INSTITUTE FOR DEFENSE ANALYSES

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June 2015

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IDA Document NS D-5466
(Revised)
H 15-000293

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About This Publication

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Analysis and Forecasts of Army Enlistment Supply

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Presented to
Recruiting 2025 Forum-Workshop 2
U.S. Army Recruiting Command
Fort Knox, Kentucky

June 2015

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1. Introduction

A. Background

Business cycles, budgeting cycles, and wars make it difficult for the United States Army Recruiting Command (USAREC) to succeed at its job. The military competes with the private sector for personnel. When the economy expands, civilian pay and benefits grow rapidly and unemployment declines, causing enlistment supply to decline. The Army experienced accession shortfalls[1] in Fiscal Years (FYs) 1978–79 and FYs 1998–99 because it added recruiting resources too slowly when the economy expanded.[2] During subsequent recessions, resources were over-budgeted because they were reduced too slowly.

To help reduce budgeting response lags, the Office of the Secretary of Defense/ Accession Policy (OSD/AP) funded the Economic Research Laboratory[3] to develop an Enlistment Early Warning System (EEWS1) for each military Service in 1984–85. Each system included innovative gender-specific short-term econometric forecasting models for high-quality enlistment contracts[4] estimated with national monthly-level data.[5] Updated monthly, the systems accurately forecasted enlistments over the next twelve months.[6]

OSD/AP used EEWS1 in FYs 1986–89 to assess the recruiting outlook over the next twelve months, primarily to help predict recruiting shortfalls.[7] When the Cold War ended in 1989, the military downsized and recruiting failure was no longer a concern. As a result, the EEWS1 "fire alarm" was turned off.

An economic boom in the 1990s caused (1) shortfalls of both contracts and accessions and (2) declines in recruit quality in FYs 1996–2001, especially for the Army.

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1 An applicant signs an enlistment contract and typically enters a "delayed entry pool" for one to twelve months. They become an "accession" when they start boot camp. Some attrite from the delayed entry pool and do not join the military.

2 There were also accession shortfalls in FY 2005 because of the War on Terror.

3 A private research company (1983–1996) unaffiliated with the Institute for Defense Analyses (IDA), founded by Lawrence Goldberg, one of the authors of this study.

4 Rather than accessions, contracts are used in modeling because they are more closely tied to the date of the enlistment decision and the underlying determinants of enlistment supply, e.g., monthly unemployment.

5 EEWS1 used state-of-the-art "transfer functions" to forecast enlistments, i.e., time-series models with explanatory variables derived from economic theory. For a discussion on transfer functions, see Pindyck and Rubinfeld (1981).

6 See Goldberg et al. (1984), Greenston et al. (1985), and Hunter and Goldberg (1985).

7 The eligible population was declining in the 1980s, and OSD/AP feared recruiting difficulties if there was also an economic expansion.

The economy kept expanding, and recruiting resources were added too slowly. Forecasts of enlistments were needed for budgeting and, in 2002, USAREC funded IDA to resurrect and refine the Enlistment Early Warning System (EEWS2).[8] IDA updated the forecasting models and added a computer simulation module for analyzing recruiting risk. Since EEWS2 provided assessments for each Service, OSD/AP funded IDA to maintain the system and provide periodic reports until 2011.[9] At that point maintenance was discontinued because of tight budgets and recruiting success.

EEWS2 also forecasted high-quality contracts: namely, high school Graduates and Seniors who score above average (1-3A) on the Armed Forces Qualification Test (GSAs).[10] Models for GSAs were estimated with peacetime data in FYs 1993–2001. Explanatory variables included economic benefits, recruiting resources, and GSA missions. The EEWS2 models fit the data well and, in an out-of-sample test, forecasted accurately for each Service in FY 2001.[11]

With the economic recession in FYs 2002–03, Army GSA goals were achieved. Demand limitations dampened production, and EEWS2 over-predicted Army enlistments. Later, as fatalities increased in Iraq and public support for the war declined, the EEWS2 also over-predicted enlistments.

IDA responded by (1) including “war variables” and (2) using a “switching regression” model to forecast GSA contracts—one equation to predict enlistments when goal is not achieved (supply-limited regime) and another to predict enlistments when goal is achieved (demand-limited regime).[12] The refined system, EEWS3, forecasts accurately over the twelve months during wartime, as evidenced by out-of-sample forecasting tests in FY 2011.

EEWS3 provides evidence that Army recruiting was severely depressed by the War on Terror, especially after the Fallujah campaign in April 2004. A severe economic recession in FYs 2009–11 mitigated the negative effects of the war by increasing the supply of GSAs (especially men, or GSMAs). EEWS3 predicted this turning point in Army recruiting. The Army achieved its GSA contract mission in FYs 2010–11 for the first time since FY 2003. Unfortunately, it failed to achieve the mission by a wide margin in FY 2013.[13]

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8 See Goldberg and Kimko (2003).

9 Periodic updates became less frequent as recruiting improved.

10 GSA enlistees have lower attrition rates in boot camp and are easier to train.

11 Models estimated with data for FYs 1993–2000 accurately forecasted FY 2001 enlistments.

12 See Daula and Smith (1985) for the first use of a switching model to analyze Army enlistments.

13 It is likely this would have been predicted by EEWS3.

B. Research Questions and Approach

Why did the Army fail to achieve its GSA contract mission in FY 2013? Will shortfalls persist in FYs 2014–2020? If so, what can be done to mitigate them?

To answer these questions, we need long-run forecasts of GSA supply and the effects of supply factors. One approach is to (once again) resurrect and update the Army EEWS. However an EEWS would be inadequate for this analysis because it provides only short-run forecasts, and estimates of supply factors are either unavailable or are poorly measured.[14]

Our approach is to analyze the supply of GSA contracts in FYs 1995–2013 with monthly recruiting district (battalion)-level data. As the sample includes observations affected by demand limitations and the War on Terror, we analyze GSA enlistments using a switching model that includes war variables. The results from this model are used to estimate the effects on GSA supply of economic factors, demographic factors, recruiting resources, and the War on Terror. The research is unique in analyzing the effects of recruiting stations, the Post-9/11 GI Bill,[15] dependents of retirees,[16] and numerous war variables. The results are used to forecast GSA supply in FYs 2014–2020 and to answer the questions posed above.

Chapter 2 discusses the theory of enlistment supply. Chapter 3 reviews trends in recruiting success at the national and recruiting district levels. We analyze GSA supply using a switching model. Chapter 4 presents major findings of the analysis and validation tests. Chapter 5 provides forecasts of GSA supply in FYs 2014–2020, and Chapter 6 gives a summary and conclusions. Appendix A presents technical details regarding the specification and estimation of the switching model.

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[14] The EEWS uses national monthly level data to estimate forecasting models. The short-term forecasts are accurate and maintenance costs are low. However, demographic factors change very little at the national level and are excluded. Economic variables and recruiting resources are highly correlated. Due to a small sample (252 observations in FYs 1993–2013) and collinearity, estimates of explanatory variables are either unavailable or have large standard errors.

[15] The Post-9/11 GI Bill more than doubled education benefits for all Services in August 2009.

[16] It has been often noted that recruiting is a "family business." We test the hypothesis that dependents of military retirees enlist at a higher rate than the general population.

2. Theory of Enlistment Supply

We assume the enlistment rate depends on the economic and non-pecuniary benefits of enlistment versus civilian alternatives.[17] Figure 1 depicts an enlistment supply curve S_o, a positive function of relative military pay. Holding other factors fixed, as relative military pay increases from P_o to P_1, enlistments per population increase along supply curve S_0 from E_0 to E_1.

Other variables shift the supply curve to the left or right. For example, an increase in unemployment shifts the curve to the right from S_0 to S_1. Although pay is unchanged (P_o), enlistments increase from E_0 to E_1. Recruiting resources shift the curve to the right; war variables to the left. These are discussed in Chapter 3.

