), we find that VSI eligibility negatively affected the probability of retention after 23 months by more than 11 percentage points for soldiers near the sample average AFQT score of 59 ($-0.186 + 0.128 * 59$), but that effect was dampened by approximately by more than 1.2 percentage points for each additional

Figure 3 The Effect of VSI Eligibility on Soldier Retention, by Soldier Ability Terciles.

(a) By Within-Military AFQT Score Tercile. (b) By Speed-of-Promotion Bin.



Note. Panels plot non-parametric estimates of the marginal effect of VSI program eligibility on the probability of remaining in the Army in period t for high- and low-ability soldier, where t is defined as the number of months since the start of the VSI program on August 1, 1993. Panel (a) compares soldiers in the top tercile of the within-military AFQT score distribution to soldiers in the bottom AFQT score tercile; Panel (b) compares soldiers who spent greater-than-zero months as a Sergeant or above in their first term of service to soldiers who spent zero months at or above the rank of Sergeant. Coefficients are obtained from separate regressions for each time period t where program eligibility is interacted with dummies for a soldier's relative ability. The middle tercile was also included in the AFQT score regressions but is not plotted here. Sample consists of all soldiers actively serving on February 1, 1993.

10 points of AFQT score. Similarly, VSI eligibility negatively affected the probability of retention by more than 14 percentage points for a soldier who spent the sample average of 1.51 months as a Sergeant in their first term of service, but that effect is dampened by 0.6 percentage points for each additional month of promotion speed. Figure 3 confirms these results graphically and illustrates how the VSI program's effects evolved before and after program implentation. Figure 3a compares soldiers in the top AFQT score tercile with those in the bottom AFQT tercile, and Figure 3b compares soldiers who made Sergeant at any time in their first term of service with those who did not. By 24 months after the VSI program's initial rollout, early retirement offers were less than half as effective at enticing separation for soldiers in the top AFQT score tercile relative to soldiers in the bottom AFQT tercile, and offers were almost completely ineffective for soldiers made the rank of Sergeant at any time in their first term of service.

The magnitude of these selection effects is economically significant. Our results, discussed in more detail in Appendix Section D, suggest that counterfactually extending early retirement offers to a cohort of 10,000 additional early-career soldiers would induce 1,210 additional early separations. Among these marginal soldiers, the average AFQT score would be approximately one sixth of a standard deviation below the usual average for separating soldiers. Thus, in contrast to SRBs,

which tend to negatively select soldiers for retention, early retirement offers tend to negatively select soldiers for early separation, and the self-selection induced by the program is large enough to increase the average ability profile of retained soldiers while decreasing the ability profile of separating soldiers.

5. Explanatory Mechanisms

Why would high-ability soldiers be less responsive to cash retention incentives, whether in the form of reenlistment bonuses or early retirement buy-outs? In this section we explore the role of three potential explanatory mechanisms, namely differences between high- and low-ability soldiers in financial liquidity, personal discount rates, and unobservable "taste for service."

First, low-ability soldiers may exhibit differential sensitivity to cash incentives because they are less liquid and more credit constrained than high-ability soldiers. For example, credit-constrained soldiers may use the lump-sum early retirement benefit to prolong and optimize their job search in the civilian labor market. Given that family resources account for a large share of the variation in AFQT scores (Neal and Johnson 1996) and that AFQT scores are strongly correlated with future labor market outcomes (Heckman et al. 2006), access to credit is likely to be correlated with cognitive ability. We match individuals in our sample to their credit records and confirm that AFQT scores and credit scores are correlated in our sample ($\rho = 0.22$, $p < 0.0001$).

To formally explore the liquidity mechanism, we estimate regressions similar to equation 1, augmenting them with two- and three-way interactions between SRB offers, individual ability (AFQT or promotion speed), and individual credit scores. We present our results in Table 5 and focus our attention on Column 3. Our estimates reveal a negative and statistically significant coefficient on the three-way interaction between SRB offer amount, individual ability (measured here by the soldier's AFQT score percentile), and individual credit scores. These results suggest that, while high-ability soldiers are less responsive to SRBs in general, the pattern is especially stark among those high-ability soldiers with high credit scores. Conversely, while low-ability soldiers continue to be quite responsive to SRBs, the relationship is largely driven by low-ability soldiers with low credit scores.

Next, we explore the potential role of different personal discount rates across high- and low-ability soldiers. Previous research has established that cognitive ability is correlated with decision-making characteristics including patience and risk tolerance (see, e.g., Frederick 2005, Benjamin et al. 2013). In the military context, Warner and Pleeter (2001) and Simon et al. (2015) document a

Table 5 The Effects of SRB Offer Amounts and Individual Ability on Soldier Retention, Controlling for Possible Mechanisms

	Credit Score			TSP Contribution Share			County Veteran Share		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
SRB Offer	0.080***	0.187***	0.065	0.068***	0.068***	0.067***	0.031***	0.014**	-0.009
	(0.010)	(0.017)	(0.053)	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.013)
SRB Offer * Ability	-0.087***	-0.068***	0.113	-0.062***	-0.059***	-0.058***	-0.025***	-0.026***	0.011
	(0.014)	(0.014)	(0.075)	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.020)
Ability	-0.093***	-0.039	-0.075*	-0.102***	-0.103***	-0.104***	-0.152***	-0.169***	-0.181***
	(0.010)	(0.037)	(0.039)	(0.010)	(0.010)	(0.010)	(0.006)	(0.010)	(0.011)
SRB Offer * Mechanism Var.		-0.019***	0.000		-0.084***	-0.017		0.129***	0.303***
		(0.002)	(0.008)		(0.019)	(0.061)		(0.025)	(0.077)
Ability * Mechanism Var.		-0.007	-0.001		-0.317***	-0.292***		0.141**	0.231***
		(0.006)	(0.006)		(0.050)	(0.056)		(0.058)	(0.067)
Mechanism Var.		-0.000***	-0.000***		0.542***	0.525***		0.315***	0.262***
		(0.000)	(0.000)		(0.038)	(0.042)		(0.040)	(0.043)
SRB * Ability * Mechanism Var.			-0.028**			-0.085			-0.275**
			(0.011)			(0.078)			(0.111)
Adjusted R^2	0.184	0.186	0.186	0.202	0.203	0.203	0.134	0.135	0.135
Year*Month FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
MOS*Rank*YOS FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Demographic Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
Avg. Reenlistment Rate	0.69	0.69	0.69	0.65	0.65	0.65	0.67	0.67	0.67
Avg. SRB	0.20	0.20	0.20	0.26	0.26	0.26	0.32	0.32	0.32
Avg. Ability	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
Avg. of Mechanism Proxy	633.90	633.90	633.90	0.02	0.02	0.02	0.13	0.13	0.13
Observations	626,242	626,242	626,242	1,201,372	1,201,372	1,201,372	1,483,861	1,483,861	1,483,861

Note. Table shows possible explanatory mechanisms for main effect of SRBs and ability on soldier reenlistment. Standard errors are two-way clustered at the MOS*Rank*YOS and individual level and reported in parentheses. SRBs are in $10,000s of 2015 dollars. Demographic controls include gender, age, marital status, race, and special skill dummies. is defined as AFQT percentile (on a scale from 0-1). Columns (1)-(3) proxy for liquidity with individual credit scores; columns (4)-(6) proxy for personal discount rates with contributions (as % of base pay) to the Thrift Savings Plan; columns (7)-(9) proxy for individual taste for military service with the veteran share of the total adult population in a soldier's home-of-record county according to the 2000 Decennial Census. Samples are restricted to spells ending with eligibility for reenlistment and with reenlistment windows opening between 1997–2015; samples are further restricted to constant samples based on non-missingness of mechanism proxies.

negative correlation between AFQT scores and personal discount rates (PDRs). Their findings help to explain why it is that, among soldiers in our sample who were offered and opted for early separation through the VSI/SSB program, soldiers with lower AFQT scores and soldiers with slower promotion speeds were substantially more likely to choose the lump-sum SSB option over the annuitized VSI option, despite the latter having more than double the net present value at discount rates below 7%.

We explore the relationship between PDRs and our observed patterns of selection by augmenting our models with proxies for PDRs, namely whether a soldier is currently saving for retirement in the Thrift Savings Plan), which is the same 401(k)-style retirement savings program available to most other federal government employees. Retirement savings inherently involve a willingness to transfer resources from the present to the future, and existing research has shown retirement savings to depend, among other things, on an individual's pure time preferences Finke and Huston (2013). We observe soldier's TSP contributions as a share of total base pay over the course of an enlistment

and interact this with our measures of ability and SRB offers. As predicted and consistent with prior research, we find that AFQT scores are indeed positively correlated with a soldier's TSP contribution share. Similar to the above credit score analysis, columns (4)–(6) of Table 5 explore the effects of SRB offers and individual ability on reenlistment rates after controlling for two- and three-way interactions with a soldier's TSP contribution share. While we do find that high-ability, high-TSP-contribution soldiers are particularly insensitive to SRB offers, the effect is relatively small and statistically insignificant.

