

**CBO'S METHOD FOR
PROJECTING THE RECRUITMENT AND RETENTION
OF ENLISTED MILITARY PERSONNEL**

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The Congress regularly considers proposals that would change military pay or benefits. Often, CBO is asked to project the likely effects of such changes on the ability of each service to recruit and retain active-duty personnel. This paper describes the models, assumptions, and data that CBO now uses to project enlisted recruitment and retention. (CBO focuses on enlisted personnel because officers' recruitment and retention are generally not serious problems.) It assumes the reader is familiar with the basic terminology of military manpower.

To assess each service's ability to retain enlisted personnel, CBO projects the size of the career force; as is common in planning for military manpower, personnel with more than four years of service are assumed to belong to the career force. For enlisted recruitment, CBO examines the ability of each service to attract high-quality recruits; it assumes that each service can always enlist enough lower-quality recruits to meet numerical objectives, and that each service limits the number of recruits who score low on the military entrance examination. As a measure of quality, CBO projects the percent of male recruits who are high school graduates. Although this is not the only measure of quality, it is a frequently used guideline and is part of the current law governing recruitment.

This paper first discusses the method for projecting numbers of personnel in the career force, because the number retained over time affects the number of recruits needed each year, and hence the services' ability to recruit adequate manpower.

ESTIMATING ENLISTED RETENTION

To estimate the size of the career force, CBO uses an inventory flow model that simulates the passage of enlisted personnel between years of service from one fiscal year to another. The model multiplies the actual number of people in each year of service (one to thirty-one) at the end of the latest fiscal year for which data are available by a "continuation rate"--this rate indicates the fraction of those in the military who will still be in the by the end of the next fiscal year. The successive application of continuation rates to the projected numbers of people in each year of service generates a multiyear projection of the career force's size. Numbers of people separating, and any desired increase in total size or end strength, determine how many recruits enter in the next fiscal year (accessions). (The model counts recruits who have never served in the

military as being in the first year of service, and recruits who have prior military service as being in later years of service.)

The inventory model works against a scenario for the enlisted force that describes the total desired end strengths over the next few years; the number of recruits with prior service who will be accepted; the distribution of recruits by length of initial service; and the rates of attrition, which are continuation rates that indicate how many recruits are expected to leave before completing their first year of training. Tables 1 and 2 summarize the key elements of the scenario that is now in use.

The key to operating the inventory flow model lies in accurately determining future continuation rates. CBO adjusts actual continuation rates from a base year for future changes in military pay and in-service policies that affect career personnel. The following sections discuss how the base year is chosen and how the continuation rates from that base year are adjusted.

Choosing a Base Year for Continuation Rates

CBO would like the base year for continuation rates to be the latest year for which data are available. The continuation rates would then be adjusted for future changes in pay and personnel policies. They would also be adjusted for likely changes in the rate of unemployment, because CBO believes that enlisted retention is affected by economic conditions. Unfortunately, present analyses offer no good way to relate continuation rates to unemployment. For that reason, CBO chooses a base year that seems most likely to reflect the influence of future changes in unemployment on continuation.

For fiscal years after 1983, when CBO assumes that unemployment will be declining, the inventory model uses fiscal year 1979 as a base year for continuation rates, because the economy was relatively healthy in 1979 (unemployment overall was 5.8 percent). These 1979 continuation rates are adjusted for the military pay raises of October 1979, 1980, and 1981, in the manner discussed below. For fiscal year 1983, when unemployment will be high, the inventory model uses fiscal year 1981 as a base year, because in that year the economy went into recession.

Adjusting for Changes in Military Pay

The base-year continuation rates are adjusted for three sorts of changes in military compensation: the annual October military pay raise, specific changes in allowances, and changes in selective reenlistment bonuses (SRBs).