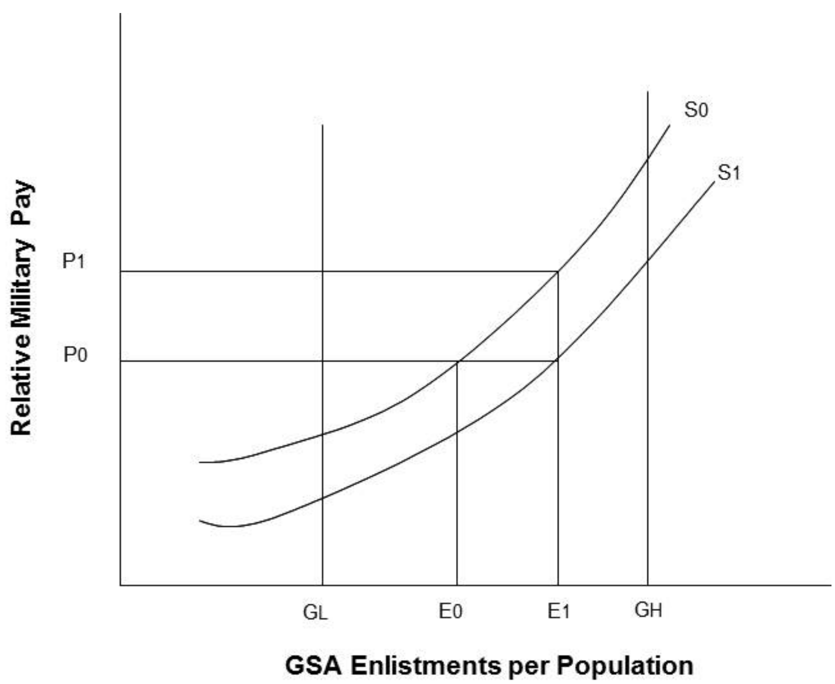

Figure 1. Enlistment Supply and Goals

[17] Early enlistment studies were based on the theory of equalizing wage differentials, e.g., Fisher (1969) and Gray (1970). Grissmer et al. (1974) extended the theory to include recruiters; Jehn and Shugart (1976) added goals as a factor. Dertouzos (1985) further developed the treatment of goals based on a model of recruiter behavior. All studies focused on the supply of high-quality enlistments. They assumed these were in short supply and that one always observes enlistment supply. Daula and Smith (1985) introduced the "switching model," which assumes one observes supply only if goal is not achieved. These studies were estimated with aggregate data. Kilburn and Klerman (1999) specify a three-choice model (military, civilian employment, and college attendance) and estimate it with individual-level data.

Suppose the supply curve is S_0, relative military pay is P_0, and enlistments are E_0. If the enlistment goal were relatively high—e.g., G_H—we would observe E_0 enlistments. If pay increased to P_1, we would observe E_1 enlistments and could measure the effect of the pay raise. However, if the enlistment goal were relatively low—e.g., G_L—we would observe G_L (approximately) rather than E_0 enlistments. Low goals would prevent us from observing the supply curve and the effects of factors on it. To estimate a supply curve, we focus on an enlistment cohort that is in relatively short supply—i.e., non-prior service GSAs—and estimate the supply curve with data from periods when goals were greater than production.

3. Trends in Recruiting Success for GSA Contracts and the Data Sample

Table 1 provides annual trends in GSA contracts and GSA goals assigned to recruiters in FYs 1995–2013. The GSA goal was not achieved in 14 of 19 years (74 percent of the years).[18] On average, 76 percent of the GSA contracts goal was achieved in during this period.[19]

During the "peacetime" years FYs 1995–2003, 77.2 percent of the GSA goal was achieved. During the wartime years FYs 2004–2013, only 75.1 percent was achieved, despite a 14.2 percent decline in the GSA goal and a deep recession in FYs 2009–11. In FY 2013, only 77 percent of the GSA goal was achieved.

One reason for not achieving the recruiting goal in FYs 2004–2013 was the War on Terror. Compared to the peacetime years FYs 1995–2003, GSA contracts declined in FYs 2004–2013 by 9.5 percent for men (GSMAs) and 40.7 percent for women (GSFAs).[20] This foreshadows later findings on the effects of war variables when we hold constant other factors that changed between the two periods.

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18 Unlike GSA contract goals, total accession goals were achieved in FYs 1995–2013 except for FYs 1998–99 and FY 2005.

19 The GSA contracts goal assigned to recruiters is higher than the accessions required to achieve accession quality targets. It reflects goals for building the delayed entry pool, expected attrition from that pool, and management's policy of assigning very challenging goals to recruiters. Failure to meet GSA contract goals leads to declines in the delayed entry pool and the quality of accessions. When quality can be reduced no further, there are accession shortfalls.

20 The Iraq war began in March 2003. Although US military personnel were in Afghanistan earlier, these operations were largely "under the public's radar."

Table 1. Army GSA Recruiting Success at the National Level in FYs 1995–2013

FY	GSA Males (GSMA)	GSA Females (GSFA)	Total GSA	GSA Goal	% GSA Goal Achieved	War
1995	38,737	11,235	49,972	49,317	101.3	No
1996	39,552	12,946	52,498	60,249	87.1	No
1997	38,855	12,702	51,557	59,616	86.5	No
1998	36,933	11,637	48,570	80,407	60.4	No
1999	32,705	10,039	42,744	83,744	51.0	No
2000	37,705	10,985	48,690	79,490	61.3	No
2001	38,390	10,891	49,281	71,594	68.8	No
2002	47,390	12,056	59,446	58,631	101.4	Some
2003	45,160	11,084	56,244	51,387	109.5	Some
1995–2003	**39,492**	**11,508**	**51,000**	**66,048**	**77.2**	**No**
2004	37,621	8,715	46,336	60,262	76.9	Yes
2005	33,018	6,787	39,805	74,468	53.5	Yes
2006	35,004	6,883	41,887	70,641	59.3	Yes
2007	27,663	5,703	33,366	57,206	58.3	Yes
2008	31,440	6,145	37,585	63,466	59.2	Yes
2009	44,836	8,546	53,382	61,093	87.4	Yes
2010	43,678	7,555	51,233	49,842	102.8	Yes
2011	37,076	6,193	43,269	38,168	113.4	Yes
2012	32,557	5,605	38,162	38,710	98.6	Yes
2013	34,669	6,085	40,754	52,914	77.0	Yes
2004–2013	**35,756**	**6,822**	**42,578**	**56,677**	**75.1**	**Yes**
Percent Change						
War vs. Peace	**-9.5**	**-40.7**	**-16.5**	**-14.2**	**-2.7**	**Yes**

Table 2 provides monthly data on GSA goals versus contracts in FYs 1995–2013 (9,144 battalion-months) for Army recruiting districts ("battalions"). The GSA goal was not achieved in 7,004 of those months (77 percent). We assume that in these months one observes points on the supply curve (enlistments are "supply-limited"). We will use the data for observations to estimate a supply curve for GSA contracts (supply equation). In the remaining 2,140 battalion-months, the GSA goal was achieved. For these, we assume enlistments were restrained by low goals (observations are "demand-limited"). Over the sample, 23 percent of observations were demand-limited—only 6 percent in FY 2013. We use these observations to construct an enlistment forecasting model for demand-limited districts (production equation).

Table 2. Supply vs. Demand Limited Monthly Observations at the Recruiting District Level in FYs 1995–2013

FY	GSA Goal Achieved (Demand-Limited)	GSA Goal Not Achieved (Supply-Limited)	Battalion Months	Supply-Limited (%)
1995	227	265	492	53.9
1996	117	375	492	76.2
1997	217	275	492	55.9
1998	5	487	492	99.0
1999	2	490	492	99.6
2000	5	487	492	99.0
2001	17	475	492	96.5
2002	255	237	492	48.2
2003	324	168	492	34.1
2004	64	428	492	87.0
2005	2	490	492	99.6
2006	3	489	492	99.4
2007	5	487	492	99.0
2008	0	468	468	100.0
2009	84	372	456	81.6
2010	239	217	456	47.6
2011	332	124	456	27.2
2012	215	241	456	52.9
2013	27	429	456	94.1
1995–2013	**2,140**	**7,004**	**9,144**	**76.6**

4. Analysis of Army Enlistment Supply Using a Switching Model: Major Findings

A. Introduction

We use a switching regression model to analyze GSA enlistments separately for men and women. The model includes (1) a supply equation, (2) a production equation, and (3) a Probit equation. The supply equation is a function of economic factors, demographic factors, recruiting resources, and war variables. The production equation is a function of the GSA goal. The Probit equation is a function of all factors in the supply and production equations. We discuss the detailed specification and estimation of the switching model in **Error! Reference source not found.**.

Below we summarize the major findings. Our focus is primarily on the supply equation because it provides information useful for policy analysis and forecasting.

B. Analysis of Enlistment Supply for GSA Males (GSMA)

Table 3 summarizes the effects on GSMA enlistment supply of economic factors, demographic factors, recruiting resources, and war variables. There are large positive effects for relative military pay and youth unemployment. These factors, especially unemployment, change a lot over the business cycle. They cause enlistment cycles, which have been a chronic problem since the advent of the All-Volunteer Force in 1973.

Recruiters and stations also have large positive effects on GSMA supply. The elasticities are 0.47 for recruiters and 0.29 for stations. A 10 percent increase in both would increase supply by 7.6 percent. However, if recruiters were simply added to existing stations, supply would increase by only 4.7 percent. There were 3.9 recruiters per station in FY 2013. Given their marginal productivities and costs, it is likely that the ratio is too high, and it would be cost-effective to increase the number of stations.[21]

USAR recruiters have a moderate negative effect (-0.18); apparently, they compete with the Regular Army (RA) for GSMA enlistments. Surprisingly, there is no effect of Education Benefits/Post-9/11 GI Bill.