Third, we explore whether idiosyncratic "taste for service" may be correlated with individual ability such that high-ability soldiers tend to be inframarginal and consequently less sensitive to pecuniary retention incentives. While taste for service is unobservable and hard to analyze, we proxy for it using the veteran share of the total adult population in the soldier's home-of-record county (where they joined the Army from) from the 2000 Decennial Census. We expect that soldiers from high veteran-share home counties are more likely to have grown up in or around military households, to have had greater exposure to the military, and thus to have a higher taste for service.

In Columns (7)–(9) of Table 5 we explore the effect of veteran share as a proxy for taste for service. The negative and statistically significant coefficient on the three-way interaction term in column (9) suggests that high-ability soldiers from high veteran-share counties are especially insensitive to SRB offers. While we encourage caution in interpreting these estimates, they suggest that SRBs may be counteracted by non-pecuniary dimensions of military service, especially for high-ability soldiers.

These results suggest that differences in individual liquidity, personal discount rates, and taste for service all help explain our main finding that low-ability soldiers are more responsive to cash retention incentives. Our data do not enable us to distinguish the relative contributions of these mechanisms, and all may be operating simultaneously. Importantly, absent any random variation in these mechanisms, our Table 5 results should be interpreted as providing correlational evidence on the heterogeneous effects SRBs across a variety of other dimensions. Nor do we mean to suggest that the three mechanisms discussed here are the only conceivable mechanisms at play. Another plausible mechanism, which we are unable to test with the data at hand, is that ability tends to correlate with lifetime wealth or earnings such that low-ability soldiers derive more marginal utility from cash offers in amounts similar to the SRB or VSI programs.

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 focused on 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 in the public sector. 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. 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. Moreover, we estimate that both effects are large enough to affect the average ability level of the military. We provide suggestive evidence for three explanatory mechanisms—differences in financial liquidity, differences in individual time preferences, and differences idiosyncratic "taste for service"—although no one mechanism appears wholly explanatory on its own. Although our results are derived from the particular context of the U.S. military, we nonetheless view our findings as potentially relevant to other public sector organizations where personnel managers lack flexible tools and the ability to target incentives to individual high-performing workers.

Notes

[1]Throughout the paper we refer to ranks by their corresponding pay grades. Pay grades begin with a letter—"E" for enlisted personnel, "O" for commissioned officers"—and end with 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).

[2]Promotion to Sergeant requires an individual to be eligible (i.e., have no misconduct) and to earn sufficient promotion points based a standardized scoring system for the following categories: physical fitness, weapons qualification, military awards, military education and civilian education (Department of the Army 2023b).

[3]Appendix Figure XX shows a histogram of this variable; notably, only 25% of soldiers in our sample make Sergeant in their first term.

[4]These same fixed effects effectively control for most other aspects of military compensation, which are similarly fixed according to observable characteristics like rank, years-of-service, and marital status.

[5]See Appendix Section B.4 for additional details.

[6]The Army regulation states "The objective of the SRB Program is to increase the number of reenlistments in critical MOSs that do not have adequate retention levels to staff the force." (Department of the Army 2023a)

[7]Borgschulte and Martorell (2018) show higher exit rates from the Army when the civilian labor market is strong.

[8]In Appendix Table we show, somewhat surprisingly, that most of the effect of SRB offers on reenlistment choices is located at the extensive margin (i.e., in the difference between a positive bonus offer and no bonus offer), with little additional effect from higher bonus offers. Appendix Figure C4 shows the coefficients of the reenlistment choices of regressing soldiers on dummies for $2,000 SRB offer bins. While noisy, the coefficients show that the effect of SRB offers on reenlistment appears to be limited to the extensive margin. While positive bonus offers are associated with higher reenlistment rates relative to no bonus offer, we see no evidence that the effect is increasing in the amount of the bonus offer. This may be attributable to the fact that we observe little variation in non-zero bonus offers, with only 29% of spells ending in a non-zero bonus offer, and with the vast majority of positive offers falling between $4,000 and $12,000 (see Appendix Figure XX).

[9]In Appendix Tables 11 and C2 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). One notable result from our robustness checks is that the relationship between soldiers' ability and their responsiveness to SRB offers is much diminished when we restrict to a sample of soldiers with strictly positive bonus offers (see columns 7 and 6 of Appendix Tables C1 and C2, respectively). In fact, when we measure soldiers' ability by their speed of promotion, our results are very small and reverse in sign. We attribute this to the fact—which we document in Appendix Figure C4 and discuss in footnote 31 above—that SRB offers are most effective along the extensive margin.

[10]Although the U.S. military continues to use early-retirement offers with some frequency—late-career early retirements were offered as recently as 2018—recent waves of Army drawdown have relied more heavily on compulsory separations for low-performing soldiers. We use the 1990s offers for reasons of data availability and due to access to the precise formula for determining early retirement offers. The latter allows us to isolate quasi-random variation in early retirement offers that were made without regard to individual ability.

[11]In Appendix Section XX we study a smaller but similarly structured wave of early retirement offers (known at the time as Temporary Early Retirement Authority (TERA) offers) extended between August 1993 and June 1995 to late-career soldiers with between 15 and 20 years of service at the time. Despite noisier estimates due to a much smaller program size, results from the TERA program are qualitatively similar to our results from the VSI program.

[12]Though primarily focused on the drawdown programs' effects on quantity of soldiers retained, Asch and Warner (2001) previously found a negative correlation between early retirement take-up and soldiers' AFQT scores in a broader drawdown program that specifically targeted low-performing soldiers. We focus on a subset of early retirement offers that was offered without regard to individual performance, yielding quasi-experimental variation.

[13]Final eligibility for early retirement was formally subject to approval by the soldier's commanding officer. Although it would be problematic for our identification if commanders considered a soldier's performance when granting approval, evidence from Army archives suggests this was not the case: for example, archival records state that 100% of on-time applications were approved in 1992 (the only year for which records are available), and an internal Army report assessing the programs' success states that the Army "stressed maximum approvals while accepting the inherent

risk of a personnel shortfall." Author interviews with Army officials familiar with these programs further confirmed that commander approval was essentially pro forma.

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Appendix for Online Publication

Appendix 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 ability 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 to service should attract higher ability soldiers and increase the average ability 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 3 to the effect of retention policies on the average ability profile of retained military members $\overline{A}$, which is itself an important quantity for military analysts (Wigdor and Green 1991). Using the example of cash reenlistment bonuses, the average ability of retained soldiers is

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

where $p_i(K)$ is the probability that individual i reenlists as a function of a reenlistment bonus offer K, and a_i is the ability of soldier i. The response of this average to an across-the-board marginal increase in reenlistment bonus offers K is

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

where $\gamma_i = \frac{dp_i(K)}{dK}$. Recall from Section 3 that, in estimating the effects of SRBs, the coefficient of interest is β_2, which we interpreted as the differential responsiveness of high- versus low-ability soldiers to SRB offers—that is, the effect of ability a_i on individual responsiveness γ_i. Using expectations, and rewriting β_2 in terms of variances, we see that we can express the effect of a retention bonus on the average ability of retained soldiers as:

$$\begin{aligned}
\frac{d\overline{A}}{dK} &= \overline{\gamma}\,\overline{a} + \text{Cov}(\gamma_i, a_i) \\
&= \overline{\gamma}\,\overline{a} + \frac{\text{Cov}(a_i, \gamma_i)}{\text{Var}(a_i)}\text{Var}(a_i) \\
&= \overline{\gamma}\,\overline{a} + \beta_2 \text{Var}(a_i)
\end{aligned}$$

where $\overline{\gamma}$ is the average response of soldiers to the bonus and $\overline{a}$ is average ability in the military. In other words, the key parameter that needs to be estimated to inform the effect of retention policies on average soldier ability is β_2, which is precisely the parameter we focus on estimating in Section 3.

