THE BUDGET COST OF A VOLUNTEER MILITARY

S. L. Canby and B. P. Klotz

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In 1967, following a request from the Air Force Deputy Chief of Staff for Personnel, Rand began to examine existing or imminent problem areas of Air Force personnel management. One problem identified concerned the slackening of the draft pressure upon prospective enlees that would accompany the termination of the Southeast Asia buildup. Because of experience gained from efforts to estimate the behavior of the post-Vietnam potential recruit population, Rand was invited to participate in the Air Force study of the impact of a volunteer force, and in the National Security Council review of occupational and student deferment policies.

A second and equally powerful event preliminary to the current study was the participation of one author in a Harvard Faculty Seminar chaired by Professors Thomas C. Schelling and John T. Dunlop in the Spring of 1967; one conclusion of the seminar was that existing budget cost estimates of a volunteer military system, which ranged from $4 to $17 billion, were grossly exaggerated.

These events created an awareness of the need for more careful estimates of the costs of voluntarism, and that is the purpose of this study.

Our long-run costs for a volunteer force comparable to a pre-Vietnam draft-induced force of 2.65 million men range between an additional $2.1 and $2.5 billion annually. The only cost approaching ours is the $2.3 billion figure (excluding Reserves and the savings from increased Treasury income tax returns) reported by the 1970 Presidential Commission; however, their estimate omits retirement costs and that part of longevity costs accruing after eight years of service. The methodology in both studies is similar, particularly in the area of econometrics; the major difference is the emphasis we place on the institutional details of the military manpower system.

An even greater difference exists between the Commission's report and ours for the transition costs (short-run costs) to voluntarism. We estimate an incremental $0.75 billion per year for the transition phase; the Commission estimate is $3.1 billion for a slightly smaller
force (excluding Reserves and tax returns). A major reason for this difference is that we assume a transition period of three or four years, when voluntarism would operate in conjunction with the draft; the Commission proposes an abrupt change to voluntarism.

This study has many policy implications for the individual military services. First, if voluntarism is adopted, the Services must know the cost increases to expect so that they can budget for them. Second, the Services must know the budget costs in order to test alternative personnel policies. Each Service may wish to reappraise its manpower policies in light of the new system and the military technology and strategy developments since World War II, when existing policies were developed. This is particularly important for the Air Force whose requirements are much different than the Army's. Yet Air Force manpower policy has been restricted by DOD guidelines, which are based on Army needs. Third, if voluntarism is adopted, DOD needs to implement voluntarism by increasing its emoluments. This can be done efficiently and rather cheaply through visible cash increases; or it can become a "goodies" bag with expensive increases in fringe benefits, which enlistees do not often perceive or value and which would do little to attract or retain personnel. These policy choices cannot be satisfactorily resolved without a detailed study.
SUMMARY

A volunteer military with the combat effectiveness of a 2.65-million man draft-induced force may be attained in peacetime for an additional budget cost of $2.1 to $2.5 billion in the long-run. These costs appear similar to those recently estimated by the President's Commission on an All-Volunteer Armed Force, but the Commission estimates focus on the short-run costs of voluntarism, and do not fully examine long-run cost implications. Our findings contrast sharply with previous volunteer studies whose estimates range between $4 and $17 billion. Our costs are lower because we consider all of the following factors in our methodology:

1. Increased retention in a volunteer force.
2. Use of the draft or the Vietnam phaseout to reduce the high short-run costs of a transition to voluntarism.
3. Reduced training activity in a volunteer force.
4. The theoretical construct of perceived pay.
5. A steep military wage structure caused by low entry wages.
8. Use of the same proportion of mental category IV (below average) enlistees as that used prior to Vietnam.
9. Recognition that category IV men are in excess supply.
10. Discrimination among Services to overcome the Army's recruiting disadvantage.

Conversely, no previous study considers the cost implications of all of the following:

2. Higher retention rates of a volunteer force, which increase compensation costs as the average soldier achieves more seniority.
3. Higher retention rates, which increase retirement costs.
4. The Department of Defense underestimate of retirement accrual costs.
Besides considering the collective impact of these fourteen points upon the cost estimates, this study shows the sensitivity of such estimates to the youth unemployment rate, the supply elasticity of volunteers with respect to military pay, the proportion of enlistees who are true volunteers, the retention rate of volunteers, two definitions of military wages, and the force size. The cost estimates are relatively insensitive to plausible changes in these variables because of the cost-retarding impact of effects 1 through 10. In most cases considered, the annual cost increments necessary to establish voluntarism are below $2.3 billion.

To clarify the analysis, the cost estimates are divided into four major elements: increased wage costs for new recruits, increased wage costs due to the greater seniority of a volunteer force, increased retirement costs, and savings from reduced training activities. This study also differentiates between the short-run transition costs to achieve voluntarism and the long-run steady-state costs. Failure to account for this distinction has caused some public confusion. Short-run transition costs are less than steady-state costs, though the transition can be expensive if an abrupt change to voluntarism is made without using the draft as a cushion or without taking advantage of a post-Vietnam force phasedown. A phase-in period during which military wages are increased is also desirable in the uncertain post-Vietnam period. For example, changing youth attitudes or a continuing threat of limited wars may vitiate the most careful analysis of past data on military supply.

This study has several limitations. First, published estimates of voluntarism's budget cost, except for the recent Presidential Commission Report, are based on pre-Vietnam data. Although data from the Vietnam period contain offsetting "nuisance" variables, existing information indicates at present that increased anti-military attitudes among youths have not appreciably influenced the subset of true volunteers from which the Services recruit. Second, our cost estimates are based on existing institutional constraints. Changes in military compensation, recruitment, and retention policies can lead to major cost savings and increases in combat effectiveness. We have accepted
existing policies since their change is a major problem and study in itself. Third, we have not considered the possibility of savings from the following factors: productivity increases caused by the rationalizing impact of market wages, capital-labor tradeoffs, and a more experienced force; "womanization" and civilian contractual performance of some military functions; and reduced veteran benefits for peacetime volunteers. Fourth, methods to obtain a voluntary reserve force are not considered.

Finally, this study considers only one criterion for evaluating the desirability of a volunteer military: its budget cost.
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I. INTRODUCTION

This study considers only the budget cost of an all-volunteer force. While economists would generally regard budget costs as an inaccurate measure of real cost, budget costs are politically relevant and important. Although a budget cost study of voluntarism is limited, it is intricate and involves more than econometrics, because the military is an institutional complex that differs in many ways from the more familiar civilian labor market. Analogies to civilian models can be misleading. Moreover, previous cost estimates have omitted certain plausible cost savings, thereby accentuating the bias against voluntarism. This Memorandum considers such savings in an effort to remove the bias.

Considerable uncertainty surrounds the 1970 projection of volunteers generated in previous studies.\(^1\) Such projections are only used as a basis of comparison for the eight alternative cases considered here. Fortunately, total budget costs do not vary widely among the cases even though we assume two unemployment rates and calculate wage costs under different assumptions about the responsiveness of volunteers to wage changes. Therefore, we feel it is not necessary to know the "true" case in order to conclude that a volunteer military is cheaper and more flexible than previously believed.

Initial manpower requirements depend on the desired force size and the overall personnel retention rate of this force. Manpower supply depends on the population of young men and the relative advantages they see in military and civilian life. These advantages depend in part on the military wage rate, a control variable enabling the

military to offset the disadvantages associated with Service life.
The size of the volunteer deficit and the responsiveness of supply to wage changes basically determine the added cost of attracting volunteers. With these thoughts in mind, we separate the estimating methodology into three processes, described in Sections II, III and IV:

1. A projection of the annual demand for military manpower requirements that will sustain a 2.65-million-man effective force.
2. A projection of the 1970 supply of volunteers in the absence of the draft.
3. A calculation of the wage change necessary to balance demand and supply.

Long-run costs and savings associated with voluntarism are also calculated for alternative assumptions about the youth unemployment rate and the responsiveness of volunteers to pay increases. Cost increases result from the more senior force and the larger number retiring under voluntarism. Savings result from reduced training activities.

To present our argument as clearly as possible, the body of the text is brief. Detailed material describing factors affecting manpower supply and demand is relegated to nine appendixes.¹ In a series of sequential calculations, Appendix A describes the annual accessions needed for a volunteer force. Appendix B outlines the perceived present value of a Second Lieutenant's pay as an example of how a young man views the benefits of Service life. Appendix C describes the longevity, retirement and training costs associated with a volunteer force. Appendix D derives the supply elasticity of volunteers, and Appendix E offers thoughts on first-term reenlistment rates and bonuses. Appendix F compares supply curve derivations from various studies. Appendix G contains the cost estimates of The Report of the Presidential Commission on an All-Volunteer Force.² Appendix H illustrates our methodology in calculating the costs of a volunteer force. Finally, Appendix I discusses the cost implications of alternative enlistment and retention policies.

¹The implications of Appendixes D, E, F, G and I have not been included in the cost estimates of this study. In general, their inclusion serves to lower our estimates.

II. PROJECTING MANPOWER REQUIREMENTS

Military force levels and retention rates determine the annual manpower inflows necessary to stock the force. The flows, in turn, are a basic element in the volunteer cost equation. In this study we assume a fixed force level of 2.65 million men, the size of the pre-Vietnam force and the force level the DOD seems to envisage for post-Vietnam. This is also the force level used in other cost studies of voluntarism. (Appendix I briefly considers a 3-million-man military.) Based on pre-Vietnam experience, a 2.65-million-man effective force would consist of 333,000 officers and 2.32 million enlisted men. Excluding perturbations caused by wartime expansions, such a force requires an average annual inflow of 43,500 officers and 498,600 enlisted men if the draft and current below-market wages for new enlistees are continued.¹

ENLISTED MEN

If the Services increase their wages, true volunteers will replace draftees and draft-induced volunteers; thus the average retention rates and average enlistment periods will rise and the inflow required to maintain the given force level will fall. The average first-term re-enlistment rate of eligible men from 1958 to 1965 has been 25.3 percent.² Not all are eligible to reenlist for various moral, mental and physical reasons, so that a 498,600-man inflow leaves only an average strength of 84,500 at the five-year point, as seen in Table 1. We assume eligibility standards are unaffected by switching to voluntarism.

The volunteer force profile may now be constructed. Oi derives a first-term reenlistment rate for true Army volunteers (those who would

¹Appendix A describes how we arrive at these figures, which are presented in Table 7. These numbers are higher than the actual pre-Vietnam experience of 37,300 officers and 482,700 enlisted men that reflected the large number of World War II and Korean veterans still in the manpower pipeline.