There is a large positive effect on GSMA supply of retiree dependents (0.14). Regarding other demographic factors, there is a large negative effect of college

[21] An optimization requires that the marginal productivity divided by the marginal cost be the same. We do not have data on the costs, but it is likely that recruiters are more expensive than stations. If costs were the same, optimization requires equal marginal productivities. Given the log-linear model, marginal productivity equals the elasticity times the average productivity. This implies that, at the optimum, recruiters per station should be 1.74. Given that recruiters are more expensive, the ratio should be even lower.

enrollments (-0.21), and small to moderate negative effects of Asians (-0.064) and Blacks (-0.11). There is no effect of Hispanic ethnicity.

The War on Terror severely hurt GSMA recruiting. The partial effects of individual war variables range from -10 to -20 percent. This made recruiting very difficult, especially during the Fallujah campaign and the surge in Iraq operations from June 2007 to July 2008. The current operations in Afghanistan are also having a large negative impact.

Table 3. Effects of Factors on GSA Supply for Men

Economic, Recruiting, and Demographic Factors	Elasticities
Relative Military Pay	0.59
Youth Unemployment	0.27
RA Foxhole Recruiters	0.47
Stations	0.29
USAR Recruiters	-0.18
Education Benefits	No effect
% Asian	-0.064
% Black	-0.11
% College	-0.21
% Hispanic	No effect
% Retiree Male Dependents	0.14
War Variables	**Effects**
@ 50 Fatalities per month (avg. FYs 2003–13)	-10%
Iraq Surge 6/07 to 7/08	-16%
Afghan War Jan 2012-Sep 2013	-20%
9/11 patriotic surge 9/2001 to 12/2001	12%

Note: Elasticity is a measure of the relationship between two variables. Specifically, it is the ratio of the percentage change in a dependent variable (Y1 – Y0)/Y0 to the percentage change in an independent variable (X1 – X0)/X0.

C. Analysis of Enlistment Supply for GSA Females (GSFA)

Table 4 summarizes the effects of factors on GSFA supply. For most factors, effects are qualitatively similar to those estimated for GSMAs; quantitatively, they are somewhat larger. There are large positive effects for relative military pay (0.66), youth unemployment (0.22), recruiters (0.51), stations (0.62), and the dependents of military retirees (0.16). USAR recruiters have a negative effect (-0.28). Again, we find no effect of the Education Benefits/Post-9/11 GI Bill. The War on Terror severely hurt GSFA recruiting. Effects are substantially larger than for men and, unlike them, supply for women *declined* immediately after 9/11.

There are some differences in the findings for demographic factors. We find no effect for college enrollments or Asians, positive effects for Blacks (0.14), and small negative effects for Hispanics (-0.070).

Table 4. Effects of Factors on GSA Supply for Women

Economic, Recruiting, and Demographic Factors	Elasticities
Relative Military Pay	0.66
Youth Unemployment	0.22
RA Foxhole Recruiters	0.51
Stations	0.62
USAR Recruiters	-0.28
Education Benefits	No effect
% Asian	No effect
% Black (coefficient * average % Black)	0.14
% College	No effect
% Hispanic	– 0.070
% Retiree Female Dependents	0.16
War Variables	**Effects**
Fatalities (@ 50 avg. FYs 2003-13)	-11%
Iraq War 3/2003-12/2011	-30%
Iraq Surge 6/07 to 7/08	-20%
Afghan War after Pullout from Iraq 1/2012-9/ 2013	-53%
9/11 **(un)**patriotic surge 9/2001 to 12/2001	-11%

D. Validation Tests and Potential Supply for GSMA Contracts

Table 5 presents within-sample forecasting tests for GSMA enlistments in each fiscal year. Forecasts are generated using both the supply and production equations. These are added to obtain predictions that are compared with the actual production. Errors cancel and are only 0.7 percent over the entire sample. They were about -4 percent in FY 2013.

Table 5. Within-Sample Forecasting Test in FYs 1995–2013 for GSA Contracts for Men

FY	Error (%)
1995	-1.54
1996	-2.96
1997	-6.60
1998	6.08
1999	15.04
2000	-1.17
2001	1.40
2002	-3.16
2003	-4.27
2004	-9.09
2005	5.41
2006	-2.38
2007	8.47
2008	2.95
2009	-2.52
2010	0.03
2011	6.80
2012	5.04
2013	**-3.94**
1995–2013	**0.70**

Table 6 estimates potential supply in FYs 1995–2013 and compares it with actual production to estimate excess supply in each year.[22] On average, the ratio of potential to actual supply is only 1.04. Not surprisingly, there was very little excess supply for the Army in FYs 1995–2013. There is virtually no excess supply for GSMAs in FY 2013; the ratio of potential supply to actual production was 1.01.

[22] Potential supply is estimated using the supply equation for all observations, i.e., Eq. (3) in Lokshin and Sajaia (2004).

Table 6. Actual Production versus Potential GSA Supply in FYs 1995–2013 for Men

FY	Actual GSMA Production	Potential GSMA Supply	Ratio
1995	38,737	38,251	0.99
1996	39,552	39,191	0.99
1997	38,855	40,371	1.04
1998	36,933	40,463	1.10
1999	32,705	38,609	1.18
2000	37,705	38,522	1.02
2001	38,390	41,079	1.07
2002	47,390	44,897	0.95
2003	45,160	39,559	0.88
2004	37,621	34,844	0.93
2005	33,018	35,532	1.08
2006	35,004	34,986	1.00
2007	27,663	31,105	1.12
2008	31,440	33,746	1.07
2009	44,836	47,661	1.06
2010	43,678	45,803	1.05
2011	37,076	45,431	1.23
2012	32,557	37,263	1.14
2013	34,669	35,131	**1.01**
1995–2013	37,521	39,027	**1.04**

E. Validation Tests and Potential Supply for GSFA Contracts

Table 7 presents a within-sample forecasting test for GSFAs using the supply and production equations. The switching model is not as accurate for women. The overall error was 6.5 percent, and there are large errors in individual years. In the most recent year, FY 2013, the error was only -1.7 percent.

Table 7. Within-Sample Forecasting Test in FYs 1995–2013 for Actual GSA Contracts for Women

FY Year	Error (%)
1995	-4.2
1996	-12.2
1997	-17.3
1998	3.9
1999	16.9
2000	8.9
2001	8.3
2002	7.1
2003	-2.6
2004	-13.1
2005	11.4
2006	3.9
2007	5.5
2008	6.1
2009	6.8
2010	28.6
2011	47.7
2012	24.2
2013	**-1.7**
1995–2013	**6.5**

We also estimate potential supply for GSFAs in FYs 1995–2013 and compare it with actual production to estimate excess supply in each year in Table 8. On average, the ratio of potential to actual supply is 1.12; this is mostly due to the "great recession" in FYs 2009–2012. Not surprisingly, there was very little excess GSFA supply in FY2013: the ratio of potential supply to actual production was just 1.04.

Table 8. Actual Production versus Potential GSA Supply in FYs 1995–2013 for Women

FY	Actual GSFA Production	Potential GSFA Supply	Ratio
1995	11,235	12,174	1.08
1996	12,946	12,864	0.99
1997	12,702	13,129	1.03
1998	11,637	13,121	1.13
1999	10,039	12,492	1.24
2000	10,985	13,051	1.19
2001	10,891	13,327	1.22
2002	12,056	14,020	1.16
2003	11,084	10,625	0.96
2005	6,787	7,859	1.16
2006	6,883	7,464	1.08
2007	5,703	6,441	1.13
2008	6,145	6,815	1.11
2009	8,546	9,675	1.13
2010	7,555	9,314	1.23
2011	6,193	9,480	1.53
2012	5,605	7,107	1.27
2013	6,085	6,318	**1.04**
1995–2013	9,093	10,212	**1.12**

5. Forecasts of Army GSA Enlistment Supply

This chapter forecasts GSA *potential supply* in FYs 2014–2020. Section A presents the forecasting assumptions; Section B, the forecasting methodology; and Section C, the forecasts of GSA potential supply in FYs 2014–2020.

A. Forecasting Assumptions

Table 9 provides forecasts of military and civilian pay. In recent years, military pay has kept up with civilian pay, which has been growing by only 1–2 percent due to a recession. The growth in civilian pay for youth was derived from forecasts of the growth in earnings per worker generated by Moody's Analytics in June 2014. Moody’s forecasts an economic recovery in which civilian pay grows by 4.5 percent. Military pay increased by 1.7 percent in FY 2013. If it does not keep up and continues to increase by only 1.7 percent, there will be a decline in relative pay of -14.6 percent from FY 2013 to FY 2020. We consider alternative scenarios in which military pay does, and does not, keep up with the expected growth in civilian earnings.