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:

$$U_i(military) = W^m(\mathbf{X}_i), \tag{3}$$

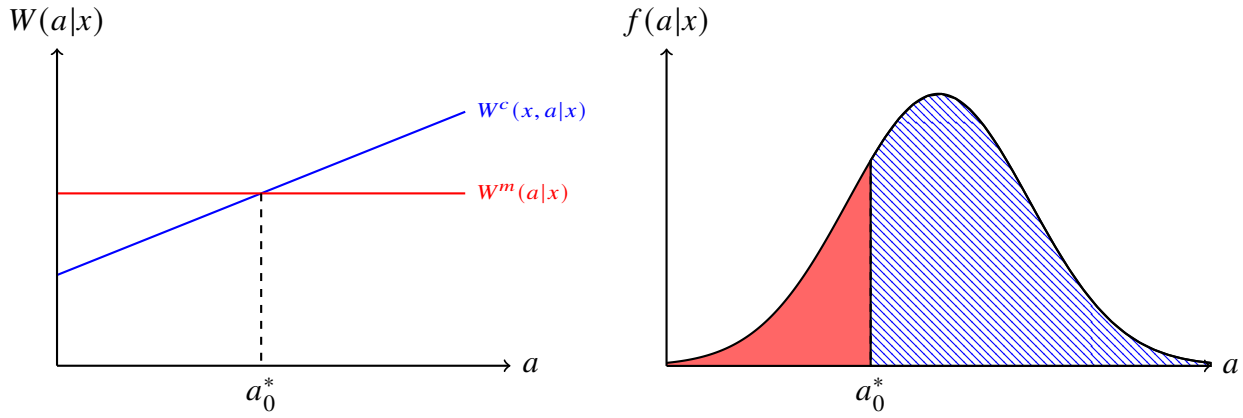
where W^m is the military wage function and $\mathbf{X}$ is a vector of individual characteristics affecting compensation (for example, rank, years of service, and military occupational specialty). Should she choose not to reenlist, the same individual earns a payoff of:

$$U_i(civilian) = W^c(\mathbf{X}_i, a_i), \tag{4}$$

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

Figures 4a and 4b 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.

Figure 4 Simple Case



(a) Civilian Wage Functions

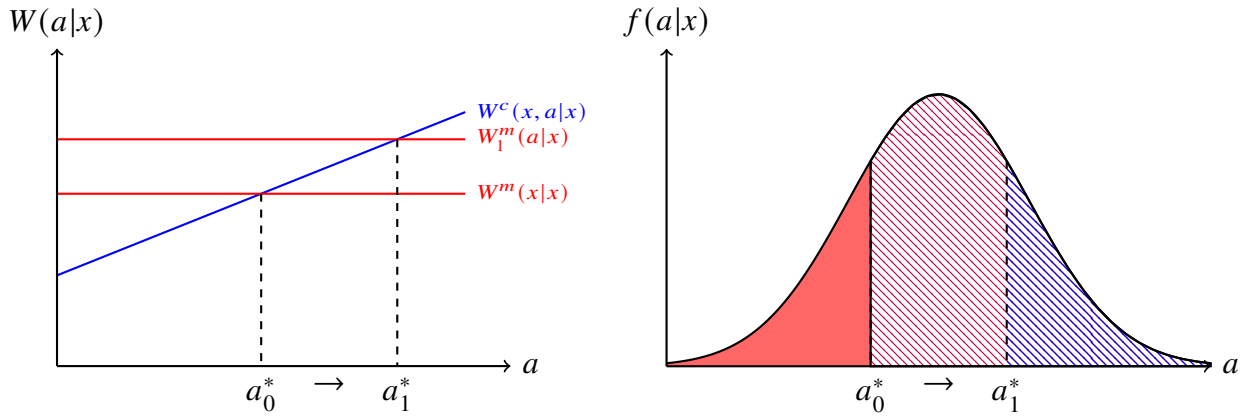
(b) PDF of Soldier Ability

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:

$$U_i(military) = W^m(\mathbf{X}_i) + K \tag{5}$$

Figure 5a depicts the civilian and military 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^*. Figure 5b depicts the new cutoff rule. Intuitively, as military wages increase, the military is able to compete for higher ability individuals for whom the military option was previously dominated by civilian employment. In this simple case, relatively high-ability soldiers (those with ability $a_0^* < a_i < a_1^*$) are uniquely responsive to reenlistment bonuses since the bonuses were inframarginal for all other ability types. The bonus also unambiguously increases the average ability of those who remain in the military.

Figure 5 Exogenous Shift in Relative Military Compensation



(a) 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

$$U_i(military) = W^m(\mathbf{X}_i) + c_i, \tag{6}$$

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

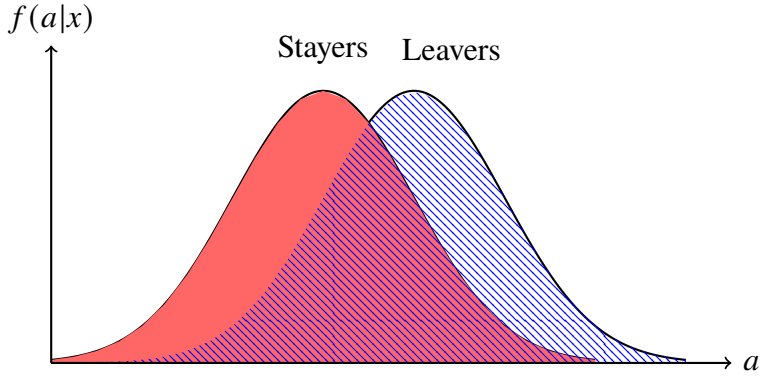
$$a_i < g(c_i), \tag{7}$$

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

Figure 6 depicts stylized baseline ability distributions of stayers and leavers in this continuous-type setting. As Equation (7) 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 4b. 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 6 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.

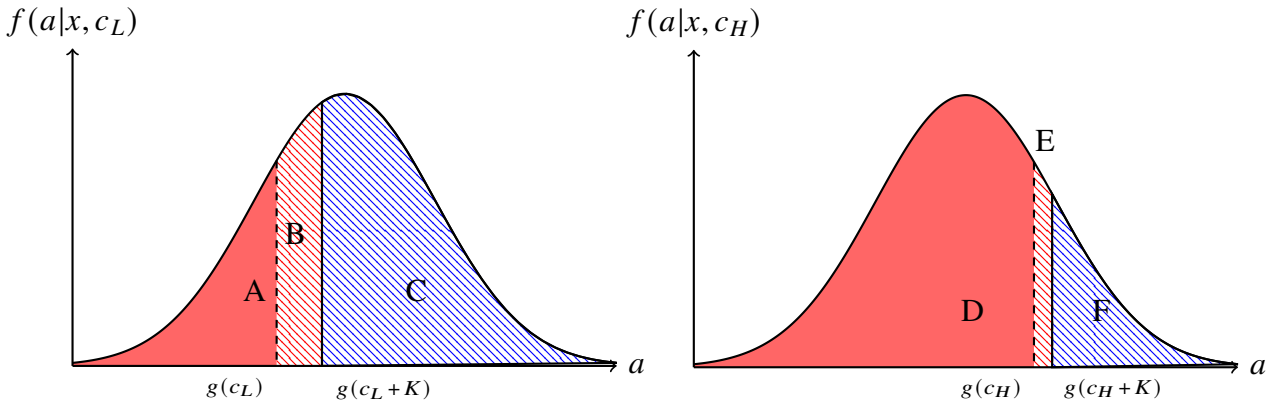
Figure 6 Stayer and Leaver Ability Distributions, Continuous Taste Types (c_i)



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 5 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 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.[14]

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 7a shows the new cutoff rule after the bonus K for individuals with a low taste for service c_L, and Figure 7b 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.

Figure 7 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)

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), which itself depends upon both the individual and joint distributions of ability and taste for service in the military. 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, nor is there an unambiguous prediction for how bonuses affect the average ability profile of retained soldiers. In this simple model, our empirical finding that lower ability soldiers are more responsive to bonuses corresponds to the case where B is larger than E, but an opposite result could easily pertain by constructing an example where E is larger than B.

Appendix B: Data Appendix

B.1. Reenlistment Data

The main data for this analysis comes from the U.S. Army's Total Army Personnel Database (TAPDB). For the SRB analysis we construct a panel of enlistment spells with reenlistment windows opening between 1997 and 2015 (which is the period for which we have SRB offer data). We exclude from the analysis all current spells, and we also exclude spells lasting fewer than three months. For the early retirement analysis we construct a sample of soldiers who were serving in the Army on February 1, 1993, which was six months prior to the VSI program's implementation date of August 1, 1993.

The primary outcome of both analyses is whether a soldier chooses to reenlist. 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. 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 before choosing not to reenlist. The left panel of Figure 13d shows the distribution of spell length in the resulting sample, and the right panel of Figure 13d shows the distribution of total enlistment terms per soldier; the modal enlistment spell lasts approximately 4 years, and a majority of soldiers serve just one term prior to separation.

In addition to knowing the date at which the soldier decided to reenlist and the date at which a 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 SRB offer that the soldier faces; in some specifications we also use the date to control for local labor

market conditions in the soldier's home commuting zone. Reenlistment windows typically lasted between 12 and 24 months throughout our sample, and soldiers are free to make a final reenlistment decision at any point within their window. Although a soldier can theoretically time their reenlistment based upon a belief that prevailing SRB offers (or other relevant considerations, like local labor market conditions) will change over the course of their reenlistment window, we abstract from such strategic timing by assigning soldiers the SRB offered to them in the first month of their reenlistment window. In fact, among soldiers who choose to reenlist, more than 50% do so within the first three months of their reenlistment window, and we have confirmed that our results are robust to alternative SRB assignment protocols (for example, assigning soldiers the SRB they were offered in the last month of their reenlistment window or assigning soldiers the minimum, maximum, or average SRB offered throughout their reenlistment window).