Table 1

ENLISTED MEN: YEARS-OF-SERVICE PROFILE FOR A 2.65-MILLION-MAN EFFECTIVE FORCE
(In thousands)

<table>
<thead>
<tr>
<th>Years of Service</th>
<th>Draft-Induced&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Volunteer&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry</td>
<td>498.6</td>
<td>312.9</td>
</tr>
<tr>
<td>1</td>
<td>478.5</td>
<td>299.3</td>
</tr>
<tr>
<td>2</td>
<td>441.6</td>
<td>276.5</td>
</tr>
<tr>
<td>3</td>
<td>292.4</td>
<td>260.1</td>
</tr>
<tr>
<td>4</td>
<td>192.0</td>
<td>181.0</td>
</tr>
<tr>
<td>5</td>
<td>84.5</td>
<td>106.0</td>
</tr>
<tr>
<td>12</td>
<td>45.9</td>
<td>58.4</td>
</tr>
<tr>
<td>16</td>
<td>41.8</td>
<td>53.3</td>
</tr>
<tr>
<td>20</td>
<td>37.8</td>
<td>48.5</td>
</tr>
<tr>
<td>21</td>
<td>23.9</td>
<td>30.7</td>
</tr>
<tr>
<td>25</td>
<td>7.1</td>
<td>9.1</td>
</tr>
<tr>
<td>29</td>
<td>3.3</td>
<td>4.4</td>
</tr>
<tr>
<td>30</td>
<td>2.7</td>
<td>3.4</td>
</tr>
</tbody>
</table>

<sup>a</sup>1965 Multiple Decrement Table for the Department of Defense, Office of the Actuarial Consultant, DOD.

<sup>b</sup>After a 5.9-percent training reduction. See Appendix A for an expanded discussion.

The initial retention rate with voluntarism is therefore assumed to increase from 25.3 to 36 percent. Subsequent rates are assumed unchanged because the force is essentially a volunteer military after the first tour of duty—three years for the Army and four years for the other Services. At the end of his second tour, an individual is largely locked in by his training, some of it specific.

<sup>1</sup>See Appendix A. The method assumes (1) the 1965 DOD survey of enlisted men obtained an accurate estimate of true volunteers, and (2) the draftee retention rates equal those of draft-induced volunteers. The survey findings are consistent with other DOD studies. If (1) and (2) are false, retention rates may be less than 36 percent; but lower retention rates do not raise costs dramatically, as seen in Appendix H.
and nontransferable, and by the growing attraction of retirement benefits.

Assuming an initial 36-percent reenlistment rate and the historical retention profile (Table 10, Appendix A) thereafter, an annual inflow of 332,700 men is sufficient to stock a 2.32-million enlisted force. This new recruit flow is only 67 percent of that required for a draft-induced force, so the portion of the force engaged in training activities may be cut with no loss in combat effectiveness. On this basis a further force reduction of 5.9 percent is calculated in Appendix A. The smaller enlisted force contains only 2.18 million men and requires only 312,900 yearly volunteers to maintain its size.¹

OFFICERS

Officer requirements for the volunteer force are based on O1's estimates. During 1960-1965, accessions of 37,300 per year were required to maintain an officer level of 340,000. The volunteer force benefits from higher officer retention rates and requires only a 34,200 inflow to maintain its officer stock of 336,000.² When training manpower savings are subtracted, the yearly officer flow falls to 32,200.

ARMY REQUIREMENTS

The Army has the most difficulty in fulfilling its requirements. If other Services paid the same recruiting wages as the Army, non-Army recruits would receive more than necessary to induce them to enlist, and they would be in excess supply. Our supply and demand projections

¹Appendix A, Table 7. Further reductions would stem from a greater use of civilians and women in noncombat tasks, tighter manpower utilization practices, and substitution of capital for labor. Also, the more experienced volunteer force should be more efficient and should require fewer men than indicated above.

²O1, p. 50 (after correcting for a slightly smaller officer corps and attrition between entry and average initial year of service based on the 1965 Decrement Table for Officers).
reflect the Army's special difficulty and are therefore broken down into Army and non-Army.¹

Replacing draftees with longer-term and higher retention rate volunteers causes Army requirements for a 2.65-million-man military to drop from 217,000 to 124,000 annual accessions. This reduction in Army training and training support activities permits a 9.6-percent overall reduction in Army strength levels,² while maintaining operating units at constant strength. Army accession requirements then drop from 124,000 to 112,100 in the steady-state. Officer demands also fall 9.6 percent, from 12,000 to 10,800. These Army figures appear in Sec. III, Table 3, along with non-Army demands.

The foregoing are requirements for a given force level; higher levels would require proportional changes in annual accessions in the long-run. Rapid buildups for war are another matter. In principle, voluntarism could be maintained for limited wars, although sharp wage increases would be necessary, unless patriotism and a sense of adventure stimulated enlistments. But sharp wage increases in wartime could easily cause administrative and morale problems, and some people would object to wartime voluntarism for a number of ethical and philosophical reasons. However the question of flexibility is not an objection to voluntarism if the draft is maintained in operational readiness for use in military expansions.³

¹Because Army enlistments are the most difficult to obtain under voluntarism, a purely cost-effective solution would reduce the size of the Army by assigning some of its functions to the Air Force (e.g., Army Aviation) and Marine Corps.

²Versus 3.8 and 5.9 percent, respectively, for non-Army service and total DOD.

³Minor buildups may be met by relaxed entrance standards. For example, 20 percent of 1969 Air Force enlistments were mental category IV (below average) quality as opposed to a previous average of less than 10 percent, due to changed DOD policy.
III. PROJECTING THE SUPPLY OF VOLUNTEERS

This section considers the supply of volunteers without a draft. In 1965 the Defense Department study of a volunteer military projected the fiscal year 1970-71 enlistments shown in Table 2A, without a draft and with the 1963 military-civilian wage ratio.\textsuperscript{1} Consistent with recruiting history, the DOD projections include mental category IV proportions of 20 percent (Army), 10 percent (non-Army), and 14.2 percent (DOD). But category IV men queue up to enlist even at the current low wages. They are in excess supply and should be subtracted from both supply and demand before calculating the wage increase necessary to equate the supply and demand of mental category I-III volunteers. Table 2B shows enlistments left after subtracting category IV personnel.

Table 2

<table>
<thead>
<tr>
<th>Service</th>
<th>Enlisted Men\textsuperscript{a}</th>
<th>Officers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14.9%</td>
<td>11.5%</td>
</tr>
</tbody>
</table>

A. Categories I-IV

<table>
<thead>
<tr>
<th>DOD</th>
<th>317.0</th>
<th>272.0</th>
<th>27.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>106.0</td>
<td>91.0</td>
<td>9.0</td>
</tr>
<tr>
<td>Non-Army</td>
<td>211.0</td>
<td>181.0</td>
<td>18.0</td>
</tr>
</tbody>
</table>

B. Categories I-III

<table>
<thead>
<tr>
<th>DOD</th>
<th>274.7</th>
<th>235.7</th>
<th>27.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>84.8</td>
<td>72.8</td>
<td>9.0</td>
</tr>
<tr>
<td>Non-Army</td>
<td>189.9</td>
<td>162.9</td>
<td>18.0</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Assuming two unemployment rates for enlisted men.

\textsuperscript{1}Altman and Fechter, p. 25. Their Table 5 summarizes the DOD study in which they participated. It assumes accuracy of a 1964 survey of enlistees to determine in 1970 those who would truly have volunteered without the draft and no change in anti-military attitudes. The elasticity of DOD volunteers to changes in unemployment implied by the above figures is about 0.6, which is consistent with our econometric results summarized in Table 20 of Appendix D.
Table 3 compares the long-term demand requirements of a volunteer force with the supply projection for 1970, assuming no draft pressure and 1963 military-to-civilian wage rates. The recruiting deficits are shown under two unemployment rates. The Army deficit is the largest, and drives the cost of attracting volunteers.

The DOD forecasts are necessarily speculative. Fortunately, the budget cost estimates that follow are not especially sensitive to changes in the supply projections. Yet the forecasts are intuitively plausible because they can be approximated by assuming that the estimated true volunteers of 1964 increase proportionately with population growth to 1970.

Table 3 indicates that recruiting deficits will appear, but the supply forecasts assume no change in the ratio of military-to-civilian wages. To determine the responsiveness of volunteers to increased military pay, so that we can eliminate these deficits, we estimate an elasticity of supply (ES) of DOD volunteers from time series data. This concept is defined as the percentage increase in volunteers divided by the percentage increase in the ratio of military-to-civilian wages.

---

1 Criticisms in Appendixes D and F focus on the correct definition of variables in the econometric estimate of the volunteer supply equation; whether the equation contains enough important variables, such as the level of youth education and a Vietnam aversion factor; and whether the equation has the proper mathematical form.

2 For example, a simple category I-III projection would look like this:

<table>
<thead>
<tr>
<th>Service</th>
<th>(1964 Enlistees)</th>
<th>X (Proportion)</th>
<th>X (Pop. Ratio)</th>
<th>= 1970 Volunteers</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOD</td>
<td>346,000</td>
<td>.60</td>
<td>1.28</td>
<td>266,000</td>
</tr>
<tr>
<td>Army</td>
<td>111,000</td>
<td>.56</td>
<td>1.28</td>
<td>79,000</td>
</tr>
<tr>
<td>Non-Army</td>
<td>234,000</td>
<td>.65</td>
<td>1.28</td>
<td>189,000</td>
</tr>
</tbody>
</table>

The 1970 volunteer projection is almost identical to the DOD projections shown in Table 3, Column 1, lines 4, 10 and 16. Enlistees for 1964 are taken from Selected Manpower Statistics, Directorate for Statistical Services, Office of the Secretary of Defense, 1964, after subtracting category IV proportions of 8, 5 and 10 percent. True volunteer proportions are from Altman and Fechter, p. 23, also after a category IV correction. Population refers to the 17-21 age group, the source of 90 percent of enlistments.
Table 3
RECRUITING DEFICITS FOR A 2.65-MILLION EFFECTIVE VOLUNTEER FORCE IN 1970
(In thousands)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Enlisted Men</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td>14.9%</td>
</tr>
</tbody>
</table>