Table 9. Forecasts and Forecasting Assumptions for Relative Military Pay

FY	Present Value Army Cash Pay	Present Value Civilian Pay Males	Present Value Civilian Pay Females	Relative Pay Males	Relative Pay Females
2013	$72,323	$79,268	$68,553	0.912	1.055
2014	$73,535	$80,854	$69,925	0.909	1.052
2015	$74,767	$85,051	$73,554	0.879	1.016
2016	$76,020	$89,060	$77,022	0.854	0.987
2017	$77,294	$93,067	$80,487	0.831	0.960
2018	$78,589	$97,443	$84,271	0.807	0.933
2019	$79,906	$101,024	$87,369	0.791	0.915
2020	$81,245	$104,309	$90,210	0.779	0.901
		Percent Changes			
2020/2013	**12.3**	**31.6**	**31.6**	**-14.6**	**-14.6**

Table 10 provides forecasting assumptions for unemployment and recruiting resources. Forecasts of youth unemployment were derived from forecasts of overall unemployment obtained from Moody's Analytics in June 2014. Expecting an economic recovery, Moody’s predicts a drop in unemployment of 35.4 percent from FY 2013 to FY 2020. We assume no change in recruiting resources over the forecast period to assess whether additional resources will be needed.

Table 10. Forecasting Assumptions for Youth Unemployment and Recruiting Resources

FY	Youth Unemployment Males	Youth Unemployment Females	RA Recruiters	Stations	USAR Recruiters
2013	0.170	0.140	5,309	1,365	1,137
2014	0.146	0.120	5,309	1,365	1,137
2015	0.136	0.112	5,309	1,365	1,137
2016	0.129	0.106	5,309	1,365	1,137
2017	0.118	0.097	5,309	1,365	1,137
2018	0.109	0.090	5,309	1,365	1,137
2019	0.109	0.089	5,309	1,365	1,137
2020	0.110	0.090	5,309	1,365	1,137
		Percent Changes			
2020/2013	**-35.4**	**-35.4**	**0.000**	**0.000**	**0.000**

Forecasts of population and demographics are given in Table 11. In most cases, these factors are hardly changing. The sole exception is that retiree dependents will increase by 7.1 to 7.6 percent over the period.

Table 11. Forecasting Assumptions for Population and Demographic Factors

FY	Male Population	Female Population	% Asian	% Black	% Hispanic	% College Females	% College Males	Retiree Male Dep. per Male Population	Retiree Female Dep. per Female Population
2013	9,194,293	9,605,603	6.4	14.7	14.6	55.9	49.0	0.0150	0.0160
2014	9,164,959	9,581,907	6.5	14.7	14.9	55.8	49.0	0.0151	0.0161
2015	9,137,417	9,565,040	6.6	14.8	15.3	55.7	48.9	0.0153	0.0163
2016	9,115,324	9,550,453	6.7	14.8	15.7	55.6	48.8	0.0159	0.0169
2017	9,112,192	9,553,124	6.8	14.8	16.0	55.5	48.7	0.0164	0.0174
2018	9,146,895	9,601,356	6.9	14.7	16.4	55.3	48.6	0.0166	0.0176
2019	9,199,162	9,661,318	7.0	14.7	16.7	55.3	48.7	0.0164	0.0174
2020	9,241,192	9,711,253	7.1	14.6	17.0	55.4	48.8	0.0161	0.0171
	Percent Changes		**Changes**					**Percent Changes**	
2020/2013	**0.5**	**1.1**	**0.7**	**-0.1**	**2.5**	**-0.5**	**-0.3**	**7.6**	**7.1**
Source:	W&P							TMA/W&P	

Note: W&P - Woods & Poole; TMA – TRICARE Management Authority

Table 12 presents forecasting assumptions regarding war variables, i.e., war versus peace. Earlier in our research, we expected a pullout from Afghanistan and a "peace dividend" for Army recruiting. With the emergence of ISIL and the likelihood of troops in Afghanistan, Iraq, and Syria, peace is a very unrealistic assumption. We analyze a peace scenario only to show how GSA supply is affected by war. The relevant forecast is based on a continuation of the war in Afghanistan.

Table 12. Forecasting Assumptions for War Variables

FY	FATALITIES(-2)	D_AFGHAN	FATALITIES(-2)	D_AFGHAN
2013	15.8	1	0	0
2014	15.8	1	0	0
2015	15.8	1	0	0
2016	15.8	1	0	0
2017	15.8	1	0	0
2018	15.8	1	0	0
2019	15.8	1	0	0
2020	15.8	1	0	0
2020/2013	**No Change**	**No Change**	**Peace**	**Peace**

B. Forecasting Methodology

This section explains the methodology used to forecast GSA enlistment supply using results obtained in earlier tables.

- Enlistment Supply (t) = Baseline*(1+∑(effects of supply factors * changes in supply factors))
- The "Baseline" is the estimated potential GSA supply in FY 2013 reported in Table 6 and Table 8. Effects of supply factors were reported earlier in Table 3 and Table 4**Error! Reference source not found.**. Changes in supply factors are derived from the forecasting assumptions reported in Table 9 through Table 12. We consider four scenarios:
  - War versus peace
  - Military pay does/does not keep up with civilian pay

C. Forecasts

Forecasts are given in Table 13. If the War on Terror ended, there would be a large recruiting peace dividend (GSA supply would increase by about 40 percent), but peace is unlikely. Assuming war continues, GSA supply will decline by 10 percent if military pay keeps up with civilian pay, and by 18.1 percent if it does not.

Table 13 also includes GSA goals. Assuming war continues, GSA goals cannot be achieved even if the potential supply is recruited. In reality, some districts will achieve the goal and actual production will be below the potential supply. GSA contract shortfalls will average at least 13,000 per year in FYs 2014–2020 if military pay keeps up with the growth in civilian pay; at least 15,000 per year if it does not.

The study collected historical data through FY 2013 and used the findings to forecast FY 2014 as well as FYs 2015–2020. We recently obtained data on actual GSA production in FY 2014; it was 36,735 versus the forecasted potential GSA supply of 39,800. There are two reasons for the difference. First, potential supply is always greater than actual production because of demand limitations in some battalion months. Second, there were greater than anticipated declines in unemployment in FY 2014 versus FY 2013.

Table 13. Forecasts of Army GSA Enlistment Supply in FYs 2014-2020

Group	Scenario	2013	2014	2015	2016	2017	2018	2019	2020	%Change 2020 vs. 2013
GSMA	War and military pay does not keep up	35,131	33,609	32,312	31,433	30,298	29,229	28,872	28,648	-18.5%
	War and military pay keeps up	35,131	33,671	33,022	32,682	32,011	31,416	31,387	31,426	-10.5%
	No war and military pay does not keep up	35,131	43,097	41,434	40,307	38,851	37,480	37,023	36,736	4.6%
	No War and military pay keeps up	35,131	43,177	42,345	41,909	41,048	40,285	40,249	40,298	14.7%
GSFA	War and military pay does not keep up	6,318	6,116	5,910	5,775	5,596	5,414	5,344	5,298	-16.1%
	War and military pay keeps up	6,318	6,129	6,057	6,035	5,955	5,873	5,872	5,881	-6.9%
	No war and military pay does not keep up	6,318	13,450	12,996	12,700	12,306	11,905	11,751	11,651	84.4%
	No War and military pay keeps up	6,318	13,478	13,319	13,271	13,094	12,915	12,913	12,933	104.7%
GSA	**War and military pay does not keep up**	**41,449**	**39,725**	**38,221**	**37,208**	**35,894**	**34,642**	**34,215**	**33,946**	**-18.1%**
	War and military pay keeps up	**41,449**	**39,801**	**39,079**	**38,717**	**37,965**	**37,289**	**37,260**	**37,307**	**-10.0%**
	No war and military pay does not keep up	41,449	56,547	54,429	53,007	51,158	49,385	48,774	48,387	16.7%
	No War and military pay keeps up	41,449	56,656	55,663	55,180	54,142	53,199	53,161	53,231	28.4%
	GSA Goal	**56,677**	**51,662**	**43,400**	**51,300**	**53,200**	**53,200**	**53,200**	**53,200**	**-6.1%**
	GSA Actual	40,754	36,735							

6. Summary and Conclusions

This paper analyzed the supply to the Army of high-quality enlistment contracts, high school Graduates and Seniors who score above average (1-3A) on the Armed Forces Qualification Test (GSAs). The analysis used a switching model, which was estimated with monthly battalion-level data in FYs 1995–2013 (9,144 observations). The major findings regarding the supply factors are:

- Large negative effect of the War on Terror, especially for women;
- Large positive effects for pay, unemployment, recruiters, stations, and dependents of retirees;
- Moderate negative effect of USAR recruiters;
- No effect of Education Benefits/Post-9/11 GI Bill;
- Small and inconsistent effects for other demographic factors; and
- Likelihood that there are too few stations and they are over-manned.

The Army failed to achieve its GSA contracts goal in FY 2013. Based on our analysis of enlistment supply, this was due to the Afghan War, improvements in the economy, declines in recruiting resources, and increases in the GSA mission. Poor budgeting made the situation worse; it reduced recruiting resources as the economy improved. Budgeting lags have been a chronic problem.