We use two main measures of soldier ability throughout our analysis: (1) the soldier's AFQT score at entry and (2) the speed of a soldier's early career promotions, which we specifically define as the number of months that the soldier spends at or above the rank of Sergeant (E-5) in their first term of service. Table 7 summarizes correlation coefficients from Wigdor and Green (1991) showing that AFQT score is highly correlated with within-military hands-on performance metrics. Figure 13 also shows that AFQT scores are promotion speed are highly correlated with one another.

B.2. Credit, Thrift Savings Plan (TSP), and Veteran Share of Population Data

In Table 5 we probed possible explanatory mechanisms by controlling for credit scores, Thrift Savings Plan (TSP) participation, and veteran share of a soldier's home-of-record county. Credit data were obtained from a major credit reporting agency, which we then matched with the TAPDB enlistment database. Credit data consists of a panel of twice-annual observations for soldiers with service between April 2007 and March 2015. Among soldiers who were eligible for at least one reenlistment during that time period, we are able to match nearly 90% to credit reporting data. For each soldier facing a reenlistment choice, we match the soldier to the credit report that is closest in time to the beginning of their reenlistment window. In addition to individual credit scores, we observe open lines of credit, balances, and delinquencies, grouped by major lending categories. For simplicity, we focus our analysis on credit scores, but we have confirmed that our results are largely robust to proxying for credit constraints with past delinquencies.

We observe Thrift Savings Plan (TSP) contribution data using payroll data from the Defense Finance Accounting Service. The TSP is a 401(k)-like retirement savings plan available to many federal workers. First established for civilian workers in 1986, members of the military became eligible for the TSP in 2001. For spells ending after 2001, we observe the soldier's total contribution to their TSP account over the course of the spell. We also observe their total base military pay over that period, which we use to calculate their TSP contribution as a share of their total base pay. Since 2001, approximately 32% of spells show a positive contribution to the TSP, and the average contribution was approximately 2.2% of the soldier's total base pay of the spell.

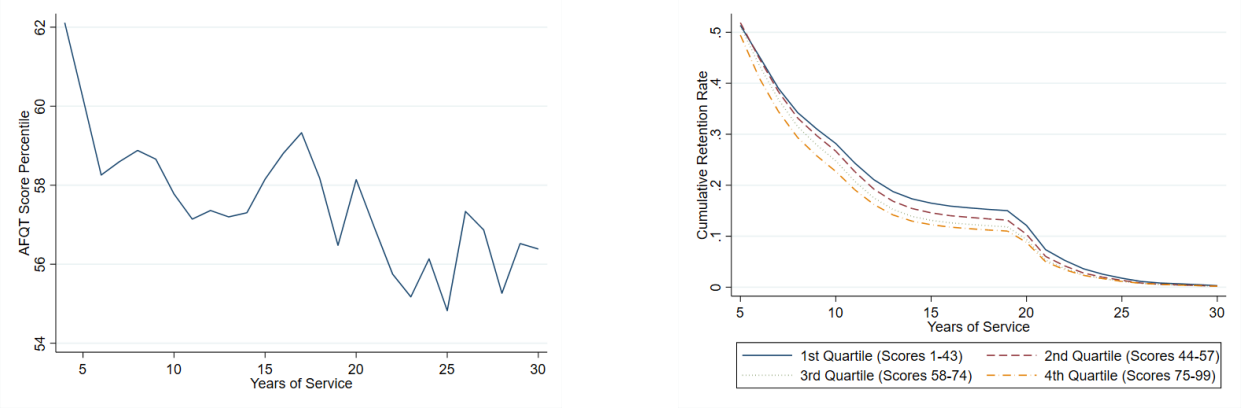
Veteran shares are calculated using veterans and active or reserve armed forces members as a share of the total adult population in a soldier's home-of-record county according to the 2000 Decennial Census (see Summary File 3, Table ID P039).

B.3. Additional Tables and Figures

Figure 8 Average Ability by Military Tenure.

(a) Average AFQT Score Percentile by Total Years of Service.

(b) Continuation Profiles by AFQT Score Quartile.

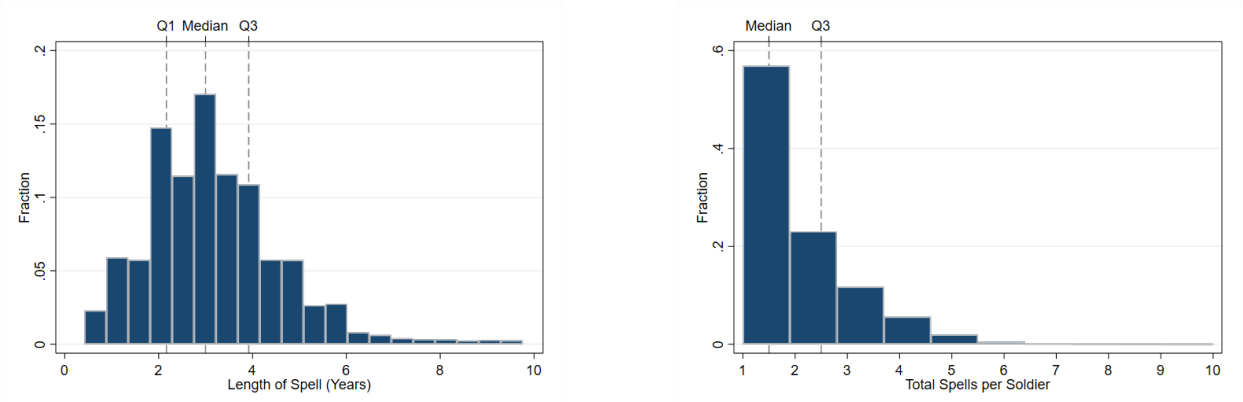


Note. Left panel plots the average AFQT score percentiles by soldiers' total years of service at separation. AFQT score percentiles are adjusted for accession-year fixed effects. Right panel plots separately by AFQT score quartile the share of soldiers remaining in the Army at various tenures.

Figure 9 Distributions of Spell Length and Total Terms per Soldier.

(a) Spell Length.

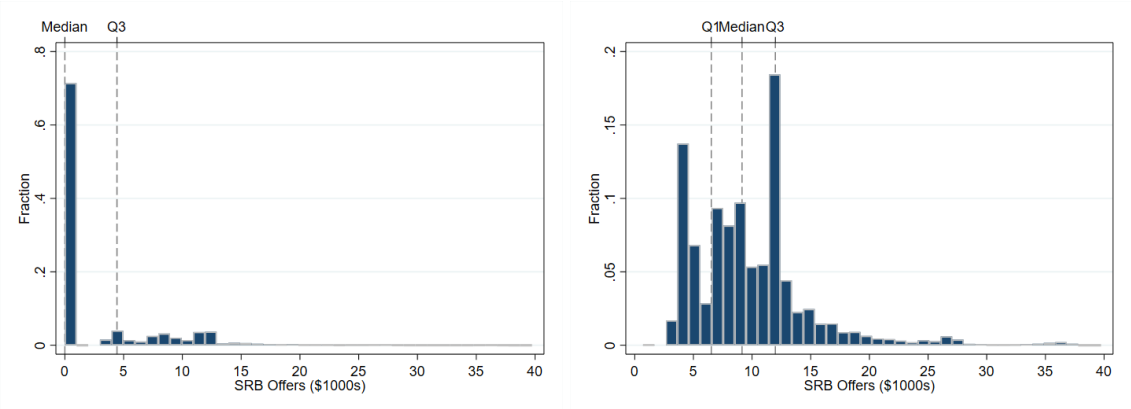
(b) Total Terms per Soldier.



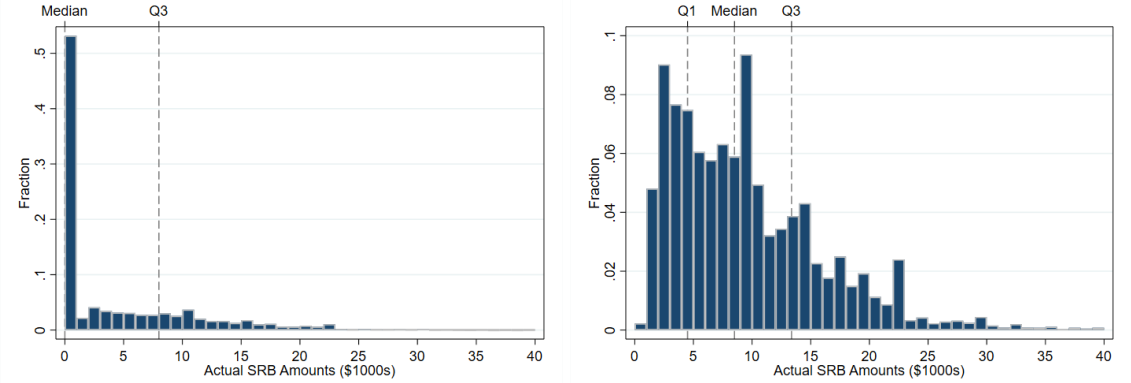
Note. Left panel plots the distribution of spells by length in years. Right panel plots the distribution of soldiers by the total number of terms they had served at the time of separation. Sample includes all enlisted soldiers from 1992-2015 and excludes soldiers currently serving in the Army.