Department of Defense

1. Total requirements (Appendix A) | 332.7 | 332.7 | 34.2 |
2. Requirements after 5.9% training reduction | 312.9 | 312.9 | 32.2 |
3. Requirements for categories I-III are 83.5% of (2) for enlisted men only<sup>a</sup> | 270.3 | 270.3 | 32.2 |
4. Supply of categories I-III<sup>b</sup> | 274.6 | 235.6 | 27.0 |
5. Deficit | 0 | 34.7 | 5.2 |
6. Percentage deficit<sup>c</sup> | 0 | 14.7% | 19.3% |

Army

7. Total requirements (Appendix A) | 124.0 | 124.0 | 11.9 |
8. Requirements after 9.6% training reduction | 112.1 | 112.1 | 10.8 |
9. Requirements for categories I-III are 80% of (8) for enlisted men only<sup>a</sup> | 89.7 | 89.7 | 10.8 |
10. Supply of categories I-III<sup>b</sup> | 84.8 | 72.8 | 9.0 |
11. Deficit | 4.9 | 16.9 | 1.8 |
12. Percentage deficit | 5.7%<sup>d</sup> | 23.3% | 20.0% |

Non-Army

13. Total requirements (Appendix A) | 208.7 | 208.7 | 22.3 |
14. Requirements after 3.8% training reduction | 200.8 | 200.8 | 21.5 |
15. Requirements for categories I-III are 90% of (14) for enlisted men only<sup>a</sup> | 180.7 | 180.7 | 21.5 |
16. Supply of categories I-III (DOD-Army) | 189.9 | 162.9 | 18.0 |
17. Deficit | 0 | 17.8 | 3.5 |
18. Percentage deficit | 0 | 10.9% | 19.5% |

<sup>a</sup> Assumes 20 percent of Army enlistments and 10 percent of other Service enlistments are category IV.

<sup>b</sup> Altman and Fechter, p. 25, Table 5, corrected for category IV proportions at 1963 relative wages.

<sup>c</sup> Altman and Fechter project deficits of 58 percent and 88 percent for enlisted men, depending upon the unemployment rate, and 37 percent for officers. They do not consider the higher retention rates of a volunteer force, however, and thus greatly overstate their requirements.

<sup>d</sup> Of, p. 48, estimates a 60.1-percent deficit, but overstates Army requirements and ignores the use of category IV personnel.
We find a supply elasticity of 1.44 for across-the-board wage increases (i.e. all ranks). Appendix D presents our methodology and a theoretical explanation of why the elasticity of supply quite probably lies in the 1.00 to 2.50 range in peacetime for across-the-board changes. The supply elasticity for first-term wage increases is lower, perhaps only 0.9, as described in Appendix D. The Army ES may be less than 0.9. Because this Memorandum explores the cost implications of only first-term wage increments, we pick two supply elasticities that bracket the 0.9 value: ES = 1.0 and ES = 0.5. The latter is simply half the "best guess" to allow for a pessimistic margin of error. The Army ES is also assigned these two values. The elasticity estimates used for our cost calculations are thus slightly lower than those used by the Presidential Commission and earlier studies. However, costs are not particularly sensitive to elasticity estimates for a steady-state military of less than 3 million men for two reasons: (1) the relatively small recruiting deficit due to population growth, and (2) the pay increases that the present compensation structure can absorb for first-term enlistees before wage increases have to be passed across-the-board to all personnel.

\[\text{\footnote{The Commission's low elasticity estimate was 1.25, Commission Report, p. 180.}}\]
IV. BONUSES AND THE CORRECT PAY VARIABLE

If we know the recruiting deficit and the elasticity of supply, we can calculate the percentage increase in military wages necessary to eliminate the deficit. But the absolute wage increase implied by this percentage depends on the wage level from which we begin. This level, in turn, depends on the definition of the pay variable.

We believe that the perceived present value of first-term pay is the theoretically correct pay variable to achieve the desired volunteer force for several reasons. First-term enlisted income is low for the first two years and then jumps about $900 at the two-year point, as shown in Table 4. The four-year pay profile rises more quickly than the comparable civilian pay profile. Also, young men have a high time preference, valuing present income much more highly than future income because they aspire to reach a certain life style quickly. They manifest the high time preference by their willingness to borrow at high interest rates. More concretely, survey results indicate that 18- to 19-year-olds have a 28-percent subjective discount rate, which apparently falls to about 7 to 10 percent when they reach middle age. Because some enlistees are over 19, we assume the entire enlistee age group discounts future income streams by only 25 percent in the following analysis.

Table 4

ANNUAL MILITARY INCOMES OF ENLISTED MEN IN 1963

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Income</th>
<th>Base Pay</th>
<th>Pay Volunteer Perceives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$1830</td>
<td>$1055</td>
<td>$1550</td>
</tr>
<tr>
<td>2</td>
<td>$2143</td>
<td>$1382</td>
<td>$1880</td>
</tr>
<tr>
<td>3</td>
<td>$2991</td>
<td>$2002</td>
<td>$2650</td>
</tr>
<tr>
<td>4</td>
<td>$3344</td>
<td>$2433</td>
<td>$3030</td>
</tr>
</tbody>
</table>

1 We consider only first-term wages instead of a lifetime income stream for three reasons: even a true volunteer has a 64-percent probability of leaving the service after four years (Table 1); military and civilian incomes are comparable after four years; and enlistees apparently have a subjective time preference rate of 28 percent. See R. L. Chaney, Discounting by Military Personnel by Various Ages, unpublished Defense Department study of military compensation, October 1962.

2 Appendix H, Fig. 7.

3 Chaney.
Discounting and the present value attained from this process must be refined even further. Pay must be perceived before it motivates enlistment, and the enlistee apparently does not perceive, or value, his pay to be as high as his real "total income," which includes base pay, cost of food and housing, and a tax advantage on these items.\(^1\) Apparently he focuses on his base pay (cash) and does not personally perceive, or value, his income in kind and deferred benefits as equal to their DOD accounting cost. Quite plausibly this may be due to ignorance, restricted choice, or low appraisal of the worth to him of military food, clothing, shelter, and other such benefits. In any case, his appraisal is much less than the cost value calculated by the DOD accountants.\(^2\)

The perceived present value concept incorporates both the undervaluation of pay by enlistees and their discounting of future income in order to arrive at a wage definition that is most relevant for enlistee behavior. Table 4 shows that in 1963, first-year base pay for enlisted men was $1055, total income was $1830, and perceived pay for all the military's income-in-kind and deferred benefits was only $1550. Apparently the recipient valued his $775 non-cash income at only $495, or 65 percent of its accounting value.\(^3\) Our concept of perceived pay is obtained for the remaining three years of service by applying the same 65-percent undervaluation.

Chaney's study leads us to apply a 25-percent discount to the stream of perceived pay (PP). We calculate perceived present value (PPV\(_m\)) for four years of service in 1963 as

\[
PPV_m = \sum_{i=0}^{3} PP_i/(1 + .25)^i = $1550 + 1500 + 1700 + 1550 = $6300 .
\]

\(^1\) This is the normal use of total income; Oi used a similar definition and also included clothing.

\(^2\) See Appendix B, which uses a Second Lieutenant's salary and benefits as an example of how a young man views the total income package.

Wage increases given to first-termers between 1963 and 1968 caused the discounted perceived pay to rise to $7971 by 1968. Assuming a 10-percent across-the-board wage increase between 1968 and 1970 we have a PPV\textsubscript{m} = $8800 in 1970.

From Table 3, both the first-term elasticity definition ES = \% V/\% PPV\textsubscript{m} and the assumption ES = 1 for first-term wages indicate that wage increases of 0 and 14.7 percent are necessary to balance the DOD's category I-III demand and supply in peacetime at 14.9 and 11.5 percent unemployment, respectively.\textsuperscript{1} But military wages for the first two years of service have already risen 30.3-percent between 1963 and 1968 as opposed to only a 21.8-percent rise for manufacturing earnings, so that relative wages for draftees have already increased 7-percent.\textsuperscript{2} Further military increases are scheduled, and we assume this differential should persist to 1970. Thus, even at the low youth unemployment rate of 11.5 percent in 1970, military wages apparently need only be increased 14.7 - 7 = 7.7 percent if ES = 1. For example, using an $8800 base, we have a PPV increase of $678.

Our wage increases are allocated to give all entrants into the military a 14.9-percent increase in PPV which amounts to $728 in cash each year for the first two years of service.\textsuperscript{3} This is to bring all enlistees up to the standard of the Federal minimum wage; it also fills in the existing gap in the enlisted wage profile for those with less than two years of service. In most cases, this increase suffices to close the recruiting deficit. In cases where this amount was insufficient, we distinguished between Army and non-Army volunteers and used an enlistment bonus up to an arbitrarily determined maximum limit of $2000 for enlisted men.\textsuperscript{4} If the amount with this procedure was still insufficient,
as it was for Army recruits in the most adverse combination, we flattened the enlisted wage profile to the civilian practice by splicing the remaining PPV increases into the wage profile. These procedures allow us potentially large increases in volunteer wages, while still maintaining inter-rank wage differentials and no wage inversion (where juniors receive almost as much as seniors, causing expensive across-the-board wage increases to all military personnel).

compensation tool, having these advantages: (1) it exploits the differential between individual time preferences and government borrowing costs; (2) it achieves wage flexibility without disturbing the necessarily more rigid pay structure; (3) it helps avoid pay inversion by paying "outside" the pay system; and (4) it facilitates pay discrimination among Services (or among ability or skill groups).

Reenlistment bonuses, in widespread use today, are another way to reduce the total cost of a military system. For example, Appendix I sketches a model to find the first-term reenlistment bonus that minimizes total costs. An exit bonus can also be used to induce opting out or to cushion forced egress at, say, the eight-year point and thus avoid large seniority and retirement pay. Soldiers would be paid a lump sum to leave the service. The military's unique advantage of a penal enforced contract and the bonus suggest that a basically six- to ten-year force with low retention thereafter may be optimal for the Army and Marines, whereas higher retention rates may be desirable for the more technical Air Force and Navy who necessarily must invest more time in training their enlistees; see Appendix I.

1See pp. 83 and 84, Appendix H.
V. THE COST OF VOLUNTARISM

The elements influencing the budget cost of a volunteer military are presented in Fig. 1. Manpower demand (accession requirements) depends upon force levels, reenlistment rates, and the length of enlistment contracts, whereas supply depends upon draft pressure and the relative attractiveness of military life. Draft pressure disappears and manpower supply falls with the advent of voluntarism. Also, substituting volunteers for draftees and draft-induced volunteers lengthens the tour of duty and causes a higher reenlistment rate. Smaller inflows can then maintain a given force size.