The findings were used to forecast the supply of GSA enlistments in FYs 2014–2020. If the War on Terror were to end, the supply of GSA men would increase by 28 percent and the supply of GSA women would more than double. But peace is highly unlikely. Instead of a peace dividend, an economic upturn is expected in FYs 2014–2020. It will reduce GSA supply by 10 percent if pay keeps up; by 18 percent if it does not.

The Army did not make its relatively high GSA mission in FY 2013 and, except for FY 2015, the goal will remain high in the future. Recruiting, already very difficult because of an unpopular war, will get harder because of an economic upturn. Without additional recruiting resources, we forecast GSA shortfalls of at least 13,000 per year on average in FYs 2014–2020. This will result in lower accession quality and possibly even accession shortfalls. The Army needs to restore recently cut recruiting resources and optimize them to minimize costs. Once again, the Army has a recruiting “fire” for which it is partially to blame. The Army needs a budgeting system that dampens rather than exacerbates enlistment cycles.

Appendix A.
Specification and Estimation of a Switching Model for Army GSA Contracts

A. Switching Regression Model and Estimation Procedure

To analyze GSA enlistments, we use a switching regression model as formulated by Lokshin and Sajaia (2004). The switching model includes three equations: (1) a supply equation that predicts enlistments when the GSA goal is not achieved; (2) a production equation that predicts enlistments when the GSA goal is achieved; and (3) a Probit model that predicts the probability of not achieving the GSA goal. The supply equation is a function of economic factors, demographic factors, recruiting resources and war variables. The production equation is a function of the GSA goal. The Probit equation is a function of all factors in the supply and production equations.

The supply equation, Eq. (1), is a function of various enlistment supply factors, monthly dummies, and random errors ε, the effects of intangible factors such as attitudes toward the military, skill and leadership of district commanders, etc. Eq. (1) will be estimated with the (7,004) supply-limited observations. This is a censored subsample of all 9,144 observations and, because the GSA goal is not achieved, they are likely to include a preponderance of negative errors, e.g., negative attitudes toward the military, poor leadership, etc. Ordinary Least Squares (OLS) estimation using the subsample will yield biased low estimates of supply and probably biased estimates of coefficients, due to correlations of supply factors with the negative errors.

A well-known solution suggested by Heckman (1979) is to include a constructed variable, the inverse mills ratio $[\phi(\Delta)/\Phi(\Delta)]$, to adjust for negative errors. The estimation equation is

$$\begin{aligned}\text{Enlistment Supply} &= \text{GSA enlistments per population} \\ &= \text{f(supply factors, monthly dummies)} + \sigma_{\varepsilon\eta}\,[\phi(\Delta)/\Phi(\Delta)] + \varepsilon \qquad (1)\end{aligned}$$

where $\Phi(\Delta)$ is the probability that an observation is supply-limited, and $\sigma_{\varepsilon\eta}$ is the covariance between the structural errors in the supply equation ε and those in the probability of being supply-limited Probit equation η (see Eq. (3)).

For demand-limited observations where the GSA goal is achieved, we assume that GSA enlistments are simply a function of the GSA goal and monthly dummies. They are also estimated with a censored sample of 2,140 demand-limited observations. A similar solution suggested by Heckman (1979) is to include the constructed variable $[\phi(\Delta)/\Phi(-\Delta)]$ to obtain unbiased estimates.

Again following Lokshin and Sajaia (2004), the estimation equation is as follows:

Enlistment production = GSA enlistments per population

$$= f(\text{GSA goal, monthly dummies}) - \sigma_{\mu\eta} [\phi(\Delta)/\Phi(-\Delta)] + \mu \qquad (2)$$

where $\Phi(-\Delta)$ is the probability that an observation is demand-limited and $\sigma_{\mu\eta}$ is the covariance between structural errors in the production equation μ and those in the probability of being supply-limited Probit equation η.

In summary, the censored samples include non-random errors. Estimates of coefficients will be biased unless one includes variables derived from a Probit regression that analyzes the probability of being supply-limited (i.e., goal not achieved). The Probit includes all of the variables in Eq. (1) and (2):

$$\text{Probit model} = f(\text{supply factors, monthly dummies, GSA goal}) + \eta. \qquad (3)$$

To estimate the three equations, we use a full information maximum likelihood (FIML) procedure that estimates all three simultaneously and takes into account correlations of errors at the battalion level. Estimates are obtained using the "MOVESTAY" command in STATA.[23]

B. Equation (1): The Enlistment Supply Model

We specify log-linear supply equations for GSA enlistments per population.[24] The log-linear model permits diminishing returns to recruiting resources (suggested by economic theory). Separate models are estimated by gender.

The explanatory factors (described in more detail later) are:

1. Economic
    a. Relative military pay
    b. Youth unemployment (18–24)
2. Recruiting resources[25]

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23 See Lokshin and Sajaia (2004) and Powers (2013).

24 Most researchers assume a log-linear model; exceptions are Fisher (1969), a semilog model; and Gray (1970), a linear model. Daula and Smith used a log-linear switching model, but did not deflate variables by population. Collinearity is a big problem; e.g., population is not statistically significant. They also included other Services' enlistments as an explanatory variable, but it is endogenous. As a result, estimates are hard to interpret—for example, the effect of pay holding other Services' enlistments constant; that is impossible, because the explanatory variable is a function of pay. We interpret our estimates as the net effects on Army enlistments. To measure inter-Service competition, we would include their recruiters and stations, but these were unavailable.

25 Due to lack of monthly battalion-level data on advertising impressions, advertising is not included in the switching model. For evidence on the effects of advertising, see Goldberg (1982), Dertouzos et al. (1989), and Hogan et al. (1996). In the EEWS, we found no effect on GSA enlistments of lagged

a. Recruiting stations
b. Regular Army (RA) recruiters
c. USAR recruiters
d. Education benefits vs. college costs

3. Demographic factors
   a. Military retiree dependents (18–24)
   b. College enrollees and graduates per youth population
   c. Demographic factors per youth population: Asian, Black, Hispanic
4. War variables
   a. 9/11 patriotic surge
   b. US military fatalities
   c. Iraq surge in operations (6/2007–7/2008)
   d. Afghanistan only operations (1/2012–9/2013)
5. Others
   a. Recruiting days per month
   b. Monthly dummies
   c. Government shutdown 11/1995

To introduce supply factors 1-4 and show how they changed over the sample in FYs 1995–2013, annual values of series are given in Table A-1 through Table A-3. These series are used to create the regression variables subsequently presented in Table A-4.

advertising expenditures, but this may be because expenditures are a poor proxy for impressions, the preferred measure. Enlistment bonuses are also excluded. In earlier research, we found little effect on GSA supply (see Goldberg et al. 2012) but large effects on job channeling (see Goldberg and Masad 2011). As a result, bonuses are not included.

Table A-1. Trends in Economic Factors and Recruiting Resources

FY	Relative Pay (Male)	Relative Pay (Female)	% Youth Unemp. (Male)	% Youth Unemp. (Female)	Recruiting Stations	RA Recruiters	USAR Recruiters	Education Benefits vs. College Costs
1995	0.893	1.027	12.5	11.7	1,445	4,623	1,124	0.481
1996	0.891	1.025	12.7	11.3	1,535	5,026	1,117	0.474
1997	0.887	1.018	11.8	10.7	1,536	5,229	1,128	0.466
1998	0.843	0.983	11.1	9.8	1,558	5,813	1,224	0.460
1999	0.833	0.954	10.3	9.4	1,576	5,616	1,159	0.538
2000	0.825	0.956	9.6	8.9	1,632	5,895	1,174	0.527
2001	0.830	0.959	11.4	9.7	1,632	5,842	1,154	0.610
2002	0.882	1.005	12.8	11.1	1,648	5,739	1,104	0.695
2003	0.817	0.908	13.3	11.4	1,604	5,570	934	0.773
2004	0.794	0.907	12.7	11.0	1,571	4,658	847	0.783
2005	0.819	0.939	12.4	10.2	1,566	5,071	915	0.740
2006	0.829	0.950	11.3	9.7	1,554	5,735	1,458	0.726
2007	0.810	0.946	11.6	9.5	1,537	5,817	1,558	0.717
2008	0.813	0.936	14.4	11.2	1,575	6,247	1,633	0.691
2009	0.835	0.944	20.1	15.0	1,621	6,929	1,625	0.924
2010	0.869	0.993	20.8	15.8	1,603	6,243	1,579	1.546
2011	0.881	1.005	18.7	15.7	1,574	6,332	1,507	1.499
2012	0.911	1.059	17.6	14.7	1,503	5,794	1,348	1.498
2013	0.912	1.055	17.0	14.0	1,365	5,309	1,137	1.511