Figure 10 Distrubutions of SRB Offers and Actual SRB Amounts Received, 1997–2015.

(a) SRB Offers. (b) Non-zero SRB Offers.



(c) Actual SRB Amounts Received. (d) Non-zero SRB Amounts Received.



Note. Panels (a) and (b) plot the distribution of SRB offers. Panel (a) shows all offers (including where no SRB is offered) and panel (b) shows positive offers only. Panels (c) and (d) plot the distribution of actual SRB amounts received, with panel (d) showing positive amounts only.

Table 6 Correlation Between Available SRB Offers

	(1)		(2)
2-year offer	0.593***	CONUS 1	0.372***
3-year offer	0.986***	CONUS 2	0.510***
5-year offer	0.988***	CONUS 3	0.585***
6-year offer	0.964***	CONUS 4	0.698***
		OCONUS 1	0.586***
		OCONUS 2	0.608***

Note. Column 1 shows within-spell correlations between a soldier's highest non-location specific SRB offer for a four-year reenlistment in the first month of their reenlistment window (i.e. their "regular" offer) and their highest non-location specific SRB offers for two-, three-, five-, and six-year reenlistments. Column 2 shows within-spell correlations between a soldier's highest regular offer and several of their highest location-specific offers within the continental U.S. ("CONUS") and outside the continental U.S. ("OCONUS").

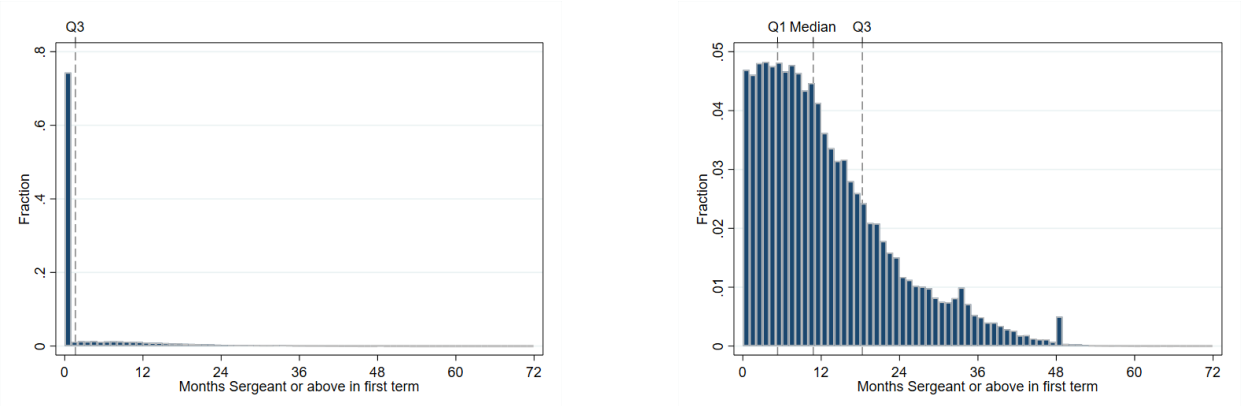
Table 7 Correlations of Armed Forces Qualifications Test (AFQT) and Job-Specific Hands-On Performance Measure

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 8-10.

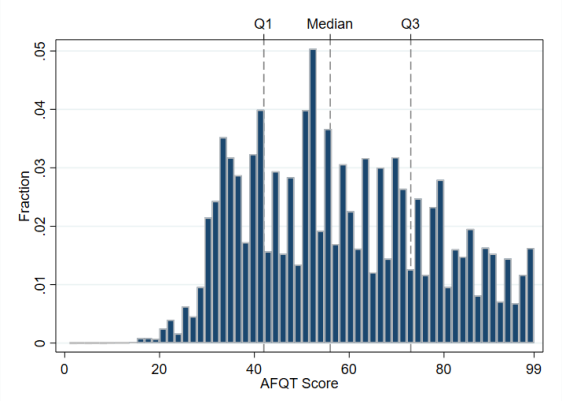
Figure 11 Promotion speed distributions.

(a) All Soldiers. (b) Soldiers who made Sergeant in their first term.



Note. Left panel plots the distribution of the number of months soldiers spent at or above the rank of Sergeant in their first term. Right panel plots the same distribution for the 25% of soldiers who made Sergeant at any time in their first term.

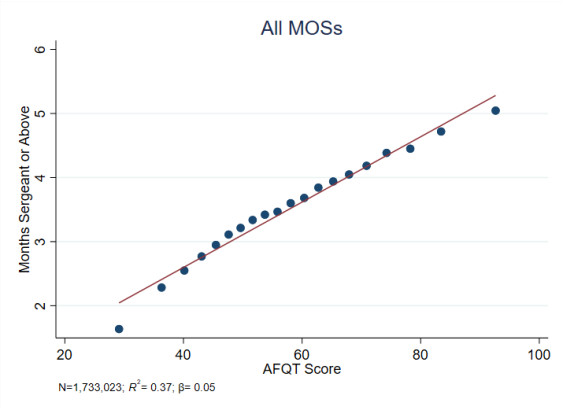
Figure 12 AFQT score distributions.



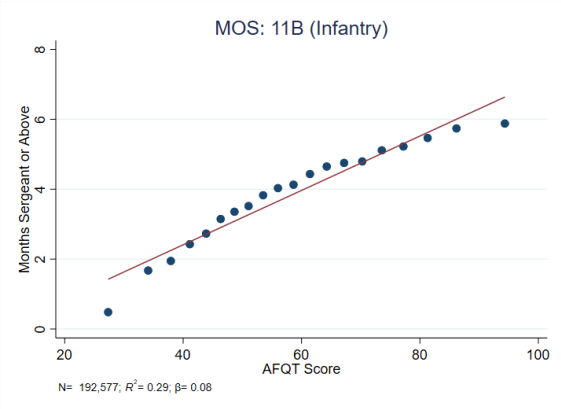
Note. Figure plots the unconditional distribution of AFQT scores among spells ending with eligibility for reenlistment.

Figure 13 Correlation of AFQT scores and speed of promotion.

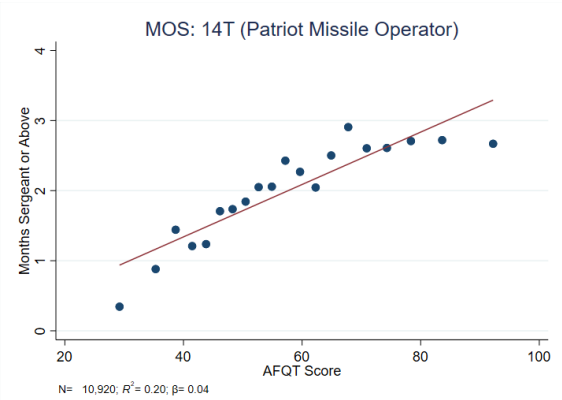
(a) All MOSs.



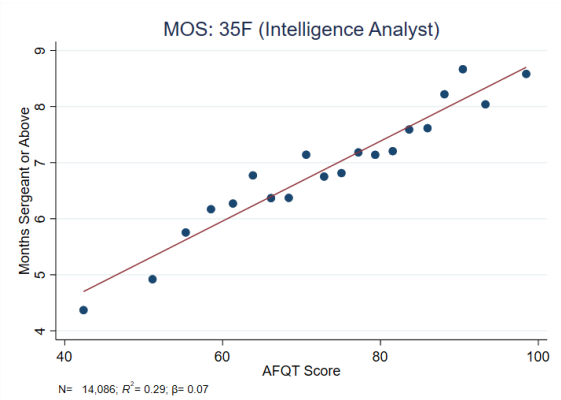
(b) MOS: 11B (Infantry).



(c) MOS: 14T (Patriot Missile Operator).



(d) MOS: 35F (Intelligence Analyst).



Note. Panels display binscatter plots of promotion speeds (defined as months a soldier spends at or above the rank of Sergeant in their first term of service) against AFQT scores. Panel (a) includes all soldiers in all MOSs; panel (b) restricts to infantry soldiers; panel (c) restricts to "Patriot" missile operators; panel (d) restricts to intelligence analysts.