TABLE 1. CBO'S ASSUMPTIONS ABOUT THE FUTURE ENLISTED FORCE: END STRENGTHS, ATTRITION, PRIOR SERVICE

| | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---------|---------|---------|---------|---------|
| End Strengths^a | | | | | |
| Army | 673,600 | 673,000 | 686,000 | 694,350 | 705,050 |
| Navy | 488,000 | 517,800 | 529,800 | 535,600 | 537,000 |
| Marine Corps | 175,500 | 177,200 | 180,100 | 182,000 | 183,300 |
| Air Force | 484,400 | 499,100 | 514,700 | 521,400 | 526,200 |
| Rates of Attrition^b | | | | | |
| Army | 11.5 | 11.5 | 11.5 | 11.5 | 11.5 |
| Navy | 10.7 | 10.6 | 10.6 | 10.6 | 10.6 |
| Marine Corps | 12.6 | 13.2 | 12.6 | 12.8 | 12.9 |
| Air Force | 8.9 | 9.0 | 8.9 | 8.9 | 8.9 |
| Prior Service Recruits^c | | | | | |
| Army | 16,650 | 17,050 | 17,230 | 18,330 | 18,170 |
| Navy | 10,620 | 13,740 | 12,110 | 11,210 | 10,510 |
| Marine Corps | 3,100 | 1,100 | 1,100 | 1,080 | 1,060 |
| Air Force | 9,400 | 10,400 | 10,570 | 9,440 | 9,200 |

^aThe end strengths for 1983 are specified in the DoD authorization for fiscal year 1983. In later years, CBO uses the services' plans underlying the Administration's 1983 budget request. (Only the Navy's plan was published; the Navy's "Enlisted Growth Distribution" is in the **Manpower Requirements Report for Fiscal Year 1983**.) Since the Congress authorized smaller end strengths in 1983 than the services requested, CBO may be overstating end strengths in future years.

^bAttrition is the percent of recruits without prior military service who leave the force during their first year. The Army's rate is the actual rate in fiscal year 1981. The other services' rates are three-year moving averages of actual and estimated rates.

^cThe actual number of prior service recruits will differ from one alternative pay raise to another because the inventory model treats prior-service recruits as a fixed percent of all recruits. These figures assume a 4 percent across-the-board raise in fiscal year 1983.

TABLE 2. ASSUMED DISTRIBUTION OF RECRUITS WITHOUT PRIOR SERVICE BY LENGTH OF SERVICE (In percent)

| | Two Years | Three Years | Four Years | Five Years | Six Years |
|-------------------|--------------|----------------|---------------|---------------|--------------|
| Army ^a | | | | | |
| 1983 | 7.5 | 58.5 | 34.0 | -- | -- |
| 1984 | 8.5 | 58.3 | 33.2 | -- | -- |
| 1985 | 9.5 | 59.5 | 31.0 | -- | -- |
| 1986 | 10.0 | 59.5 | 30.5 | -- | -- |
| 1987 | 10.0 | 60.5 | 29.5 | -- | -- |
| Navy | -- | 15.0 | 67.0 | 5.0 | 13.0 |
| Marine Corps | -- | 35.0 | 65.0 | -- | -- |
| Air Force | -- | -- | 90.0 | -- | 10.0 |

^aThe Army hopes to improve recruitment by offering more two-year enlistments. CBO gradually increases the percent of two-year recruits in rough accordance with the Army's latest plan.

October Military Pay Raise. Under current law, military pay (basic pay plus basic allowances for quarters and subsistence) is increased on October 1 by a specific percentage, either across-the-board or varying among pay grades and years of service. In 1982, for example, the increase ranged from 10 percent for pay grade E1 to 17 percent for the top enlisted pay grades. To measure the effect of the increase, CBO compares the military raise with increases in the civilian sector. Because the military competes in the blue-collar labor market for much of its enlisted manpower, CBO looks at increases in the hourly earnings of nonfarm, production workers. ^{1/}

^{1/}Estimates of future increases in hourly earnings come from the CBO economic forecast, which expresses a consensus of forecasts from major macroeconomic models for the next two years, and from the CBO economic assumptions.

To estimate the pay increase's effect on continuation rates, the inventory model multiplies the percent increase (which may differ from one pay grade or year of service to another) relative to civilian pay by continuation rate elasticities. A continuation rate elasticity shows the percent change in continuation rate resulting from a 1 percent change in the relative value of military pay. The elasticities derive from an earlier CBO model that relates continuation rates to changes in military compensation. The model uses data from a 1976 survey of military personnel in which people were asked whether they would stay in service under alternative systems of military retirement. This model generates, for each year of service, the elasticity of the continuation rate for a change in pay; the model is constrained to ensure that the elasticity of overall retention (defined as average man-years per accession) equals one in order to match roughly a more detailed model that is used by the Department of Defense. ^{2/} The elasticities appear in Table 3.