Table A-2. Trends in Population and Demographic Factors

FY	Youth Population Male	Youth Population Female	% Asians	% Blacks	% Hispanics	% College Pop.		Retiree 18–24 Dependents	
						Female	Male	Male	Female
1995	7,758,738	8,235,886	6.2	13.1	12.7	54.5	48.4	118,131	122,194
1996	7,700,621	8,174,194	6.2	13.1	12.7	54.5	48.4	118,131	122,194
1997	7,714,534	8,188,963	6.2	13.1	12.7	54.7	48.5	120,335	124,489
1998	7,764,262	8,241,750	6.2	13.1	12.7	55.0	48.8	122,871	127,278
1999	7,827,491	8,308,867	6.2	13.1	12.7	55.3	49.2	113,044	118,023
2000	7,900,184	8,386,030	6.2	13.1	12.7	56.9	49.7	105,513	113,251
2001	8,003,845	8,464,528	6.2	13.2	12.9	56.8	49.6	116,801	126,000
2002	8,113,280	8,552,610	6.2	13.3	13.1	56.7	49.5	122,403	130,239
2003	8,243,525	8,661,618	6.2	13.4	13.2	56.6	49.4	124,853	133,028
2004	8,377,016	8,783,049	6.2	13.6	13.2	56.5	49.3	127,866	136,691
2005	8,504,637	8,911,006	6.1	13.7	13.3	56.3	49.1	131,771	141,319
2006	8,660,126	9,067,861	6.1	13.8	13.3	56.1	49.0	134,841	144,983
2007	8,832,140	9,239,305	6.1	14.0	13.4	56.0	48.9	136,582	146,363
2008	8,991,590	9,396,430	6.2	14.2	13.5	56.0	48.9	133,703	143,703
2009	9,113,902	9,519,498	6.2	14.3	13.6	56.0	49.0	135,568	146,372
2010	9,186,029	9,588,547	6.3	14.4	13.8	56.0	49.0	135,091	145,720
2011	9,217,759	9,616,100	6.3	14.5	14.1	56.0	49.1	136,224	148,426
2012	9,212,392	9,615,295	6.4	14.6	14.3	55.9	49.1	138,097	151,682
2013	9,194,293	9,605,603	6.4	14.7	14.6	55.9	49.0	137,916	153,427

Table A-3. Trends in War Variables (Monthly Averages)

FY	D_911	D_IRAQ	D_SURGE	FATALITIES(-2)	D_AFGHAN
1995	0	0	0	0	0
1995	0	0	0	0	0
1996	0	0	0	0	0
1997	0	0	0	0	0
1998	0	0	0	0	0
1999	0	0	0	0	0
2000	0	0	0	0	0
2001	0.08	0	0	0	0
2002	0.25	0	0	4.3	0
2003	0	0.58	0	24.6	0
2004	0	1	0	59.3	0
2005	0	1	0	80.3	0
2006	0	1	0	73.5	0
2007	0	1	0.33	98.1	0
2008	0	1	0.84	51.0	0
2009	0	1	0	33.5	0
2010	0	1	0	44.7	0
2011	0	1	0	44.5	0
2012	0	0.25	0	32.8	0.75
2013	0	0	0	15.9	1

Table A-4 provides a detailed specification of the supply equation, including variable names, definitions, and data sources.

Table A-4. Equation (1) Variable Names, Definitions, and Data Sources

Variable	Definition	Data Source
GSMA	Logarithm of GSA male contracts per age-weighted male youth population	USAREC and W&P
GSFA	Logarithm of GSA female contracts per age-weighted female youth population	USAREC and W&P
Military Pay	$BPY_1 + BPY_2/1.145 + BPY_3/(1.145)^2 + BPY_4/(1.145)^3$, where BPY_t = YOS-specific expected Basic Pay	BPY from OSD/ Compensation TIG from OSD/Officer Enlisted Policy Management
Civilian Pay	$CPY_{18} + CPY_{19}/1.45 + CPY_{20}/(1.45)^2 + CPY_{21}/(1.45)^3$, where CPY = age and gender specific average annual cash earnings of high school graduates who work full time.	Monthly Current Population and Current Employment and Wage Surveys
Relative Military Pay	Logarithm of military pay ÷ civilian pay by gender (+)	Computed
Youth Unemployment	Logarithm of unemployment rate for 18-24 year olds by gender (+)	Current Population Survey and Bureau of Labor Statistics
Stations per population	Logarithm of RA recruiting stations per age-weighted youth population by gender (+)	USAREC and W&P
RA Recruiters per station	Logarithm of RA recruiters on production per station (+)	USAREC
USAR recruiters per population	Logarithm of USAR production recruiters per age-weighted youth population by gender (+/-)	USAREC and W&P
Education benefits	Present value of education benefits divided by present value of college costs @ 5.5 discount rate (+)	MGIB and Post-9/11 GI Bill from VA; cost of college from Dept. of Education
Retiree Dep. per pop	Logarithm of military retiree 18-24 year old dependents per age-weighted youth population by gender (+)	TMA and W&P
%College	Logarithm of college enrollees and graduates per age-weighted youth population by gender (-)	W&P
%Asian %Black %Hispanic (+/-)	Percentage of the 17–29 youth population that is Asian(+/-) Percentage of the 17–29 youth population that is Black(+/-) Percentage of the 17–29 youth population that is Hispanic(+/-)	W&P
D_911	Dummy variable for 9/11 patriotic surge from 9/2001 to 12/2001(+)	IDA
Fatalities(-2)	US military fatalities lagged two months (-)	http://icasualties.org/oif/ US_chart.aspx
D_Iraq War	Dummy variable for Iraq War operations from 3/2003 to 12/2011 (-)	IDA
D_Iraq Surge	Dummy variable for surge in Iraq operations from 6/2007 to 7/2008 (-)	IDA
D_ Afghan	Dummy variable for Afghanistan only operations in from 1/2012 to 9/2013 (+)	IDA
Recruiting days per month	Work days vary per recruiting month (+)	USAREC

Variable	Definition	Data Source
Gov. Shut 11/1995	Dummy variable government shutdown 11/1995 (-)	IDA
M11	Inverse mills ratio for the supply equation derived from gender specific the Probit models (-)	STATA

Note: BPY – Basic Pay; CPY – Civilian Pay

The following is a discussion of Table A-4.

1. Dependent Variable

The dependent variable is the logarithm of GSA gross contracts per population. We deflate GSA contracts (M/F) by population (M/F) weighted by the percent of Army enlistments in age groups 17–21 and 22–29:

Youth population = 0.67*17–21 year old pop + 0.33*22–29 year old pop.

Youth population includes high school seniors and graduates, college attendees, and those with an Associate's degree or higher. Annual ZIP code-level population data were constructed by Woods & Poole (W&P). These were mapped into recruiting battalions using annual ZIP-to-battalion cross-reference mappings. Annual observations were interpolated to estimate population monthly. Monthly recruiting battalion-level data on GSA contracts and goals, cross-reference mappings, and W&P population are from the US Army Recruiting Command (USAREC).[26]

We assume the enlistment rate depends on the intensity of supply factors per population. These explanatory variables are discussed below: their expected qualitative effect (coefficient's sign) is given in parentheses.

2. Logarithm of Relative Military Pay (+)

Relative military pay is the ratio of the present values of expected military to civilian pay over an initial four-year enlistment. To simplify the calculations, we assume enlistment occurs at age 18. The average credit card borrowing rate over the sample is 14.5 percent. We assume 14.5 percent is the opportunity cost of cash for enlistees and use it to discount cash flows for military and civilian pay.[27]

a. Military Pay

Expected military earnings are measured with data on cash wages or "Basic Pay" (BPY). Data on BPY by years-of-service (YOS) and time-in-grade (TIG) are from the

[26] Special thanks to Edward J. Alcock of USAREC who provided these critical data.

[27] Enlistees are young and unlikely to have collateral for a secured loan. So we use the average credit card borrowing rate as their opportunity cost of cash flows over the enlistment term. Since both the numerator (military earnings) and denominator (civilian earnings) are discounted by the same factor, the ratio relative to military pay is not very sensitive to the discount rate used.

OSD/Compensation Branch. The OSD/Officer Enlisted Policy Management Branch provided data on average time-in-grade. Calculations assume a four-year enlistment term. To smooth monthly fluctuations caused by intermittent pay raises, we use a twelve-month moving average.

b. Civilian Pay

To measure expected civilian pay (CPY) during years 1, 2, 3, and 4 of the first term, we need data on the full-time cash earnings of 18- to 21-year-old high school graduates. Data on civilian earnings by gender for individuals are available from the monthly Current Population Surveys (CPS). However, the samples are too small to estimate monthly earnings of youth by age and gender for battalions. Because of this, we used regression models to estimate civilian earnings.[28] Like for military earnings, we use a twelve-month moving average to smooth monthly fluctuations.

3. Logarithm of Youth Unemployment (+)

Youth unemployment for 18–24-year-olds by gender is available at the state level annually from the Bureau of Labor Statistics (BLS); however, data on youth unemployment are not available at the county level. Unemployment for youth and all workers are highly correlated; the latter are available monthly at the county and state levels. We used regression models relating total and youth unemployment at the state level, and monthly county-level data on total unemployment to predict youth unemployment monthly at the county level. Using youth population numbers as weights, these were aggregated to obtain monthly battalion-level observations on youth unemployment.