B.4. Case Studies: Time Series Variation in SRBs

Department of Defense guidance establishes that SRB amounts are to be determined by a combination of "inside" factors—i.e., the military's operational and strategic requirements—and "outside factors"—namely, labor market conditions and other economic trends affecting civilian labor market opportunities. Specifically, DoD guidance requires the Army and other branches to consider (1) the potential impact of a "critical personnel shortage" on the mission of the branch, (2) the degree to which current or historic retention in a particular military skill falls short of "established retention objectives," (3) the length and cost of training associated with a particular military skill, (4) any overall Army-wide personnel shortage and shortages within particular ranks, (5) the "relatively arduous or otherwise demanding nature of the military skill, as compared to other military or civilian alternatives," and, finally, (6) the degree of demand for the military skill in the civilian labor market.[15] In fact, our conversations with U.S. Army officials revealed that inside factors—those reflecting the "needs of the Army"—predominate, and outside factors are incorporated only indirectly. Rather than directly adjusting SRB offers based on civilian labor market conditions or other economic indicators, the Army typically only adjusts SRBs according to its own manning levels. Thus, to the extent that soldiers are more likely to exit the Army when the civilian labor market is strong (Borgschulte and Martorell 2018), SRB offers will indirectly reflect outside economic conditions by way of their effect on aggregate retention rates (either at the MOS, grade, or Army-wide level).

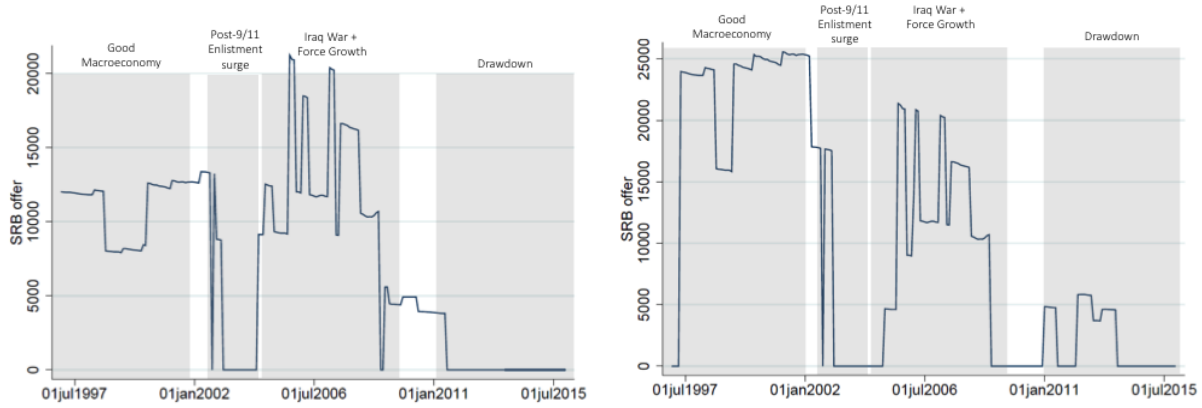
Here we briefly consider how these factors may have driven time-series variation in SRB offers for two separate MOSs. Specifically, in Figure 14, we plot the time series of SRB offers for infantrymen on the left and Patriot missile operators (responsible for operating a type of surface-to-air missile system that gained notoriety during the 1991 Gulf War) on the right. The Infantry MOS is not only the largest in the Army (11% of our sample) but also 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. Relatively high pre-war SRBs for infantry personnel may also reflect lower average retention rates relative to other MOSs as well as the perceived "arduousness" of the specialty relative to other civilian jobs. Still, infantry SRBs dipped dramatically in early 2002 and remained low throughout much of the 2002-2004 period. This may reflect higher accessions and retention during a period of surging enlistment, which many attribute to heightened patriotism in the aftermath of the 9/11 attacks. Infantry SRBs increased again in 2004, and despite considerable volatility, they remained high through approximately 2008, most likely 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 that is likely to affect reenlistment outside of its effect on SRBs), 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 14, 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, which was 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 military technology—can be an important driver of variation in SRBs over time.

Figure 14 Selective Reenlistment Bonus (SRB) Case Studies

SRB offers by MOS (E-4), 1997-2015



(a) MOS: 11B (Infantry)

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

Appendix C: Robustness of Empirical Results

Table 8 The Effects of SRB Amounts and Individual Ability (AFQT scores) on Soldier Retention: Alternative Specifications

	(1) Baseline	(2) SRB in logs	(3) CZ FE sample	(4) Main MOS only	(5) High Corr. MOS only	(6) Excl. Iraq Surge	(7) Positive SRB offer
SRB	0.062***		0.032***	0.043**	0.064***	0.056***	0.022**
	(0.007)		(0.006)	(0.019)	(0.020)	(0.007)	(0.011)
SRB * Ability	-0.070***		-0.025***	-0.072**	-0.058*	-0.065***	-0.024**
	(0.011)		(0.010)	(0.031)	(0.033)	(0.011)	(0.012)
Ability	-0.092***	-0.090***	-0.151***	-0.124***	-0.106***	-0.088***	-0.180***
	(0.009)	(0.010)	(0.006)	(0.021)	(0.030)	(0.010)	(0.014)
log(SRB)		0.007***					
		(0.001)					
log(SRB) * Ability		-0.008***					
		(0.002)					
Adjusted R^2	0.155	0.155	0.133	0.128	0.141	0.154	0.111
Year*Month FE	✓	✓	✓	✓	✓	✓	✓
MOS*Rank*YOS FE	✓	✓	✓	✓	✓	✓	✓
Demographic Controls	✓	✓	✓	✓	✓	✓	✓
Avg. Reenlistment Rate	0.65	0.65	0.67	0.66	0.63	0.64	0.66
Avg. SRB	0.28	0.28	0.32	0.28	0.34	0.27	0.99
Avg. AFQT	0.58	0.58	0.59	0.53	0.60	0.58	0.61
Observations	1,804,326	1,804,326	1,463,546	643,859	394,353	1,473,306	516,400

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note. All samples are restricted to soldiers who were eligible to reenlist with reenlistment windows opening between 1997 and 2015. Column (1) shows the baseline specification reported in Table 2 column (1). Column (2) uses an identical specification except that SRBs are log-scaled. Column (3) uses the same specification as Column (1) but is restricted to a sample with non-missing Year*Month*CZ fixed effects. Column (4) is restricted to the 10 highest-density MOSs in our sample (namely: infantry, artillery crew members, calvary scouts, wheeled vehicle mechanics, combat medics, motor transport operators, logistics specialists, culinary specialists, supply specialists, and armor crew members). Column (5) is restricted to the MOSs which Wigdor & Green (1991) identified as exhibiting a high correlation between AFQT scores and hands-on job performance (namely: infantry, armor crew members, health care specialists, information systems specialists, radio operators, and administrative specialists). Column (6) excludes soldiers who entered their reenlistment windows during the Iraq war years (2007–2009). Column (7) is restricted to soldiers who were offered a non-zero SRB.

Table 9 The Effects of SRB Amounts and Individual Ability (AFQT scores) on Soldier Retention: Alternative SRB Assignment Rules

	(1) Baseline (First SRB Offer)	(2) 6-mo. Avg. SRB	(3) 12-mo. Avg. SRB	(4) 6-mo. Max. SRB	(5) 12-mo. Max. SRB
SRB	0.062***	0.064***	0.063***	0.062***	0.061***
	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)
SRB * Ability	-0.070***	-0.075***	-0.079***	-0.071***	-0.072***
	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)
Ability	-0.092***	-0.092***	-0.092***	-0.089***	-0.088***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Adjusted R^2	0.155	0.155	0.155	0.155	0.155
Year*Month FE	✓	✓	✓	✓	✓
MOS*Rank*YOS FE	✓	✓	✓	✓	✓
Demographic Controls	✓	✓	✓	✓	✓
Avg. Reenlistment Rate	0.65	0.65	0.65	0.65	0.65
Avg. SRB	0.28	0.26	0.25	0.31	0.33
Avg. AFQT	0.58	0.58	0.58	0.58	0.58
Observations	1,804,326	1,804,326	1,804,326	1,804,326	1,804,326

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note. samples are restricted to soldiers who were eligible to reenlist with reenlistment windows opening between 1997 and 2015. Column (1) shows the baseline specification reported in Table 2 column (1), which assigns soldiers the highest non-location-specific SRB offer available to them for a 4-year reenlistment on the first day of the first month of their reenlistment windows. Column (2) and (3) assign soldiers the average of the highest non-location-specific 4-year offers available to them on the first day of the first 6 or 12 months of their reenlistment windows, respectively. Column (4) and (5) assign soldiers the maximum of the highest non-location-specific 4-year offers available to them on the first day of the first 6 or 12 months of their reenlistment windows, respectively.