A recruiting deficit remains. It is eliminated by military wage increases equal to the product of the percentage deficit, the elasticity of supply, and the fraction of military compensation that the enlistee perceives (a function of the compensation structure). The wage increment, when multiplied by the inflow of required volunteers, is defined as accession costs.

If we currently had a 2.65-million draft-induced force, the short-run accession cost would be high. Before the higher retention rates and longer enlistment contracts of volunteers took effect, manpower losses would be 499,000, and accessions would need to equal this amount for two years to maintain the force. The initial recruiting deficit would therefore be large, as would the initial wage increase required to attract volunteers.

We can ease the transition to voluntarism and reduce its costs, however, by maintaining the draft for two or three years. This would not only maintain force flexibility for Vietnam contingencies, but would also provide the data base to test the accuracy of statistical supply projections. Wages would only be increased enough to attract the target inflow of 312,900 enlisted volunteers and 32,200 officers

---

1Excluding perturbations caused by Korea and Vietnam.

2It would also eliminate the sensitive task of having to progressively lower military wage rates as the inflow requirement dropped because of longer enlistment tours and higher reenlistment rates.
Fig. 1 -- The interaction of cost elements
(Table 3). Any residue for contingencies would be drafted and, we assume, paid the volunteer wage.¹

Incremental short-run accession costs would equal total accessions (volunteers and draftees) flowing through their first tour of duty multiplied by the wage increases necessary to eliminate the moderate recruiting deficits of Table 3; these costs appear on line 1 of Table 5. The table summarizes short-run and long-run costs for eight alternative cases depending on the elasticity of supply (ES = 1.0 or 0.5), youth unemployment rate (14.9% or 11.5%), and definition of the relevant wage variable (PPV or DOD "total income"). We also impose three judgmental constraints in our costing: no enlisted man receives less than the federal minimum wage; enlistment bonuses are used, but do not exceed $2000 for enlisted men and $4000 for officers; and the Army may

Table 5
COST INCREASES TO ESTABLISH A VOLUNTEER FORCEᵃ
(in $ million)

<table>
<thead>
<tr>
<th>Costs</th>
<th>Perceived Present Value</th>
<th>DOD Total Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Short-run costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage increases</td>
<td>$ 722</td>
<td>$ 743</td>
</tr>
<tr>
<td>Long-run costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage increases b</td>
<td>$ 481</td>
<td>$ 495</td>
</tr>
<tr>
<td>Seniority costs</td>
<td>1573</td>
<td>1573</td>
</tr>
<tr>
<td>Retirement costs</td>
<td>1726</td>
<td>1726</td>
</tr>
<tr>
<td>Less training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total costs</td>
<td>$2125</td>
<td>$2139</td>
</tr>
</tbody>
</table>

ᵃCombat effectiveness of a 2.65-million draft-induced force. Details in Appendixes A and H, especially in Table 22.

ᵇExcludes consideration of tax increases that return to the Treasury.

¹Alternatively, since our forces currently exceed three million men, we may set a target wage, draft no one, and let the temporarily high attrition rates of the Vietnam force deflate our strength to the peacetime target.
receive a differential enlistment bonus. Short-run costs do not exceed $1710 million, and are usually closer to $1000 million because recruiting deficits (Table 3) are small and we use enlistment bonuses.1

Now, holding population and other economic variables constant, the combination of diminished accessions and increased retention rates creates a new steady-state personnel flow through the system. An older and more experienced force results in the long run. We assume personnel costs rise with this increased seniority, as do retirement costs. Conversely, the dramatically reduced accessions of voluntarism imply large savings in training and support manpower that are realizable without reducing personnel in operating forces. The figures in the lower portion of Table 5 show the cost impact of these elements. In all cases, the force has the fighting ability of a 2.65-million draft-induced force, and the first-term reenlistment rate of enlisted men is assumed to average 36 percent. Long-run cost increments range between $2132 million and $2791 million, with the bulk due to retirement and seniority costs.2 Reduced training and ancillary activities in the volunteer force save $1655 million, as described in Appendix C.

Costs increase if larger forces or lower retention rates are assumed. In the long run, a volunteer force with a combat size equal to a draft-induced force of 3 million men would cost $3 billion more than its draft-induced alternative.3 Imagining the worst possible case in Table 5 (the last column), long-run costs increase $4.6 billion if the reenlistment rate is only 30 rather than 36 percent.4

---

1 Our costs are somewhat lower than those of the Presidential Commission (Appendix C), but much lower than previous estimates of $4 to $17 billion (see Altman and Fechter, and Ol).

2 These elements, along with the training saving, are the same for all eight cases because reenlistment rates and force size are assumed constant.

3 See Appendix H. This assumes ES = 1.0, unemployment (U/P) = 14.9%, and wages = PPV.

4 See Appendix H, section entitled "A Lower Retention Rate."
VI. CONCLUSIONS

The added budget cost of a volunteer military is probably between $2.1 and $2.5 billion. The largest cost increases are caused by higher retention rates which, in turn, cause higher seniority and retirement costs that only become manifest in the long run. Initial wage increases for entrants are $0.5 to $0.8 billion in the long run, and $0.75 to $1.2 billion during the transition to voluntarism if the draft is used to phase in voluntarism. These surprisingly small estimates are primarily due to population growth\(^1\) and the structure of the military compensation system. If these projections prove optimistic, then enlistment bonuses applied to a perceived income base should cheaply eliminate any recruiting deficit. The penumbra of uncertainty about the cost estimate may be easily dispelled by simply raising first-term military wages and observing enlistment response during a transition period of decreasing draft calls.

\(^1\)The number of men coming of military age grew 31 percent from 1964 to 1970, and 44 percent from 1964 to 1974.
Appendix A

MANPOWER REQUIREMENTS

This Appendix develops the sequence of calculations for determining the annual accessions into a volunteer force. The sequence requires a new years-of-service profile to account for different retention rates. Comparing the old and new years-of-service profiles is also necessary for calculating the increased budget costs accruing from a profile shift from a younger, higher turnover force to one somewhat older with less personnel turnover. An older force entails two cost increases: higher longevity pay to maintain civilian wage comparability, and higher retirement costs. Three cost benefits accrue from an older force: reduced annual accessions, reduced training costs, and higher labor productivity. Increased productivity is not measured in this study and is not used to offset our incremental budget costs. Such improvements do have great potential for reducing personnel requirements, but translating higher productivity into reduced manpower requirements is itself a major study.

The first step in projecting demand is to determine force levels, which must be broken down into Service, officer, and enlisted categories. The standard force for the volunteer military cost studies has been set at 2.65 million men. Its composition is shown in Table 6.

Table 6
FORCE LEVEL COMPONENTS

<table>
<thead>
<tr>
<th>Group</th>
<th>Navy</th>
<th>Air Force</th>
<th>Marine Corps</th>
<th>Total Non-Army</th>
<th>Army</th>
<th>Total DOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Officer</td>
<td>75,800</td>
<td>133,700</td>
<td>16,900</td>
<td>226,400</td>
<td>110,000</td>
<td>336,400</td>
</tr>
<tr>
<td>Enlisted</td>
<td>583,600</td>
<td>712,600</td>
<td>170,900</td>
<td>1,467,100</td>
<td>846,500</td>
<td>2,313,600</td>
</tr>
<tr>
<td>Total</td>
<td>659,400</td>
<td>846,300</td>
<td>187,800</td>
<td>1,693,500</td>
<td>956,500</td>
<td>2,650,000</td>
</tr>
</tbody>
</table>
These components are found by taking the 1964-1965 average for each Service and proportionally reducing their total from 2.6805 to 2.65 million men. Next, the Service totals are separated into officer and enlisted strength.

The second major step is calculated from the Decrement Tables developed by the DOD's Actuarial Consultant. These tables show the years-of-service profile after perturbations are removed, such as those caused by large numbers of veterans, particularly officers, remaining after wartime periods. The mean officer input from 1960-1965 was 37,000, yet excluding the World War II and Korean "hump," the required input would have been 43,500 officers, an increase of 17.6 percent. The active duty enlisted input would have been 498,600 rather than the 1960-1965 average of 482,700. Our requirements are based on a theoretically corrected Decrement Table, thereby excluding wartime perturbations and slightly increasing our required number of annual accessions vis-à-vis projections based on historical averages. Table 7 shows our years-of-service profile for voluntary enlistees as compared to that for the draft-induced force.

Table 7 requires three calculations: estimating the new retention rates for a volunteer military; determining the new inflow of annual accessions; and making allowances for having to train fewer men.

No scientific method exists for estimating the new retention rates for a volunteer military. The most reliable estimate would come from longitudinal surveys based on the reenlistment rates of men who claim, at the time of entry, that they would have enlisted in the absence of a draft. (The critical assumption of this method is that the new and the old true volunteer populations are identical.) Since these data do not

1 Selected Manpower Statistics, "Average Military Strength (Man Years)," Directorate for Statistical Services, Office to Secretary of Defense, p. 21.