Changes in Allowances. The Congress may sometimes choose to increase military compensation selectively. For example, the Military Manpower Management Act of 1981—which included the so-called Nunn-Warner amendment—clearly benefited more senior personnel by creating a variable housing allowance and increasing the cash subsistence payment by 10 percent.

CBO treats these sorts of selective changes in military compensation as percent increases in military pay. Increases in allowances are apportioned to junior and senior enlisted personnel, and divided by each group's pay and allowance base to estimate the implied percent increase in military pay. Then the inventory model applies the elasticities of continuation rates, as above.

Changes in Reenlistment Bonuses. The services pay selective reenlistment bonuses (SRB) to enlisted personnel in designated skills in amounts determined by a reenlistee's pay grade and length of reenlistment and by the bonus multiplier assigned to that skill. Bonuses are now authorized for the first three reenlistments, known as Zones A, B, and C. They are paid in installments, with one-half available at the time of reenlistment and the remainder in annual payments over the reenlistment contract.

The inventory model does not differentiate between skills. Instead, it estimates the effect of SRB on reenlistments by using an "average" bonus multiplier. This average is a hypothetical rate that each reenlistee would be paid if all skills received bonuses of equal value and if the actual budget for SRB was approximately met. CBO uses a regression model equation

²See Congressional Budget Office, *The CBO Military Retention Model* (July 1981).

TABLE 3. CBO'S ESTIMATES OF CONTINUATION RATE ELASTICITIES FOR CHANGES IN PAY: ALL SERVICES

| Year of Service | Elasticity | Year of Service | Elasticity |
|-----------------|-------------------|-----------------|-------------------|
| 0-1 | 0.00 ^a | 16 | 0.02 |
| 2 | 0.00 ^a | 17 | 0.01 |
| 3 | 0.28 | 18 | 0.01 |
| 4 | 1.00 | 19 | 0.01 |
| 5 | 0.15 | 20 | 0.46 |
| 6 | 0.23 | 21 | 0.24 |
| 7 | 0.23 | 22 | 0.14 |
| 8 | 0.31 | 23 | 0.29 |
| 9 | 0.21 | 24 | 0.14 |
| 10 | 0.16 | 25 | 0.06 |
| 11 | 0.12 | 26 | 0.35 |
| 12 | 0.10 | 27 | 0.24 |
| 13 | 0.05 | 28 | 0.12 |
| 14 | 0.03 | 29 | 0.05 |
| 15 | 0.02 | 30 | 0.00 ^a |

^aCBO assumes that retention in this year is determined more by policy than by pay.

that is based on actual data from past bonus programs to project changes in reenlistment rates for changes in the average bonus. The elasticities of supply implied by this model are generally similar in size to the elasticities estimated in studies on the effects of other types of military compensation.

The inventory model generates separate estimates of the average reenlistment rate for the years of service corresponding to Zones A, B, and C--that is, years 3 through 6, 7 through 10, and 11 through 14. The estimates are adjusted down because a bonus paid in installments is less attractive than one of the same amount paid in a lump sum.

Adjusting for Changes in Service Policies

The Army and Marine Corps plan to limit future growth in their career forces by tightening standards for reenlistment. To simulate these limits on reenlistment, CBO adjusts continuation rates for years of service

3 to 6 so that the projected career force remains steady as a percent of the total force (roughly 43.5 percent in the Army and 33 percent in the Marine Corps). The sizes of these adjustments differ from one projection year to another.

ENLISTED RECRUITMENT

CBO develops its projections of enlisted recruitment in three stages:

- o First, CBO uses the previously discussed inventory flow model to calculate the annual demand for recruits without prior military service. These demands are divided between women and men in accordance with the services' known plans;
- o Second, CBO estimates the future supply of "scarce" recruits--male high school diploma graduates with scores on the Armed Forces Qualification Test (AFQT) in categories I to III--by adjusting the actual supply in a recent fiscal year for expected changes in four key variables;
- o Third, CBO projects the numbers of other high school diploma graduates--those with test scores in category IV, the lowest acceptable category--that are consistent with the services' goals for quality. Because these low-scoring recruits are abundant, their numbers are largely determined by demand rather than by supply.

Enlistments of high school graduates in AFQT categories I to IV (from the second and third stages) are divided by requirements for male recruits (from the first stage) to get the percent of male recruits with high school diplomas. The following sections discuss each stage in greater detail.