Table 10 The Effects of SRB Amounts and Individual Ability (Promotion Speed) on Soldier Retention: Alternative Specifications

	(1) Baseline	(2) SRB in logs	(3) CZ FE sample	(4) Main MOS only	(5) High Corr. MOS only	(6) Excl. Iraq Surge	(7) Positive SRB offer
SRB	0.029***		0.026***	0.012	0.042**	0.025***	0.026***
	(0.004)		(0.004)	(0.010)	(0.018)	(0.004)	(0.007)
SRB * Ability	-0.002***		-0.002***	-0.002	-0.003**	-0.002***	-0.003***
	(0.000)		(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Ability	0.003***	0.003***	0.003***	0.003**	0.004**	0.003***	0.004***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
log(SRB)		0.003***					
		(0.000)					
log(SRB) * Ability		-0.000***					
		(0.000)					
Adjusted R^2	0.149	0.149	0.131	0.124	0.138	0.149	0.107
Year*Month FE	✓	✓	✓	✓	✓	✓	✓
MOS*Rank*YOS FE	✓	✓	✓	✓	✓	✓	✓
Demographic Controls	✓	✓	✓	✓	✓	✓	✓
Avg. Reenlistment Rate	0.66	0.66	0.67	0.67	0.64	0.65	0.66
Avg. SRB	0.29	0.29	0.32	0.29	0.35	0.28	0.99
Avg. Months Above E-4	3.53	3.53	3.71	2.59	3.58	3.33	4.39
Observations	1,750,220	1,750,220	1,473,794	633,626	388,670	1,418,353	521,516

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note. All samples are restricted to soldiers who were eligible to reenlist with reenlistment windows opening between 1997 and 2015. Column (1) shows the baseline specification reported in Table 2 column (1). Column (2) uses an identical specification except that SRBs are log-scaled. Column (3) uses the same specification as Column (1) but is restricted to a sample with non-missing Year*Month*CZ fixed effects. Column (4) is restricted to the 10 highest-density MOSs in our sample (namely: infantry, artillery crew members, calvary scouts, wheeled vehicle mechanics, combat medics, motor transport operators, logistics specialists, culinary specialists, supply specialists, and armor crew members). Column (5) is restricted to the MOSs which Wigdor & Green (1991) identified as exhibiting a high correlation between AFQT scores and hands-on job performance (namely: infantry, armor crew members, health care specialists, information systems specialists, radio operators, and administrative specialists). Column (6) excludes soldiers who entered their reenlistment windows during the Iraq war years (2007–2009). Column (7) is restricted to soldiers who were offered a non-zero SRB.

Table 11 The Effects of SRB Amounts and Individual Ability (Promotion Speed) on Soldier Retention: Alternative SRB Assignment Rules

	(1) Baseline (First SRB Offer)	(2) 6-mo. Avg. SRB	(3) 12-mo. Avg. SRB	(4) 6-mo. Max. SRB	(5) 12-mo. Max. SRB
SRB	0.029***	0.029***	0.025***	0.028***	0.027***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
SRB * Ability	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ability	0.003***	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Adjusted R^2	0.149	0.149	0.149	0.149	0.149
Year*Month FE	✓	✓	✓	✓	✓
MOS*Rank*YOS FE	✓	✓	✓	✓	✓
Demographic Controls	✓	✓	✓	✓	✓
Avg. Reenlistment Rate	0.66	0.66	0.66	0.66	0.66
Avg. SRB	0.29	0.28	0.26	0.32	0.35
Avg. Months Above E-4	3.53	3.53	3.53	3.53	3.53
Observations	1,750,220	1,750,220	1,750,220	1,750,220	1,750,220

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note. All samples are restricted to soldiers who were eligible to reenlist with reenlistment windows opening between 1997 and 2015. Column (1) shows the baseline specification reported in Table 2 column (1), which assigns soldiers the highest non-location-specific SRB offer available to them for a 4-year reenlistment on the first day of the first month of their reenlistment windows. Column (2) and (3) assign soldiers the average of the highest non-location-specific 4-year offers available to them on the first day of the first 6 or 12 months of their reenlistment windows, respectively. Column (4) and (5) assign soldiers the maximum of the highest non-location-specific 4-year offers available to them on the first day of the first 6 or 12 months of their reenlistment windows, respectively.

Appendix D: Selection Effects on Average Ability Levels

So far we have showed in Sections 3 and 4 that soldiers of higher ability are less responsive to both SRB offers (intended to retain soldiers) and early retirement "buy-out" offers (intended to entice soldiers to separate). Appendix Section A further demonstrates that the effect this has on the average ability profile of retained soldiers is ambiguous and depends on the magnitude of the individual-level selection effects. In this section, we show that our individual-level effects are large enough to generate changes in the average ability level of a cohort of retained soldiers. This analysis also enables us to characterize the ability profile of marginal soldiers—that is, soldiers who were induced to either reenlist or separate as a consequence of SRB or early retirement offers.

We start this section with the Army's SRB program. Stated in terms of in a regression framework, our goal is to estimate the effect of SRB offers on the *average* ability levels of soldiers who choose to reenlist ("stayers") and those who choose to separate ("leavers"). Specifically, we estimate the following:

$$\begin{aligned} \text{Ability}_i = \alpha_0 &+ \alpha_1 \text{SRB}_{it} * \text{Stay}_{it} \\ &+ \alpha_2 \text{SRB}_{it} * \text{Leave}_{it} + \alpha_3 \text{Stay}_{it} \\ &+ \gamma_{MOS,rank,yos} + \mu_t + \delta \mathbf{X}_{it} + \epsilon_{it} \end{aligned} \tag{8}$$

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. The intuition behind Equation 8 is that, at any given time t, the Army possesses a fixed cohort of soldiers entering their reenlistment windows. The cohort is then sorted into subcohorts of stayers and leavers, due in part to soldiers' endogenous responses to reenlistment bonus offers. A negative value on α_1 would suggest that higher bonus offers induce sufficient sorting (for example, low-ability soldiers reenlisting at higher rates, high-ability soldiers separating at higher rates, or both) to reduce the average ability profile of the stayer subcohort.

As in Equation 1, we include MOS∗rank∗years-of-service fixed effects in an attempt to control for the observable criteria for SRB eligibility. The identifying assumption underlying this analysis is that, conditional on these observable criteria, higher SRBs are not systematically offered to cohorts of soldiers that are of higher average ability. If this were the case, then we would observe that higher SRB offers are associated with higher ability reenlistees, but it would not reflect soldier selection.[16] The first column of Table 12 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 ability and SRB offers. Columns 2–4 then split the sample by the soldier's reenlistment decision, with each column mirroring the high-dimensional fixed effect specifications featured in columns 2–4 of Table 2. Column 2 shows that, for each additional $10,000 dollars of SRB offer, the average AFQT score of the soldiers who endogenously reenlist is 0.4 points (0.7%) lower and the average AFQT score of those who exit the Army is 0.7 points (1.2%) higher. The magnitudes vary somewhat but are qualitatively consistent across fixed effects specifications. The confirms the finding from Section 3.4 that lower ability soldiers are more responsive to SRB offers, but it also goes further by showing the the selection effect is large enough bring down the average ability level of a reenlisting cohort.

While these magnitudes may appear small at first glance, they are likely economically significant from the military's perspective. Setting aside the effect of SRBs, soldiers who reenlist tend to have AFQT scores that are approximately

Table 12 The Effects of SRBs on Average Soldier Ability

	AFQT Score				Months Sergeant in First Term			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SRB	-0.001				0.091			
	(0.001)				(0.080)			
SRB * Stay		-0.004***	-0.005***	-0.002*		-0.089	-0.147	-0.091
		(0.001)	(0.002)	(0.001)		(0.094)	(0.091)	(0.115)
SRB * Leave		0.007***	0.001	0.010***		0.468***	0.332***	0.491***
		(0.002)	(0.002)	(0.002)		(0.082)	(0.075)	(0.132)
Stay		-0.012***	-0.018***	-0.012***		0.597***	0.505***	0.626***
		(0.001)	(0.001)	(0.001)		(0.070)	(0.078)	(0.068)
Adjusted R^2	0.310	0.311	0.323	0.319	0.456	0.457	0.483	0.464
Year*Month FE	✓	✓	✓	✓	✓	✓	✓	✓
MOS*Rank*YOS FE	✓	✓	✓	✓		✓	✓	✓
Year*Month*CZ FE			✓				✓	
Year*Month*MOS FE				✓				✓
Demographic Controls	✓	✓	✓	✓	✓	✓	✓	✓
Avg. Reenlistment Rate	0.65	0.65	0.67	0.65	0.66	0.66	0.67	0.66
Avg. SRB	0.28	0.28	0.32	0.28	0.29	0.29	0.32	0.29
Avg. Ability	0.58	0.58	0.59	0.58	3.53	3.53	3.71	3.53
Observations	1,804,326	1,804,326	1,463,546	1,800,355	1,750,220	1,750,220	1,473,794	1,746,355

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note. Table shows the effects of SRB offer amounts on stayers and leavers' average ability levels. Sample is restricted to soldiers who were eligible to reenlist in spells ending between 1997–2015. SRBs are in $10,000s of 2015 dollars. Demographic controls include gender, age, marital status, race, and special skill dummies. Columns (1) and (5) pool stayers and leavers whereas columns (2)–(4) and (6)–(8) estimate SRB effects separately for stayers and leavers. Ability is defined as AFQT percentile (on a scale from 0-1) for columns (1)-(4) and months at or above Sergeant for columns (5)-(8).