Table 7

ENLISTED MEN: YEARS-OF-SERVICE PROFILE FOR A
2.65-MILLION-MAN EFFECTIVE FORCE
(in thousands)

<table>
<thead>
<tr>
<th>Years of Service</th>
<th>Draft-Induced</th>
<th>Volunteer</th>
<th>Army</th>
<th>Non-Army</th>
<th>DOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry</td>
<td>498.6</td>
<td>112.1</td>
<td>200.8</td>
<td>312.9</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>478.5</td>
<td>107.8</td>
<td>191.5</td>
<td>299.3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>441.6</td>
<td>100.3</td>
<td>176.2</td>
<td>276.5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>292.4</td>
<td>94.2</td>
<td>165.9</td>
<td>260.1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>192.0</td>
<td>41.4</td>
<td>139.7</td>
<td>181.0</td>
<td></td>
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<tr>
<td>5</td>
<td>84.5</td>
<td>41.4</td>
<td>68.4</td>
<td>106.0</td>
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</tr>
<tr>
<td>6</td>
<td>73.4</td>
<td>33.9</td>
<td>59.0</td>
<td>93.0</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>68.8</td>
<td>30.4</td>
<td>56.5</td>
<td>87.0</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>62.9</td>
<td>28.0</td>
<td>51.8</td>
<td>79.7</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>55.8</td>
<td>25.2</td>
<td>45.7</td>
<td>70.9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>50.9</td>
<td>23.4</td>
<td>41.5</td>
<td>64.8</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>47.9</td>
<td>21.9</td>
<td>39.0</td>
<td>61.0</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>45.9</td>
<td>20.9</td>
<td>37.5</td>
<td>58.4</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>44.4</td>
<td>20.2</td>
<td>36.3</td>
<td>56.5</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>43.4</td>
<td>19.9</td>
<td>35.3</td>
<td>55.2</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>42.5</td>
<td>19.6</td>
<td>34.5</td>
<td>54.1</td>
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</tr>
<tr>
<td>16</td>
<td>41.8</td>
<td>19.4</td>
<td>33.9</td>
<td>53.3</td>
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<tr>
<td>17</td>
<td>41.3</td>
<td>19.2</td>
<td>33.4</td>
<td>52.6</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>40.8</td>
<td>19.0</td>
<td>33.0</td>
<td>52.0</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>40.4</td>
<td>18.9</td>
<td>32.6</td>
<td>51.5</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>37.8</td>
<td>18.7</td>
<td>29.7</td>
<td>48.5</td>
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<tr>
<td>21</td>
<td>23.9</td>
<td>12.3</td>
<td>18.4</td>
<td>30.7</td>
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<tr>
<td>22</td>
<td>16.4</td>
<td>8.7</td>
<td>12.4</td>
<td>21.1</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>11.8</td>
<td>6.1</td>
<td>9.1</td>
<td>15.2</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>8.9</td>
<td>4.4</td>
<td>7.0</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>7.1</td>
<td>3.4</td>
<td>5.7</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>5.9</td>
<td>2.7</td>
<td>4.8</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>4.9</td>
<td>2.2</td>
<td>4.0</td>
<td>6.2</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>4.0</td>
<td>1.9</td>
<td>3.3</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>3.3</td>
<td>1.5</td>
<td>2.7</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>2.7</td>
<td>1.2</td>
<td>2.2</td>
<td>3.4</td>
<td></td>
</tr>
</tbody>
</table>

| Total Avg Man Years | 2315.8 | 765.0 | 1411.0 | 2176.1 |
| Corrected for Rounding Errors | 2313.6 | 765.2 | 1411.5 | 2176.0 |

\(^a\)1965 Multiple Decrement Table for the Department of Defense, Office of the Actuarial Consultant, DOD.

\(^b\)Training reductions of 9.6% for Army and 3.8% for non-Army.
exist, we use Oi's assumption that draft-induced volunteers have the same reenlistment propensities as draftees.\footnote{Ibid., p. 46. This assumption is arbitrary but not critical as the reader will see in Appendix E and pp. 84-90, Appendix H. Higher retention rates mean fewer required accessions and hence lower accession and training costs; but higher retention rates also imply higher seniority and retirement costs. Thus as long as retention rates are sufficient to avoid large wage increases to entrants and wage inversion, costs are relatively insensitive to retention rates.}

Table 8

<table>
<thead>
<tr>
<th>Group</th>
<th>Army</th>
<th>Navy</th>
<th>Marine Corps</th>
<th>Air Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draft-motivated volunteers\footnote{\textsuperscript{a}Altman and Fechter, p. 23.}</td>
<td>43.2</td>
<td>32.6</td>
<td>30.4</td>
<td>42.9</td>
</tr>
<tr>
<td>First-term retention rate\footnote{\textsuperscript{b}Selected Manpower Statistics, FY 1958-1965, p. 51.}</td>
<td>23.5</td>
<td>24.1</td>
<td>17.4</td>
<td>32.5</td>
</tr>
<tr>
<td>Draftee retention rate\footnote{\textsuperscript{b}}</td>
<td>9.2</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Table 8 shows the retention rate for draftees and first-term volunteers, as well as the percentage of draft-motivated volunteers. These parameters are then applied to the formula

\[(1) \quad DM(9.2) + (1 - DM)(x) = (1)(FT),\]

where \(DM\) = fraction of draft-motivated volunteers.

\(FT\) = first-term retention rates.

\(x\) = true volunteer's reenlistment rate.

This calculation yields the Table 9 estimate of retention rates for a volunteer force.

Given the retention rate estimate, the second step in calculating Table 7 is to determine the new inflow of annual accessions. This calculation is based on a reprint of several columns of the DOD
Table 9
ESTIMATED RETENTION RATES FOR A VOLUNTEER FORCE
(In percent)

<table>
<thead>
<tr>
<th>Service</th>
<th>True Volunteer Retention Rate</th>
<th>Increase in Retention Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>34.3</td>
<td>46.2</td>
</tr>
<tr>
<td>Non-Army</td>
<td>38.0</td>
<td>39.0</td>
</tr>
<tr>
<td>Navy</td>
<td>31.2</td>
<td>29.8</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>20.9</td>
<td>20.5</td>
</tr>
<tr>
<td>Air Force</td>
<td>50.1</td>
<td>53.8</td>
</tr>
</tbody>
</table>

\[ \text{[(true volunteer rate ÷ first-term rate of a draft-induced force)] - 1} \times 100. \]

Decrement Tables (shown in our Table 10) that give average man-years for each year of completed service from an initial one-million-man input. Since we are postulating no change in institutional practices, we can multiply years 3 to 30 for the Army and years 4 to 30 for the other Services by the retention rate increase for each Service, giving an expanded number of average man-years for careerists. This figure is added to the unchanged number of average man-years for first-termers, for a total average man-years based on an initial input of one million men. Dividing this number into actual service strength yields the required accession number. The formula is thus

\[ \text{[(true volunteer rate ÷ first-term rate of a draft-induced force)] - 1} \times 100. \]

\[ \text{[(true volunteer rate ÷ first-term rate of a draft-induced force)] - 1} \times 100. \]

Such an assumption often forecloses otherwise viable options. In this particular case, reenlistment rates are based on only those eligible to reenlist. From 20 to 30 percent of first-term personnel are typically declared ineligible for reenlistment and are excluded from the statistics. This makes reenlistment data unreliable because (1) commanders have been known to classify eligibles as ineligible in order to enhance their own image, and (2) changes in acceptance standards cause a lagged impact upon reenlistment eligibility rates.

From a volunteer military standpoint, a hard look at these institutional practices can lead to reduced annual accession requirements. Another institutional change to obtain higher retention rates would be better initial assignments of individuals to their preferred occupational areas. A major problem of economic analysis is that its aggregative statistical approach ignores these problems and therefore often biases the case against otherwise viable options.
### Table 10

ENLISTED MEN: 1965 MULTIPLE DECREMENT TABLES
(In thousands)

<table>
<thead>
<tr>
<th>Years of Service</th>
<th>DOD</th>
<th>Regular Army</th>
<th>Navy</th>
<th>Regular Marine Corps</th>
<th>Air Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>959.8</td>
<td>961.4</td>
<td>951.7</td>
<td>954.9</td>
<td>955.2</td>
</tr>
<tr>
<td>2</td>
<td>885.7</td>
<td>894.6</td>
<td>873.6</td>
<td>888.5</td>
<td>877.9</td>
</tr>
<tr>
<td>3</td>
<td>586.5</td>
<td>840.4</td>
<td>826.7</td>
<td>838.2</td>
<td>822.1</td>
</tr>
<tr>
<td>4</td>
<td>385.2</td>
<td>252.4</td>
<td>701.4</td>
<td>710.6</td>
<td>685.8</td>
</tr>
<tr>
<td>5</td>
<td>169.4</td>
<td>234.3</td>
<td>209.7</td>
<td>198.8</td>
<td>285.1</td>
</tr>
<tr>
<td>6</td>
<td>147.2</td>
<td>207.1</td>
<td>198.3</td>
<td>171.6</td>
<td>232.0</td>
</tr>
<tr>
<td>7</td>
<td>137.9</td>
<td>185.7</td>
<td>193.1</td>
<td>155.3</td>
<td>221.9</td>
</tr>
<tr>
<td>8</td>
<td>126.1</td>
<td>170.6</td>
<td>182.4</td>
<td>141.3</td>
<td>199.1</td>
</tr>
<tr>
<td>9</td>
<td>111.8</td>
<td>153.8</td>
<td>172.2</td>
<td>121.0</td>
<td>167.6</td>
</tr>
<tr>
<td>10</td>
<td>102.1</td>
<td>142.5</td>
<td>154.7</td>
<td>106.2</td>
<td>154.1</td>
</tr>
<tr>
<td>11</td>
<td>96.1</td>
<td>133.8</td>
<td>144.9</td>
<td>97.3</td>
<td>146.5</td>
</tr>
<tr>
<td>12</td>
<td>92.0</td>
<td>127.4</td>
<td>138.6</td>
<td>92.1</td>
<td>141.4</td>
</tr>
<tr>
<td>13</td>
<td>89.1</td>
<td>123.3</td>
<td>134.0</td>
<td>89.1</td>
<td>137.0</td>
</tr>
<tr>
<td>14</td>
<td>87.1</td>
<td>121.3</td>
<td>130.3</td>
<td>87.2</td>
<td>133.5</td>
</tr>
<tr>
<td>15</td>
<td>85.3</td>
<td>119.7</td>
<td>127.1</td>
<td>85.6</td>
<td>130.3</td>
</tr>
<tr>
<td>16</td>
<td>83.9</td>
<td>118.5</td>
<td>124.6</td>
<td>84.1</td>
<td>127.9</td>
</tr>
<tr>
<td>17</td>
<td>82.8</td>
<td>117.2</td>
<td>122.5</td>
<td>82.8</td>
<td>126.4</td>
</tr>
<tr>
<td>18</td>
<td>81.9</td>
<td>116.1</td>
<td>121.1</td>
<td>81.8</td>
<td>124.9</td>
</tr>
<tr>
<td>19</td>
<td>81.1</td>
<td>115.2</td>
<td>119.8</td>
<td>81.0</td>
<td>123.4</td>
</tr>
<tr>
<td>20</td>
<td>75.9</td>
<td>114.2</td>
<td>98.6</td>
<td>70.9</td>
<td>121.8</td>
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<tr>
<td>21</td>
<td>47.9</td>
<td>75.0</td>
<td>59.9</td>
<td>53.4</td>
<td>73.9</td>
</tr>
<tr>
<td>22</td>
<td>32.8</td>
<td>53.0</td>
<td>34.7</td>
<td>41.3</td>
<td>53.0</td>
</tr>
<tr>
<td>23</td>
<td>23.7</td>
<td>37.2</td>
<td>23.3</td>
<td>33.1</td>
<td>40.1</td>
</tr>
<tr>
<td>24</td>
<td>17.9</td>
<td>26.9</td>
<td>16.7</td>
<td>26.8</td>
<td>31.6</td>
</tr>
<tr>
<td>25</td>
<td>14.3</td>
<td>20.7</td>
<td>12.6</td>
<td>23.0</td>
<td>26.1</td>
</tr>
<tr>
<td>26</td>
<td>11.8</td>
<td>16.6</td>
<td>9.6</td>
<td>20.2</td>
<td>22.2</td>
</tr>
<tr>
<td>27</td>
<td>9.7</td>
<td>13.6</td>
<td>7.3</td>
<td>17.8</td>
<td>18.8</td>
</tr>
<tr>
<td>28</td>
<td>8.0</td>
<td>11.0</td>
<td>5.6</td>
<td>15.6</td>
<td>15.7</td>
</tr>
<tr>
<td>29</td>
<td>6.6</td>
<td>9.0</td>
<td>4.3</td>
<td>13.6</td>
<td>13.1</td>
</tr>
<tr>
<td>30</td>
<td>5.4</td>
<td>7.3</td>
<td>3.2</td>
<td>11.9</td>
<td>10.6</td>
</tr>
</tbody>
</table>

Total Avg Man Years 4641.0 5519.8 5902.5 5395.4 6218.9

SOURCE: Office of the Actuarial Consultant, DOD.