4. Logarithm of Stations per Population (+)

Recruiters work out of offices known as stations. Each station is assigned a market area consisting of surrounding ZIP codes, which are canvassed by the station's recruiters. Hogan et al. (2000) analyzed recruiting at the ZIP code level. They found that ZIP codes further from a station yield substantially fewer enlistments. Because of greater travel time, recruiters have less contact with applicants in faraway ZIP codes. There are also likely to be fewer walk-ins from those living further from the station.

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28 For each year, we used CPS data to estimate cash earnings regression models; these were used to estimate earnings annually by age, gender, and state. We also estimated a second set of regression models with state-level data, relating CPS youth earnings to overall earnings from the County Employment and Wage (CEW) Surveys. With these regression model and county-level CEW data, we estimated youth earnings at the county level. Population-weighted estimates of youth earnings for counties were aggregated to obtain battalion observations.

The productivity of recruiters depends on whether they are added to existing stations or create new stations. If added to an existing station, there will be no extra walk-ins. Productivity will decline because of (1) greater travel time to faraway ZIP codes, and (2) diminishing returns to canvassing population near the station. If a station is created from the faraway ZIP codes of other stations, there will be more walk-ins and contacts with a heretofore under-recruited population. However, existing stations will have fewer enlistees, since some will be diverted. To estimate the net effect of stations, we include the logarithm of stations per population as an explanatory variable. We expect stations to have a net positive effect. Because of the law of diminishing returns, we expect the effect to decline as stations are added.[29]

5. Logarithm of Recruiters per Station (+)

The recruiting resource most often analyzed is recruiters. Recruiters provide information on military jobs, which reduces applicants' search costs. Researchers typically find a strong effect on enlistments, i.e., an elasticity of 0.56 on average in previous studies.[30] However, this may be overstated because the studies omit stations that are correlated with recruiters. The variable is measured with data on RA "foxhole" recruiters, i.e., on-production recruiters (excluding station commanders) who seek non-prior service active force enlistees. We expect the logarithm of recruiters per station to increase enlistments, but, like stations, the effect should decline as recruiters are added.

6. Logarithm of USAR Recruiters per Population (+/ -)[31]

US Army Reserve (USAR) recruiters offer the Army on a part-time basis, and this may divert some from joining full-time. Conversely, they provide referrals to active force recruiters and some active force enlistees. To estimate the net effect on active force GSA enlistment supply, we include the logarithm of USAR recruiters per population. Data to measure the USAR series are from USAREC.

7. Logarithm of Army Military Education Benefits (+)

The Montgomery GI Bill (MGIB) was the military education benefits program available to enlistments in all Services until August 2009. It provides payments for post-service education and job training; payments are a function of the enlistee's term-of-

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29 Special thanks to Jason Favier of USAREC. He provided detailed monthly data on stations as well as RA and USAR recruiters that enabled us to construct consistently defined series for these factors.

30 Elasticity is a measure of the relationship between two variables. Specifically, it is the ratio of the percentage change in a dependent variable (Y1 – Y0)/Y0 to the percentage change in an independent variable (X1 – X0)/X0.

31 A (+/-) indicates that the expected effect is indeterminate prior to the study. .

service (TOS). The Post-9/11 GI Bill was implemented in August 2009, and it more than doubled benefits.

We assume the enlistee stays for one term, and then enrolls in college and collects the maximum payments allowed. To measure Army education benefits, we calculate an Army-specific TOS-weighted present value of education benefit payments available in each post-service month. To adjust for inflation, the expected present value of benefits is divided by a TOS-weighted average of the present value of current college costs.[32]

Data on education benefits by TOS are from the Department of Veterans Affairs. To create the deflator, we used state-level data on higher education costs in public colleges from the Department of Education.[33]

8. Logarithm of Military Retiree 18–24-Year-Old Dependents per Population (+)

It has been often noted that recruiting is a "family business." We test the hypothesis by including the logarithm of 18- to 24-year-old dependents of military retirees per population as an explanatory variable. The variable was constructed using ZIP code-level data from TRICARE Management Authority on dependents eligible for TRICARE. These were mapped into battalions using ZIP-to-battalion cross-reference mappings.

9. Logarithm of College Enrollees and Graduates per Population (-)

College enrollment is an alternative to military service and graduates have relatively good job opportunities. We expect enlistment rates to vary inversely with college enrollees and graduates per population. Data on education status/attainment and ethnicity (see below) are available at the ZIP code level from W&P. These were mapped into battalions using ZIP-to-battalion cross-reference mappings.

10. Other Demographic Factors: %Asian, %Black, %Hispanic (+/-)

To test for ethnicity differences in enlistment rates, we included the percentage of the population that is Asian, Black, and Hispanic.

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[32] The present values of education benefits and the cost of college are computed using a 5.5 percent discount factor, the average interest rate on Stafford loans over the sample period.

[33] The Army also offered extra education benefits or "kickers" for college enrollment under the Army College Fund (ACF) program. This factor is not included. ACF benefits were offered to GSAs in hard-to-fill military occupation specialties (MOSs), provided that they enlisted for a minimum required term-of-service. The effect is hard to measure because it is highly correlated with bonuses and was increased/decreased inversely with enlistments. In previous studies, we find that ACF had a small effect on GSA supply and a moderate effect on MOS channeling. However, bonuses are much more cost-effective for job channeling.

11. War Variables

The data include observations both in peace and wartime. Except for a patriotic surge after 9/11, the War on Terror caused sharp decline in GSA enlistments. We include "war variables" to measure the effects versus recruiting in peacetime.

a. 9/11 Patriotic Surge (+)

After 9/11, there was a patriotic surge in enlistments from 9/2001 to 12/2001. We include a dummy variable to measure the effect.

b. US Military Fatalities in Iraq and Afghanistan (-)

The risk of injury and death is an intangible factor that is likely to reduce enlistment supply. There was a precipitous drop in GSA contracts two months after the Fallujah campaign when fatalities peaked; the decline was especially large for women. We include fatalities lagged two months as an as explanatory variable. This variable had a strong negative effect in EEWS3.

c. Iraq War Variables (-)

We tested for the effect of two Iraq war dummy variables. The first is for the entire period of military operations from 3/2003 to 12/2011. The second is for the surge in military operations led by General Petraeus from June 2007 to July 2008.

d. Afghanistan Only Operations 1/2012–9/2013 (-)

The United States pulled out of Iraq in December 2011 and increased military operations in Afghanistan. After eleven years of fighting without a victory, this war was also unpopular. We include a dummy variable for Afghan operations in January 2012 to September 2013 to test for an effect versus peacetime.

12. Other Variables

a. Recruiting Days per Month (+)

USAREC provided data on GSA contracts by "recruiting month." Recruiting months overlap calendar months; work days vary per recruiting month. To control for the varying length of the recruiting month, we include recruiting days as an explanatory variable.

b. Government Shutdown 11/1995 (-)

The government was shut down in November 1995, temporarily halting recruiting. A dummy variable is included to adjust for this event.

c. Monthly Dummies (+/-)

Monthly dummies were initially included to account for the seasonality of recruiting. They had little effect on coefficients or annual forecasts, and the extra variables made it impossible to estimate the model's Wald statistic, so these variables were dropped in all equations.

d. Supply Equation's Inverse Mills Ratio (-)

We include a variable measuring the inverse mills ratio. In the supply equation, the coefficient $\sigma_{\varepsilon\eta}$ equals the standard error of the supply equation σ_{ε} times the correlation between the errors in Eq. (1) and the Probit. The STATA software provides estimates of these components: "sigma_1" and "rho_1". We expect the product, an estimate of $\sigma_{\varepsilon\eta}$, to be negative in Eq. (1).

C. Equations (2) and (3)

Eq. (2) is a production model that analyzes and predicts GSMA/GSFA enlistments for demand-limited observations, i.e., GSA goal achieved. For Eq. (2), variable names, definitions, and data sources are summarized in Table A-5. It includes simply the logarithm of the GSA contract mission per population, and a gender-specific inverse mills ratio. In Eq. (2), the coefficient of the inverse mills ratio $-\sigma_{\mu\eta}$ equals minus the standard error of Eq. (2), σ_{μ}, times the correlation between the errors in Eq. (2) and the Probit. The STATA software provides estimates of these components: "sigma_2" and "rho_2". The sign of the product is indeterminate a priori.[34]

Table A-5. Equation 2 Variable Names, Definitions, and Data Sources

Variable	Definition	Data Source
GSMA	Logarithm of GSMA contracts per male population	USAREC and W&P
GSFA	Logarithm of GSFA contracts per female population	USAREC and W&P
GSA Goal per pop.	Logarithm of total GSA contract mission divided by weighted-average total youth population (+)*	USAREC and W&P
M00	Inverse mills ratio for the demand equation derived from gender-specific Probit models (+/-)	STATA

* Since the GSA goal is not gender-specific, we deflated it by a weighted average of male and female youth population. Weights are the average GSAs by gender over the sample: males 0.8; females 0.2.