Computing Requirements for Women and Men

To compute the services' requirements for males under any change in military pay and benefits, CBO subtracts female enlistments--shown in Table 4--from the inventory flow model's estimates of requirements for recruits without prior service.

Since neither the Army, Marine Corps, or Air Force plans significant increases in numbers of servicewomen, Table 4 assumes that they continue the present rates of female enlistments. The Navy, however, intends enlisting roughly 2,000 more women in 1983 than in 1982, and adding 10,000 enlisted women to its active-duty force by fiscal year 1985. Thus, Table 4 assumes that the Navy gradually increases female enlistments through 1986.

TABLE 4. THE DEMAND FOR FEMALE RECRUITS (In thousands)^a

| | 1983 | 1984 | 1985 | 1986 | 1987 |
|--------------|------|------|------|------|------|
| Army | 17.2 | 17.2 | 17.2 | 17.2 | 17.2 |
| Navy | 8.4 | 10.5 | 11.3 | 12.1 | 12.1 |
| Marine Corps | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Air Force | 10.6 | 10.6 | 10.6 | 10.6 | 10.6 |

^aCBO assumes that the demand for females will not change under alternative pay plans for 1983.

The Supply of Scarce Recruits

Male high school diploma graduates who score in categories I to III on the AFQT are scarce for military service. Since the AVF began, their annual supply has ranged from a high of roughly 218,000 in fiscal year 1975, which was then 53.5 percent of the services' requirement for recruits without prior service, to a low of roughly 126,000 in fiscal year 1979, which was then 41 percent of the requirement. Past studies of military recruitment have found that much of this variation in the supply of scarce recruits can be explained by four variables: the level of military pay relative to civilian pay, the rate of youth unemployment, the number of military recruiters, and the size of the youth population. To estimate future changes in the supply of scarce recruits, CBO adjusts the actual supply in the latest fiscal year for which data are available for likely changes in the four key variables.

The relationship between each key variable and the supply of scarce recruits is expressed by an elasticity that shows the percent change in enlistments for a 1 percent change in the variable. Although studies frequently disagree on the size of the elasticity for a given variable, they tend to agree on relationships among elasticities. For example, most studies have found that of the four services' enlistments those of the Army are most responsive to changes in military pay and least responsive to changes in youth unemployment.

CBO selected a set of elasticities that strikes a balance between the different findings of past studies. The assumed elasticities differ by service and by AFQT category; they are shown in Table 5. Since one could

choose from among many elasticities, CBO tested slightly different sets of elasticities and found that they did not greatly alter projections.

CBO uses the elasticities in Table 5 to project changes in the supply of scarce recruits for expected changes in key variables. The following sections discuss CBO's assumptions about these variables.

TABLE 5. ASSUMED ELASTICITIES OF SUPPLY FOR CHANGES IN KEY VARIABLES (By service and AFQT category)

| | Military/ Civilian Pay Level | Rate of Youth Unemployment | Numbers of Military Recruiters | Size of Youth Population |
|--------------|------------------------------------|----------------------------------|--------------------------------------|--------------------------------|
| Army | | | | |
| I-III A | 1.25 | 0.30 | 0.40 | 0.60 |
| III B | 1.50 | 0.25 | 0.45 | 0.55 |
| Navy | | | | |
| I-III A | 0.90 | 0.40 | 0.50 | 0.50 |
| III B | 1.25 | 0.30 | 0.50 | 0.50 |
| Marine Corps | | | | |
| I-III A | 0.50 | 0.35 | 0.45 | 0.55 |
| III B | 0.45 | 0.45 | 0.50 | 0.50 |
| Air Force | | | | |
| I-III A | 1.00 | 0.50 | 0.50 | 0.50 |
| III B | 1.20 | 0.40 | 0.55 | 0.45 |

Military Pay Relative to Civilian Pay. Using the elasticities in Table 5, CBO adjusts the supply of scarce recruits for two sorts of changes in military compensation: the October military pay raise, and changes in specific benefits that affect compensation in the first term of service, like enlistment bonuses and educational benefits.

To estimate the effects of the October pay raise, CBO compares the percent increase in military pay (basic pay plus basic allowances for quarters and subsistence) over the typical first term of enlistment with

projected increases in the hourly earnings of all nonfarm production workers. ^{3/} The typical first term is just over three years in the Army, just under four years in the Marine Corps, and just over four years in the Air Force and the Navy. CBO discounts the value of military pay over the typical first term--using a real discount rate of 20 percent--to express the strong preference of youths for money now rather than later.