\(^a\)Average man years based on a one-million-man entry.
(2) \[
A \left[ \sum_{i=0}^{20r3} M_i + RRI \sum_{i=30r4}^{} M_i \right] = SS,
\]

where \( A = \text{annual accessions} \div 1,000,000. \)

\( M_i = \text{average man years for each year completed service as given by Decrement Table (Table 10).} \)

\( RRI = \text{retention rate increase.} \)

\( SS = \text{service strength in average man years (Table 6).} \)

Table 7 entries without training reductions may now be found by dividing the product of \( M_i \) and \( A \) into \( SS \).

The third calculation concerns the beneficial overall impact of having to train fewer men: less training means a smaller training establishment and less overhead in general to support any given number of operating or output forces. This impact is iterative. If operating forces are held constant and the number of accessions are cut, then the training forces are proportionately reduced, which implies a cut in the supporting and transient/patient categories, as well as a further reduction in the training forces. The reduction process can be described as a simultaneous equation (see pp. 29-32, "The Effect of Training Savings on Force Size") which can be approximated by the geometric series:

(3) \[
FR = \frac{a r}{1 - r},
\]

where \( a = \text{the reduced accessions of a volunteer force (Table 12)}, \)

\( FR = \text{force reduction from reduced accessions}, \)

and

(4) \[
r = T + T(S/2 + P),
\]

where the initials stand for the force heading of Table 11.
Table 11
MEAN ALLOCATION OF MILITARY PERSONNEL BY PROGRAM CATEGORY: 1958-1962
(In percent)

<table>
<thead>
<tr>
<th>Services</th>
<th>(O) Operating Forces</th>
<th>(S) Supporting Forces</th>
<th>(T) Training Forces</th>
<th>(F) Transients 6 Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>64.6</td>
<td>16.6</td>
<td>16.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Non-Army</td>
<td>63.1</td>
<td>15.5</td>
<td>17.4</td>
<td>4.0</td>
</tr>
<tr>
<td>Navy</td>
<td>60.1</td>
<td>16.0</td>
<td>16.8</td>
<td>7.0</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>63.2</td>
<td>10.2</td>
<td>19.6</td>
<td>7.0</td>
</tr>
<tr>
<td>Air Force</td>
<td>65.8</td>
<td>16.7</td>
<td>17.3</td>
<td>0.2</td>
</tr>
</tbody>
</table>


*Weighted average by accessions.

Table 12
VOLUNTEER AND DRAFT-INDUCED ACCESSIONS
(In thousands)

<table>
<thead>
<tr>
<th>Group</th>
<th>(1) Volunteer Force</th>
<th>(2) Draft-Induced Force</th>
<th>(3) Accessions Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>124.0</td>
<td>217.1</td>
<td>0.429</td>
</tr>
<tr>
<td>Non-Army</td>
<td>208.7</td>
<td>247.6</td>
<td>0.157</td>
</tr>
<tr>
<td>Navy</td>
<td>87.6</td>
<td>98.7</td>
<td></td>
</tr>
<tr>
<td>Marine Corps</td>
<td>29.4</td>
<td>34.3</td>
<td></td>
</tr>
<tr>
<td>Air Force</td>
<td>91.7</td>
<td>114.6</td>
<td></td>
</tr>
<tr>
<td>DOD</td>
<td>332.7</td>
<td>498.6</td>
<td>0.333</td>
</tr>
</tbody>
</table>

*From Eq. (2).

Numbers do not sum to DOD Decrement total because the theoretically correct Army and Marine Corps components cannot be computed from the Decrement Tables.

Based on actual 1958-1965 experience rather than Decrement Tables.

Army and non-Army estimates are low because Army and Marine Corps accessions are based on lower historical data rather than the higher Decrement data. This leads to a smaller training saving and a slightly higher accession requirement.

Enlisted costs are entirely based on Army and non-Army estimates. In this study only relatively small incremental officer costs have been based on DOD aggregates.
Inserting the parameters of Tables 11 and 12 into Eqs. (3) and (4) yields the following force reductions:

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>.096</td>
</tr>
<tr>
<td>Non-Army</td>
<td>.038</td>
</tr>
<tr>
<td>DOD</td>
<td>.059</td>
</tr>
</tbody>
</table>

Table 7 entries which include training reductions can now be calculated by

\[
\begin{align*}
    m_i &= (1 - FR)(A)M_i, \quad i = 0, \ldots, 3, \\
    m_j &= (1 - FR)(A)(RRI)M_j, \quad j = 3 \text{ or } 4, \ldots, 30,
\end{align*}
\]

Equation (5), with the non-career/career break occurring at the third-year point, yields the Army column of Table 7 directly. The non-Army column is weighted by the volunteer force accessions given in Table 12. Finally, we list below the annual accessions required \([(A)(1 - FR)]\) to support the average man-years in Table 7.

<table>
<thead>
<tr>
<th></th>
<th>Accessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>112,100</td>
</tr>
<tr>
<td>Non-Army</td>
<td>200,800</td>
</tr>
<tr>
<td>DOD</td>
<td>312,900</td>
</tr>
</tbody>
</table>

The Effect of Training Savings on Force Size

Assuming (1) linearity; (2) operating forces held constant in size, and (3) only half the supporting forces respond to iterative reductions in the training, supporting, and transient/patient categories, the exact formula for training savings is

\[
\begin{align*}
    A &= A_0 \left( \frac{\bar{O} + S + T + P}{P_0} \right) = a_0 (\bar{O} + S + T + P), \\
    T &= a_1 A, \\
    S &= a_2 T + \beta_2 P + \gamma_2 \bar{O} + \delta_2 (S - \overline{S}_0) + \overline{S}_0, \\
    P &= a_3 T + \beta_3 P + \gamma_3 \bar{O} + \delta_3 S,
\end{align*}
\]
where \( \bar{O} \) = number in operating category, to be held constant.
\( T \) = number in training category.
\( S \) = number in supporting category.
\( P \) = number in patient and transient category.
\( S_o \) = minimal support base (i.e., the initial 1/2 that is invariant).
\( A_o \) = "raw" accessions/year required in a volunteer force before training reduction (Table 12).
\( A \) = "true" accessions/year.
\( F_o \) = initial enlisted strengths (Table 6).

Rearranging equations (6) to (9) into the generalized matrix form gives

\[
\begin{align*}
(10) \quad &A \quad - \quad \alpha_o S \quad - \quad \alpha_o T \quad - \quad \alpha_o P \quad = \quad \alpha_o \bar{O} , \\
(11) \quad &\alpha_1 A \quad = \quad T \quad = \quad 0 , \\
(12) \quad &\delta_2 S + \alpha_2 T \quad + \quad \beta_2 P \quad = \quad -\gamma_2 \bar{O} + \delta_2 \bar{S}_o \quad - \quad \bar{S}_o , \\
(13) \quad &\delta_3 S + \alpha_3 T \quad + \quad (\beta_3 - 1)P \quad = \quad -\delta_3 \bar{O} .
\end{align*}
\]

The coefficients for these equations can be found in Table 11. These coefficients imply that for every 100 Army men, 16.6 are needed in supporting forces, etc. Therefore,

\[
\begin{align*}
(14) \quad &\alpha_2 = \beta_2 = \gamma_2 = \delta_2 \quad \text{which equals} \quad S/2 \quad \text{or} \quad .083 \quad \text{for the Army}, \\
(15) \quad &\alpha_3 = \beta_3 = \gamma_3 = \delta_3 \quad \text{which equals} \quad P \quad \text{or} \quad .021 \quad \text{for the Army}.
\end{align*}
\]

The constants can be computed from the force levels of Table 6, the volunteer accessions from Table 12, and the proportion of operating and supporting forces from Table 11. For the Army, these give

\[
\begin{align*}
(16) \quad &\bar{O} = .646(846,500) = 546,839 , \\
(17) \quad &A_o \quad = \quad 124,000; \quad \alpha_o = \frac{A_o}{846,500} \quad = \quad .1465 .
\end{align*}
\]
\( S_o = 0.083(846,500) = 70,260 \),

\( a_1 = \frac{0.166(846,500)}{217,100} = 0.647 \).

Substituting values (14) through (19) into Eqs. (10) through (13) yields the solution:

\[
\begin{align*}
A &= 111,769 \\
S &= 127,751 \\
T &= 72,314 \\
P &= 16,021 \\
S + T + P &= 216,086 \\
\bar{O} &= 546,839 \\
\text{Force Strength} &= 762,925 \\
\text{Force reduction} &= 1 - \frac{762,925}{846,500} = 1 - 0.901 = 0.099
\end{align*}
\]

The percentage category relationships for the Army follow:

<table>
<thead>
<tr>
<th>Category</th>
<th>Volunteer</th>
<th>Draft-induced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Forces</td>
<td>71.7</td>
<td>64.6</td>
</tr>
<tr>
<td>Supporting Forces</td>
<td>16.7</td>
<td>16.6</td>
</tr>
<tr>
<td>Training Forces</td>
<td>9.5</td>
<td>16.6</td>
</tr>
<tr>
<td>Transients/Patients</td>
<td>2.1</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Thus operating forces have increased in percentage terms at the expense of training forces. Support forces are also slightly higher due to the overhead assumption.