1.2 points lower than soldiers who separate, on average. As previously discussed, that discrepancy has been enough to prompt military officials and policymakers to complain of a "brain drain" problem in the military. What we show here is that a $10,000 increase in the average SRB bonus offer increases the difference in AFQT scores between these two groups by an additional 1.1 $(0.4 + 0.7)$ points—a near doubling of the "brain drain" phenomenon. In columns 5–8 we repeat this analysis using soldiers' promotion speed as our measure of ability. The results are noisier but similar: reenlisting soldiers are in general almost sixth tenths of a month behind separating soldiers in average promotion speed, but on top of that, a $\$10,000$ SRB offer nearly doubles the discrepancy.

Combining estimates from Table 12 with the previous results from Table 2, we can also benchmark the effect of SRBs on the ability level of the *marginal* soldier—the soldier who would not have reenlisted but for a bonus offer. Specifically, for any increase in average SRB offers, we can express the average AFQT score of all retained soldiers ($\tilde{A}$) as a convex combination of the average AFQT score of inframarginal soldiers (i.e. those who would have reenlisted regardless of the heightened bonus offers) and that of marginally-retained soldiers (those who are specifically induced to reenlist by the additional cash bonuses):

$$\tilde{A} = \frac{r}{r + r'} * \bar{A} + \frac{r'}{r + r'} * \bar{A}', \tag{9}$$

where $\bar{A}$ is the average AFQT score of inframarginal soldiers, r is the quantity of inframarginal soldiers, $\bar{A}'$ is the average AFQT score of marginally-retained soldiers, and r' is the quantity of such soldiers. By solving for $\bar{A}'$, we can describe how the average ability of marginally-retained soldiers would respond to a counterfactual $10,000 increase in the Army's average SRB offer.

On average, approximately 96,400 enlisted soldiers are eligible to reenlist in each year of our sample, of whom approximately 62,950 (65.3%) actually do. Column 1 of Table 2 shows that a $10,000 increase in the average SRB offer makes soldiers approximately 1.7 percentage points more likely to reenlist. Therefore, were the Army to counterfactually increase the average SRB offer by $10,000, it would retain approximately 1,640 additional soldiers in an average year. These marginally-retained soldiers would account for approximately 2.5% of all retained soldiers, whereas the remaining 97.5% would have reenlisted absent the additional bonus offers. We also know from our data that soldiers who choose to reenlist at the end of their spell have an average AFQT score of 57.4. Finally, from column 2 of Table 12, we saw that a $10,000 increase in SRB offers would lower the average AFQT score of retained soldiers by 0.4 points, resulting in a new average AFQT score of 57.0. Plugging these quantities ($r = 62,950$; $r' = 1,640$; $\bar{A} = 57.4$; and $\tilde{A} = 57.0$) into Equation (9) and solving for $\bar{A}'$, we find that, given a $10,000 increase in the average SRB offer, the group of marginally-retained soldiers would have an average AFQT score of just 41—almost a full standard deviation below retained soldiers' usual AFQT average of 57.4, and not much above the Army's current minimum score of 31 for first-time enlistments. Moreover, our results from Figure 2 (in which we allow the effect of SRBs on reenlistment to vary by decile of the AFQT distribution) suggest that almost four-fifths of the marginally-retained group would come from below the median of the Army's AFQT score distribution.[17]

We can similarly analyze the effect of the VSI program on the average ability of retained versus separated soldiers by estimating the following equation:

$$\begin{aligned}\text{Ability}_i = \alpha_0 &+ \alpha_1 \text{VSI}_i * stay_{i,t_T} \\ &+ \alpha_2 * \text{VSI}_i * leave_{i,t_T} + \alpha_3 stay_{i,t_T} \\ &+ \gamma_{MOS,rank} + \delta \mathbf{X}_i + \epsilon_i \end{aligned} \tag{10}$$

The coefficients of interest from Equation 10 are α_1 and α_2, which estimate the effect of VSI program eligibility on the average ability of stayers and leavers, respectively. In this context, 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 **??** presents estimates from Equation 10, 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 VSI program eligibility. The first column shows that even after controlling for soldier rank, occupation, tenure and demographics, the average AFQT score of VSI-eligible soldiers is slightly higher than that of ineligible soldiers, though the difference is statistically insignificant. This is not automatically a problem for identification unless VSI eligibility is also correlated with unobservable factors influencing retention decisions. It does however mean that the coefficients in column 2, which show the relative ability of stayers and leavers by the end of the VSI sample period, must be interpreted relative to the coefficient on VSI/SSB eligibility in Column 1, rather than relative to 0 as in the earlier analysis.

While the samples are small and the estimates noisy, column 2 at least suggests that by the end of the VSI period the average AFQT score of the eligible stayers is about 0.1 points higher ($0.005 - 0.004$) and the average AFQT score of the eligible leavers is almost 0.9 points lower ($-0.005 - 0.004$) than the average for the eligible population, shown in

Table 13 The Effects of VSI Eligibility on Average Soldier Ability

	AFQT Score		Months Sergeant in First Term	
	(1)	(2)	(3)	(4)
VSI/SSB Eligibility	0.004		0.561***	
	(0.004)		(0.146)	
VSI/SSB Eligibility * Stay		0.005		0.431***
		(0.004)		(0.155)
VSI/SSB Eligibility * Leave		-0.005		0.388**
		(0.005)		(0.160)
Stay		-0.012***		-0.020
		(0.002)		(0.052)
Adjusted R^2	0.299	0.299	0.238	0.236
MOS FE	✓	✓	✓	✓
Rank FE	✓	✓	✓	✓
Demographic Controls	✓	✓	✓	✓
Avg. Retention Rate	0.79	0.79	0.80	0.80
Avg. SRB	0.05	0.05	0.05	0.05
Avg. Ability	0.59	0.59	1.51	1.51
Observations	135,497	135,497	114,107	114,107

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note. Table shows the effects of early retirment program eligibility on stayers and leavers' average ability levels. Stayers are those who remain in the Army as of the VSI/SSB program's expiration date. Sample comprises all soldiers who were actively serving on February 1, 1993 (that is, six months prior to the VSI/SSB program start date of August 1, 1993). Demographic controls include gender, age, marital status, race, and special skill dummies. Columns (1) and (3) pool stayers and leavers whereas columns (2) and (4) estimate SRB effects separately for stayers and leavers. Ability is defined as AFQT percentile (on a scale from 0-1) for columns (1)-(2) and months at or above Sergeant for columns (3)-(4).

Column 1. Finally, as we did with SRBs, we can perform a back-of-the-envelope calculation in order to characterize the group of marginal soldiers. Here, the question is not which soldiers were induced to reenlist at the end of their contract, but rather, which soldiers were induced to separate from the Army by the end of the program eligibility window. From Table 3 we know that approximately 135,500 enlisted soldiers were exposed to the VSI/SSB program (in the sense that they were actively serving on August 1, 1993, when the program was first offered). Of these, only 6,480 soldiers (5%) met the eligibility criteria based on tenure, rank, and MOS. A relevant counterfactual, then, is how the average ability profile of marginal soldiers would respond to a relaxation of program eligibility rules.

We consider a counterfactual scenario in which VSI/SSB offers are extended to an additional 10,000 soldiers, either by relaxing the tenure criteria or by extending early retirement offers to additional MOSs and ranks. We can benchmark the effect of VSI/SSB offers on the ability of the marginal soldier by constructing another weighted average similar to Equation (9). From Table 4 we know that, of the soldiers serving on August 1, 1993, just 21% would separate from the Army by the end of June 1995, when the VSI/SSB program expired. The same table shows that eligibility for VSI/SSB increased the separation rate by 12.1 percentage points (58%). Therefore, were the Army to counterfactually extend VSI/SSB-style early retirement incentives to an additional 10,000 soldiers, we can anticipate that an additional 1,210 soldiers would exit the military by June 1995, on top of the roughly 2,100 soldiers who would be expected to separate regardless of the early retirement incentives. Under actual program eligibility criteria, soldiers who separated from the Army by the conclusion of the VSI/SSB period had an average AFQT percentile score of 60.5, more than two points above the average score of those who remained in the Army over the same period (58.1). However, Column 2 of

Table **??** shows that VSI/SSB eligibility reduced the average AFQT score of leavers by 0.9 points, resulting in a new average AFQT score of 59.6. Plugging these quantities ($r = 2,100$; $r' = 1,210$; $\bar{A} = 60.5$; and $\tilde{A} = 59.6$) into Equation (9), we find that, were the Army to extend VSI/SSB offers to an additional 10,000 soldiers, almost 1,000 additional soldiers would be induced to leave, and their average AFQT score would be approximately 58.0—approximately one sixth of a standard deviation below the usual average of 60.5 for soldiers exiting the Army during this time period. Our results from Figure 3 make a similar point, suggesting that, given an expansion in VSI/SSB eligibility, well over half of marginal leavers would come from the bottom tercile of the AFQT score distribution.

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