34 The error in the production equation's censored sample is affected positively by above average "tastes for enlistment" and negatively by declines in recruiting effort when goal is achieved. The net effect is indeterminate.

Eq. (3) is a Probit model used to predict whether the GSA goal will not be achieved. Probits are estimated by gender: the variables are those in Table A-4 plus the GSA Goal per population variable in Table A-5. The Probits provide the mills ratios required to estimate Eqs. (1) and (2).

D. Estimates of Switching Models

1. Males

Table A-6 presents the switching model for GSA males. The large Wald chi2 statistic indicates that the model is significant at the 1-percent level. All factors have the expected sign, and most are significant at the 1-percent level.

Table A-6. Switching Model for GSA Men

	Coefficient	Std. Err.	z
Equation 1			
Relative Military Pay	0.585	0.122	4.79
Unemployment	0.271	0.035	7.78
Stations per Population	0.761	0.083	9.21
Recruiters per Station	0.468	0.084	5.56
USAR Recruiters per Population	-0.177	0.035	-5.01
Recruiter Days per Month	0.029	0.002	16.35
Retiree Dependents per Pop.	0.141	0.021	6.68
% College	-0.212	0.210	-1.01
% Black	-0.768	0.222	-3.47
% Asian	-1.035	0.428	-2.42
Govt Shutdown 11/1995	-0.475	0.056	-8.47
D_911 9/2001 to 12/2001	0.116	0.028	4.15
Fatalities(-2)	-0.002	0.000	-5.9
D_Iraq Surge 6/07 to 7/08	-0.178	0.025	-7.21
D_Afghan 1/2012-9/2013	-0.217	0.040	-5.44
Constant	-2.772	0.648	-4.28
Sigma_1	0.265	0.038	7.03
Rho_1	-0.988	0.102	-9.72
M11*	-0.262		
Equation 2			
GSA Goals per Population	0.821	0.070	11.79
Constant	-1.232	0.602	-2.05
Sigma_2	0.224	0.071	3.17
Rho_2	0.799	0.165	4.85
M00**	-0.179		

	Coefficient	Std. Err.	z
Probit			
Relative Military Pay	-2.123	0.936	-2.27
Unemployment	-0.706	0.490	-1.44
Stations per Population	-2.942	0.561	-5.24
Recruiters per Station	-1.761	0.373	-4.72
USAR Recruiters per Population	0.723	0.225	3.22
Recruiter Days per Month	-0.105	0.010	-10.35
Retiree Dependents per Pop.	-0.500	0.108	-4.64
% College	0.550	0.729	0.75
% Black	1.859	1.157	1.61
% Asian	2.578	1.531	1.68
Govt Shutdown 11/1995	1.924	0.374	5.14
D_911 9/2001 to 12/2001	-0.190	0.430	-0.44
Fatalities(-2)	0.009	0.001	7.04
D_Iraq Surge 6/07 to 7/08	0.503	0.162	3.1
D_Afghan 1/2012-9/2013	0.947	0.161	5.89
GSA Goals per Pop.	3.344	0.320	10.46
Constant	7.149	2.259	3.16
Number of Observations	**9144**		
Wald chi2(15)	**4676.13**		

*M11 = Sigma_1*Rho_1

**M00= -Sigma_2*Rho_2

2. Females

Table A-7 presents the switching model for GSA women.

Table A-7. Switching Model for GSA Women

	Coefficient	Std. Err.	z
Equation 1			
Relative Military Pay	0.656	0.163	4.03
Unemployment	0.219	0.063	3.46
Stations per Population	1.128	0.089	12.74
Recruiters per Station	0.505	0.144	3.52
USAR Recruiters per Population	-0.275	0.055	-5.04
Recruiter Days per Month	0.029	0.002	12.42
Retiree Dependents per Pop.	0.164	0.030	5.54
% Black	1.013	0.321	3.15
% Hispanic	0.527	0.187	2.81
Fatalities(-2)	-0.002	0.000	-7.44
D_Iraq 3/03 to 12/11	-0.356	0.040	-8.83
D_Iraq Surge 6/07 to 7/08	-0.221	0.036	-6.2
D_Afghan 1/2012-9/2013	-0.745	0.055	-13.62
D_911 9/2001 to 12/2001	-0.117	0.047	-2.46
Govt Shutdown 11/1995	-0.370	0.126	-2.94
Constant	-2.051	0.784	-2.62
Sigma_1	0.434	0.031	14.21
Rho_1	-0.920	0.080	-11.56
M11*	-0.399		
Equation 2			
GSA Goals per Population	1.227	0.231	5.31
Constant	0.568	1.898	0.3
Sigma_2	0.533	0.069	7.75
Rho_2	0.824	0.219	3.77
M00**	-0.440		
Probit			
Relative Military Pay	-1.306	0.533	-2.45
Unemployment	-0.590	0.268	-2.2
Stations per Population	-2.529	0.410	-6.17
Recruiters per Station	-1.444	0.437	-3.31
USAR Recruiters per Population	0.602	0.132	4.56
Recruiter Days per Month	-0.072	0.010	-6.92
Retiree Dependents per Pop.	-0.377	0.098	-3.86
%Black	-0.284	0.909	-0.31
%Hispanic	-0.715	0.439	-1.63
%Asian	1.353	0.803	1.69
Fatalities(-2)	0.005	0.001	3.51
D_911 9/2001 to 12/2001	-0.053	0.185	-0.28

	Coefficient	Std. Err.	z
D_Iraq 3/03 to 12/11	0.423	0.096	4.39
D_Iraq Surge 6/07 to 7/08	0.735	0.202	3.63
D_Afghan 1/2012-9/2013	1.284	0.190	6.75
Govt Shutdown 11/1995	1.253	0.418	2.99
GSA Goals per Population	2.791	0.323	8.64
Constant	5.192	1.991	2.61
Number of observations	**9,144**		
Wald chi2(15)	**1918.18**		

*M11 = Sigma_1*Rho_1

**M00=-Sigma_2*Rho_2

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REPORT DOCUMENTATION PAGE	*Form Approved* *OMB No. 0704-0188*

1. REPORT DATE *(DD-MM-YYYY)*: xx-06-2015

2. REPORT TYPE: Final

3. DATES COVERED *(From - To)*:

4. TITLE AND SUBTITLE
Analysis and Forecasts of Army Enlistment Supply

5a. CONTRACT NUMBER: HQ0034-14-D-0001

5b. GRANT NUMBER:

5c. PROGRAM ELEMENT NUMBER:

5d. PROJECT NUMBER:

5e. TASK NUMBER: C7149

5f. WORK UNIT NUMBER:

6. AUTHOR(S)
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Institute for Defense Analyses
4850 Mark Center Drive
Alexandria, VA 22311-1882

8. PERFORMING ORGANIZATION REPORT NUMBER
IDA Document NS D-5466
(Revised)
H 15-000293

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Institute for Defense Analyses
4850 Mark Center Drive
Alexandria, VA 22311-1882

10. SPONSOR/MONITOR'S ACRONYM(S): IDA

11. SPONSOR/MONITOR'S REPORT NUMBER(S):

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Why did the Army fail to achieve its enlistment goal in FY 2013? Could it achieve the goal in future years without additional resources? To answer these questions, this paper analyzes and forecasts Army enlistment supply. We assume supply depends on the relative benefits of enlistment versus civilian alternatives. One observes supply if the enlistment goal is not achieved (Regime 1). If the goal is achieved, recruiting effort is curtailed and one observes less than supply (Regime 2). We estimate separate equations for each regime—a "switching model." These are estimated with monthly battalion-level data in Fiscal Years (FYs) 1995–2013. The large sample enabled us to measure the effects of economic and demographic factors, recruiting resources, and the War on Terror. The results were used to forecast enlistment supply in FYs 2014–2020.
The Army's enlistment goal was not achieved in FY 2013 because of the Afghan war, declines in unemployment and recruiting resources, and increases in the mission. An economic upturn is expected in FYs 2014–2020.This will reduce supply by 10 to 18 percent. Given war and an economic upturn, the Army's FY 2013 enlistment goal cannot be achieved in FYs 2014–2020 without additional recruiting resources.

15. SUBJECT TERMS
Army Recruiting, Enlistment Supply, Analysis, Forecasting, Economic Factors, Demographic Factors Recruiting Resources, War on Terror, Manpower/Personnel, Statistical Estimation, Switching Model

16. SECURITY CLASSIFICATION OF: a. REPORT	b. ABSTRACT	c. THIS PAGE	17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
Unclassified	Unclassified	Unclassified	Same as Report	45	Goldberg, Lawrence
					19b. TELEPHONE NUMBER *(Include area code)* (703) 575-4678

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