The approximation indicated by Eqs. (3) and (4) for the geometric progression yields the series

\[
\frac{\Delta F}{F_0} = ar + ar [(1 - \alpha)r] + ar [(1 - \alpha)r]^2 + \ldots
\]

\[
= \frac{ar}{1 - (1 - \alpha)r}
\]

\[
= \frac{ar}{1 - r + ar}
\]

However, Eq. (22) underestimates the true force reduction because its \( r \) term excludes the interaction between the supporting
and transient/patient categories. By dropping the ar term in the denominator, we get the closer approximation:

\[
\frac{\Delta F}{F_0} = \frac{ar}{1 - r}.
\]

In the case of the Army, Eq. (23) yielded a force reduction of .096 rather than the true estimate of .099. The advantage of Eq. (23) is its simplicity. Equation (23) also gives a slight underestimate. This means a slight overestimate of total costs because of lower training savings and a slightly higher accession estimate of 112,100 instead of 111,800.

Other Studies

How do our annual accession requirements of 112,100 Army and 200,800 non-Army, comprising a DOD total of 312,900, compare with other studies? Altman and Fechter cite at length the 1964-65 DOD Study, which set the tone of the public policy discussion with its mean cost estimates of $5.4 to $8.3 billion (but with high standard deviations).\(^1\) They estimate that to maintain a 2.65-million-man active force, 500,000 entrants would be required at the overall rate of 5.5-percent unemployment, and 512,000 at 4-percent unemployment. The accession inflow required for the pre-Vietnam draft-induced Decrement Table is 498,600 (Table 7). Rounded off, this is 500,000. The DOD cost estimate therefore really is an initial transitional cost, rather than a long-term steady-state cost. Furthermore their estimates do not consider the transitioning to voluntarism with the draft or a phasedown from the high Vietnam levels. Draft assistance is desirable not only as a hedge against the estimates and to reduce transitional costs, but also to prevent long-run distortions in the military pay structure.

Oi corrects for the DOD transition costs and estimates an accession requirement of 333,500.\(^1\) This agrees with our own estimate in Table 12 of 332,700 before training reductions. Oi excludes training force reductions, but states they would be "at least 3 percent and still retain the same number of men in an 'effective' status."\(^2\) We estimated these reductions as 9.6 and 3.8 percent for Army and non-Army respectively. With this correction, our required annual accessions to support a 2.65-million-man effective force are 312,900. Our gross total thus corresponds to Oi's calculations.

The major and crucial difference is the Army estimate. Oi estimates Army accessions at 144,600.\(^3\) Our comparable estimate is 124,000, which drops to 112,100 after the 9.6-percent training correction. Since the Army is the Service that drives voluntarism's cost estimates, this 29-percent difference in accession requirements is extremely important; particularly if non-Army enlistees receive the Army wage as Oi presupposes.

Oi implies that Army accessions will be 144,600 of 333,500, or 43.4 percent of volunteer military accessions. His own figures show that Army enlisted accessions averaged 45.5 percent during the 1960-1965 period. Yet replacing draftees with longer-term, higher-retention propensity volunteers suggests that the Army's share of accessions will now correspond more closely to its 36.3 percent share of total manpower (Table 6). Reconstructing his calculations from the appendix in the longer unpublished version of his American Economic Review article, Oi apparently inadvertently used the Multiple Decrement Table for all DOD personnel, rather than only Army personnel. Substituting the 1965 Multiple Decrement Table for Regular Army enlisted personnel into his own Table 2.5 to get a lower turnover rate, using his true volunteer retention rate of 33.0 percent, and his Army force strength of 857,000 (versus our 846,500), Oi's corrected accession requirement is 123,840. This corresponds to our own estimate of 124,000 before the 9.6-percent training drawdown.

\(^2\) Ibid., p. 50.
\(^3\) Ibid., p. 48.
Appendix B

PERCEIVED PRESENT VALUE OF OFFICER PAY

In 1968, a second Lieutenant with under two years of service received the following:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic pay</td>
<td>$4118</td>
</tr>
<tr>
<td>Quarters allowance</td>
<td>1321</td>
</tr>
<tr>
<td>Subsistence</td>
<td>575</td>
</tr>
<tr>
<td>Tax advantage</td>
<td>333</td>
</tr>
</tbody>
</table>

$6347

He perceives only 76 percent of this amount ($4824). After 18 months, he becomes a First Lieutenant, and his second year perceived pay is $5365. His perceived third-year pay climbs to $6049. Assuming a three-year tour, his subjectively discounted three-year perceived pay is

$$PPV = \frac{4824}{1 + .10} + \frac{5365}{(1 + .10)^2} + \frac{6049}{(1 + .10)^3} = 14,700.$$  

Assuming a pay increase of 10 percent, their figure would increase to $16,170 for 1970.

The 1970 average DOD "Total Income" of first-term officers is assumed to be ($6347 + $6850 + $7550)(1 + 10 percent)/3 = $7600.


2Cheney indicates the discount rate for officers is about 10 percent.
Appendix C

THE INCREMENTAL LONGEVITY, RETIREMENT AND TRAINING COSTS OF A VOLUNTEER FORCE

Substituting true volunteers for draftees and draft-induced volunteers implies a force with longer enlistments, higher retention rates, and consequently less personnel turnover. Such a force would be more productive as well as more costly. These costs are of three types: (1) higher pay for personnel with more years of service, (2) more retirees, and (3) a negative cost (saving) due to reduced training. All are future costs and would not immediately affect voluntarism's budget costs. Higher pay due to increased seniority and reduced training requirements would not be felt until two years after voluntarism is installed; although the full impact would not be felt until 30 years later, it would be substantial by the eighth year. Increased retirement costs would not impact until 20 years later because military retirement is currently an unfunded system and funds are disbursed on a past-services basis.

In this study we show both the incremental short-run transition and long-run steady-state budget costs of voluntarism with the emphasis, of course, on the latter. We assume that the present pay profile will be maintained under voluntarism except for the increased costs for first-timers. That is, we assume the lifetime pay profile of the average enlisted man will not fall because of a slower promotion pattern under voluntarism. This assumption facilitates comparisons and insures that voluntarism will not lower career wages.

SENIORITY (OR LONGEVITY) COSTS

Voluntarism's incremental costs due to higher retention rates can be calculated by this formula:

\[ \Delta C = (1.233)(1.204) \sum_{i=0}^{30} B_i (N_i^V - N_i^{DI}) \]
where $i$ = completed years of service.

$B_i$ = base pay by years of service, Table 13.

$N_i$ = number of personnel in their $i^{th}$ year of service in the volunteer (V) and draft-induced systems (DI), Table 13.

1.233 = an adjustment factor representing compensation as functionally related to basic pay, Table 14.

1.204 = an adjustment factor representing basic pay raises of 6.9 and 12.6 percent since 30 June 1968.

The manpower frequencies and wage costs summarized in Table 13 are sensitive to both force levels and assumed retention rates.\(^1\) Table 14 shows the various percentage relationships among items of military compensation. In fact, many items have a constant absolute per capita cost rather than a constant percentage markup above base pay. Only the quarters allowance is closely related to basic pay, so the 1.233 cost blowup factor in (24) is taken from the quarters line (line 4), column 3, Table 14.

Table 13 shows basic pay costs of $8,004,196 and $7,101,165 thousand for the volunteer and draft-induced systems. Correcting for rounding errors to a 2.31-million enlisted force, these basic pay costs become $8,006,597 and $7,094,676 thousand, respectively. Multiplying this difference by (1.223)(1.204) yields a differential of +$1,342,800 thousand.

**RETIREMENT COSTS**

The second major long-run cost in going to a volunteer system stems from increased retirement. Incremental retirement cost computations are complex and cannot be derived entirely from DOD sources, which underestimate the economic accrual costs of retirement.

Incremental retirement costs can be computed as follows:

\[(25) \quad \Delta RC = (0.365)(1.204) F \sum_{i=0}^{30} B_i N_i P_i,\]

---

\(^1\) Table 13 supposes a force level of 2.65 million men (of which 2.31 million are enlisted men), and reenlistment rates of 34.3 and 38.0 percent for the Army and non-Army enlistees. It does not include the saving in training personnel. See Appendix I for the cost impact of alternative retention rates.
Table 13

BASIC PAY AND NUMBER OF PERSONNEL, BY YEARS OF SERVICE
(In thousands)

<table>
<thead>
<tr>
<th>Years of Completed Service</th>
<th>Average Annual Basic Pay (Actual Dollars)</th>
<th>Volunteer Force</th>
<th>Draft-Induced Force</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Actual Dollars)(^a)</td>
<td>(3) Number of Personnel(^b)</td>
<td>(4) Cost</td>
</tr>
<tr>
<td>0</td>
<td>$1440</td>
<td>318</td>
<td>$458,281</td>
</tr>
<tr>
<td>1</td>
<td>1973</td>
<td>294</td>
<td>580,240</td>
</tr>
<tr>
<td>2</td>
<td>2762</td>
<td>277</td>
<td>764,118</td>
</tr>
<tr>
<td>3</td>
<td>3009</td>
<td>191</td>
<td>574,638</td>
</tr>
<tr>
<td>4</td>
<td>3401</td>
<td>114</td>
<td>386,262</td>
</tr>
<tr>
<td>5</td>
<td>3515</td>
<td>99</td>
<td>347,616</td>
</tr>
<tr>
<td>6</td>
<td>3797</td>
<td>92</td>
<td>350,923</td>
</tr>
<tr>
<td>7</td>
<td>3864</td>
<td>85</td>
<td>327,497</td>
</tr>
<tr>
<td>8</td>
<td>4106</td>
<td>75</td>
<td>309,609</td>
</tr>
<tr>
<td>9</td>
<td>4210</td>
<td>69</td>
<td>290,187</td>
</tr>
<tr>
<td>10</td>
<td>4393</td>
<td>65</td>
<td>284,825</td>
</tr>
<tr>
<td>11</td>
<td>4424</td>
<td>62</td>
<td>274,576</td>
</tr>
<tr>
<td>12</td>
<td>4655</td>
<td>60</td>
<td>279,682</td>
</tr>
<tr>
<td>13</td>
<td>4691</td>
<td>56</td>
<td>275,531</td>
</tr>
<tr>
<td>14</td>
<td>4904</td>
<td>58</td>
<td>282,323</td>
</tr>
<tr>
<td>15</td>
<td>4970</td>
<td>57</td>
<td>281,665</td>
</tr>
<tr>
<td>16</td>
<td>5127</td>
<td>56</td>
<td>286,861</td>
</tr>
<tr>
<td>17</td>
<td>5291</td>
<td>55</td>
<td>292,836</td>
</tr>
<tr>
<td>18</td>
<td>5423</td>
<td>55</td>
<td>297,050</td>
</tr>
<tr>
<td>19</td>
<td>5582</td>
<td>52</td>
<td>288,098</td>
</tr>
<tr>
<td>20</td>
<td>5776</td>
<td>33</td>
<td>189,043</td>
</tr>
<tr>
<td>21</td>
<td>5947</td>
<td>23</td>
<td>133,879</td>
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<td>22</td>
<td>6264</td>
<td>16</td>
<td>101,627</td>
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<td>23</td>
<td>6384</td>
<td>12</td>
<td>77,783</td>
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<td>24</td>
<td>6508</td>
<td>10</td>
<td>63,010</td>
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<tr>
<td>25</td>
<td>6668</td>
<td>8</td>
<td>53,031</td>
</tr>
<tr>
<td>26</td>
<td>7504</td>
<td>7</td>
<td>49,354</td>
</tr>
<tr>
<td>27</td>
<td>7627</td>
<td>5</td>
<td>41,132</td>
</tr>
<tr>
<td>28</td>
<td>7758</td>
<td>4</td>
<td>34,539</td>
</tr>
<tr>
<td>29</td>
<td>7758</td>
<td>4</td>
<td>27,983</td>
</tr>
<tr>
<td>30+</td>
<td>7324</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>$2841(^c)</td>
<td>2313</td>
<td>$8,004,196</td>
</tr>
</tbody>
</table>