CBO estimates that between 1981 and 1982 military pay over the first term increased by about 12.5 percent and civilian pay increased by roughly 8.1 percent, for a 4 percent increase in the relative value of military earnings. If comparability is expected of future October pay raises, CBO assumes that the annual percent increase in recruits' pay will equal the expected increase in production workers' hourly earnings.

CBO translates changes in specific benefits into percent changes in military pay over the typical first term. The dollar value of the benefit is divided by the number of eligible recipients to get an average cost; this average cost is assumed to represent the value to the recipient of the benefit. Next, the value of the benefit is divided by the discounted present value of basic military compensation over the typical first term.

Youth Unemployment. CBO's economic assumptions show overall unemployment falling from 9 percent in fiscal year 1983 to 7 percent by 1987. CBO analysts expect a tandem decline in youth unemployment: an equation estimated by CBO relating past youth unemployment to overall unemployment shows future youth unemployment falling from roughly 23 percent in 1983 to 19 percent by 1987. Table 6 shows both overall and youth unemployment assumptions, and the equation relating them.

Military Recruiters. CBO focuses on the services' plans for production recruiters in 1982. Unless otherwise noted, CBO assumes no future change in numbers of production recruiters after 1982. Between 1981 and 1982, the latest available data used by CBO showed increases in production recruiters of 2.4 percent in the Army, 0.4 percent in the Navy, and 4.5 percent in the Air Force; recruiters decreased by 1.0 percent in the Marine Corps. CBO does not have the data to measure the effects on one service of another service's change in recruiters, although such interactions may occur.

³CBO does not compare recruits' pay with the earnings of young civilian workers because CBO has no good way to project changes in youths' earnings. It is not clear, however, whether such a comparison would make a great difference in the long run. Over the last ten years, for example, the percent changes in the usual weekly earnings for young males (those aged 16 to 19 and 20 to 24) have been sometimes higher and sometimes lower than the percent changes in earnings for older males (aged 25 plus).

TABLE 6. CBO ASSUMPTIONS FOR OVERALL AND YOUTH RATES OF UNEMPLOYMENT (By fiscal year)

| | 1983 | 1984 | 1985 | 1986 | 1987 |
|---------|------|------|------|------|------|
| Overall | 9.0 | 8.4 | 7.9 | 7.5 | 7.0 |
| Youth | 22.9 | 21.8 | 20.9 | 20.1 | 19.2 |

NOTE: $\ln(\text{male youth unemployment}) = 1.639 + 0.713 \ln(\text{overall unemployment}) - .060 \ln(\text{time}) + .012 (\ln(\text{time}))^2$; Time in 1983 = 14.

Youth Population. To estimate the population of eligible youth, CBO projects a weighted average of 17-to-25-year-old men: the weights are each age's share of total active-duty enlistments in recent years. This average excludes men who have prior military service. Table 7 shows how the population of young men is expected to decline over the next five years.

Numbers of Other High School Diploma Graduates

Even when the economy is doing well, high school diploma graduates who score in category IV of the AFQT are abundant. Their numbers are determined by the services' policies on accepting recruits who score in category IV: all recruits in category IV must be high school graduates because DoD bars enlistments of low-scoring non-high school graduates.

Current law limits each service's recruits in category IV to 20 percent of all its recruits without prior military service. CBO assumes that the Army will abide by the statutory limit of 20 percent, but that the other services will continue limiting low-scoring recruits to lower percents: 10 percent of recruits in the Marine Corps, 12 percent in the Navy, and 5 percent in the Air Force.

TABLE 7. WEIGHTED AVERAGES OF 17-TO-25-YEAR-OLD MEN
 (By fiscal year)

| Year | Number | Percent Change from 1981 |
|------|-----------|-----------------------------|
| 1981 | 1,975,000 | 0.00 |
| 1982 | 1,958,000 | -0.90 |
| 1983 | 1,903,000 | -3.65 |
| 1984 | 1,836,000 | -7.00 |
| 1985 | 1,767,000 | -10.50 |
| 1986 | 1,724,000 | -12.70 |
| 1987 | 1,713,000 | -13.30 |