Corrected for Rounding Errors

|                             | 2314 | $8,006,597 | 2314 | $7,094,676 |

\(^a\) Average Annual Basic Pay for Military Personnel (Enlisted) on Active Duty 30 June 1968 by Length of Service for Pay Purposes, 1968 pay scale, Office of Assistant Secretary of Defense, Manpower, Actuarial Consultant, 16 December 1968.

\(^b\) Before training reductions. Costing was based on non-rounded numbers.

\(^c\) Weighted average.
### Table 14

**ITEMS AND PERCENTAGE RELATIONSHIPS OF MILITARY COMPENSATION**

<table>
<thead>
<tr>
<th>Item</th>
<th>(1) Cost to Government ($ million)</th>
<th>(2) Percent of Basic Pay</th>
<th>(3) Percent of Salary</th>
<th>(4) Percent of Military Pay Items</th>
<th>(5) Percent of Civilian Pay Items</th>
<th>(6) Percent of Civilian Gross</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items comparable to civilian compensation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salary</td>
<td>24,104.7</td>
<td>210.9</td>
<td>144.3</td>
<td>100.0</td>
<td>100.0</td>
<td>113.8</td>
</tr>
<tr>
<td>Quarters</td>
<td>16,707.0</td>
<td>146.1</td>
<td>100.0</td>
<td>69.3</td>
<td>87.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Subsistence</td>
<td>2,663.7</td>
<td>23.3</td>
<td>15.9</td>
<td>11.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax advantage</td>
<td>1,750.4</td>
<td>15.3</td>
<td>10.5</td>
<td>7.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash supplements</td>
<td>861.0</td>
<td>7.5</td>
<td>5.2</td>
<td>3.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal reenlistment bonus</td>
<td>463.1</td>
<td>4.1</td>
<td>2.8</td>
<td>1.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differential pays</td>
<td>178.5</td>
<td>1.6</td>
<td>1.1</td>
<td>0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Variable reenlistment bonus</td>
<td>284.6</td>
<td>2.5</td>
<td>1.7</td>
<td>1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proficiency pay</td>
<td>94.2</td>
<td>0.8</td>
<td>0.6</td>
<td>0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special pay to medical personnel</td>
<td>147.9</td>
<td>1.3</td>
<td>0.9</td>
<td>0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fringe benefits, minus retirement</td>
<td>42.5</td>
<td>0.4</td>
<td>0.3</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependent's indemnity compensation</td>
<td>1,576.6</td>
<td>13.8</td>
<td>9.4</td>
<td>6.5</td>
<td>9.8</td>
<td>11.2</td>
</tr>
<tr>
<td>Death gratuity</td>
<td>130.5</td>
<td>1.1</td>
<td>0.8</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social security</td>
<td>469.3</td>
<td>4.1</td>
<td>2.8</td>
<td>1.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical care</td>
<td>441.0</td>
<td>3.9</td>
<td>2.6</td>
<td>1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commissary and exchange&lt;sup&gt;a&lt;/sup&gt;</td>
<td>110.2</td>
<td>1.0</td>
<td>0.7</td>
<td>0.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortgage insurance</td>
<td>5.4</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployment compensation</td>
<td>29.6</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Separation pays</td>
<td>336.5</td>
<td>3.1</td>
<td>2.1</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retirement, current year accrual</td>
<td>5,358.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>46.9</td>
<td>32.1</td>
<td>22.2</td>
<td>2.3</td>
<td>2.6</td>
</tr>
</tbody>
</table>

Non-compensation items associated with special job-related risks and characteristics

| Risk and hazardous duty pays              | 1,424.9                           | 12.5                     | 8.5                   | 5.9                               |                                   |                               |
| SGLI (extra hazard premium)               | 550.8                             | 4.8                      | 3.3                   | 2.3                               |                                   |                               |
| Clothing issues and allowances            | 80.2                              | 0.7                      | 0.5                   | 0.3                               |                                   |                               |
| Personal money allowance                  | 445.9                             | 3.9                      | 2.7                   | 1.8                               |                                   |                               |
| Family separation allowance               | 0.2                               | 0.0                      | 0.0                   | 0.0                               |                                   |                               |
| Dislocation allowance                     | 128.2                             | 1.1                      | 0.8                   | 0.5                               |                                   |                               |
| Overseas station allowance                | 66.7                              | 0.6                      | 0.4                   | 0.3                               |                                   |                               |
| Burial costs                               | 142.9                             | 1.3                      | 0.9                   | 0.6                               |                                   |                               |


<sup>a</sup>These costs are underestimated because land and capital costs are excluded. Another minor fringe benefit excluded from the table is recreation.

<sup>b</sup>The official DOD accrual cost was $2,502.2 million, but this figure underestimates true accrual costs by 53 percent. The corresponding budget disbursement cost was $2,093.5 million.
where \( i \) = completed years of service.

\[ P_i \] = probability that person in \( i \)th year of service will stay until retirement, Table 16.

\[ N_i \] = number in the draft-induced system with \( i \) years of service, Table 13.

\( B \) = basic pay, Table 13.

\( F \) = Government cost as percentage of basic pay, Table 15.

1.365 = the relative increase in Retirees (volunteer versus draft-induced system) before the training reduction:

\[
\text{in Table 13} \left( \frac{N_{\text{v}}}{N_{\text{DI}}} \right) = 1.365.
\]

1.204 = increase in basic pay since 1968.

The complex calculation is \( F \). This requires computing retirement costs as a function of basic pay for individuals who retire with certainty from military service. The next step is to weigh these costs by the rank and years of service of those retiring, as in Table 13. The weighted factor \( F \) (derived as a weighted average of Column 4, Table 15) is .886 of basic pay. Thus, the Government's cost for an enlisted careerist averages 88.6 percent of his basic pay during each year of service.

Table 15

<table>
<thead>
<tr>
<th>Rank</th>
<th>Average Years of Service Completed</th>
<th>Percent of FYs 1963 and 1964 Retirees</th>
<th>Basic Pay Factor(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-9</td>
<td>25</td>
<td>3.1</td>
<td>.915</td>
</tr>
<tr>
<td>E-8</td>
<td>24</td>
<td>8.1</td>
<td>.901</td>
</tr>
<tr>
<td>E-7</td>
<td>21</td>
<td>32.6</td>
<td>.895</td>
</tr>
<tr>
<td>E-6</td>
<td>20</td>
<td>27.7</td>
<td>.907</td>
</tr>
<tr>
<td>E1-5</td>
<td>20</td>
<td>28.4</td>
<td>.847</td>
</tr>
</tbody>
</table>

\(^a\) Number of Retirements from Active Duty by Active Duty Pay Grade and Service, fiscal years 1963 and 1964, Office of Assistant Secretary of Defense, Manpower, 12 April 1965.

Table 16 shows

\[ \sum_{i=0}^{30+} B_{iNP_i} = $3,887.8 \text{ million} \].

Multiplying this by .886 yields a retirement cost of $3443.7 million for the pre-Vietnam draft-induced system. The corresponding DOD accrual cost estimate is only 23 percent of its base payroll of $7094.7\text{ million}, or $1.6318 \text{ million}.\footnote{The DOD Actuarial Consultant lists retirement costs as 23 and 23.76 percent of basic pay for enlisted men and officers, respectively. Cost of Military Retirement Benefits for Entrants without Prior Military Service Stated as a Percentage of Basic Pay, Office of Assistant Secretary of Defense, Manpower, 10 August 1967.} Thus DOD underestimates its enlisted accrual costs by 52.6 percent.

Multiplying $3443.8 \text{ million}$ by (.365)(1.204) in formula (25) yields an increased retirement cost of $1512.2 \text{ million}$. If we were to use the DOD accrual method (as others have), our incremental retirement costs would be only $716.7 \text{ million}$ and, correspondingly, our overall cost estimate of voluntarism would be $80.8 \text{ billion lower}$.

**TRAINING COSTS**

A volunteer military has lower personnel turnover because it substitutes true volunteers with higher reenlistment propensities for draftees and draft-induced volunteers. Lower personnel turnover, in turn, means fewer annual accessions are needed to maintain force size. Also, fewer training personnel are needed to instruct the diminished flow of new recruits, so a secondary reduction in force size is possible. Table 17 gives the reduction in accessions and in overall forces made possible by voluntarism.

The obvious and more accurate method to cost the training saving is via the classified Five Year Programs Document; the unclassified method adopted here fully costs only military manpower savings. This gives an underestimate of savings because civilian manpower, procurement, and construction to support training are necessarily excluded.
### Table 16

RETIREMENT COST AND PROBABILITY OF RETIRING

<table>
<thead>
<tr>
<th>(1) Years of Completed Service</th>
<th>(2) Draft-Induced Cost(^a) (In $ thousand)</th>
<th>(3) Probability Factor(^b)</th>
<th>(4) Columns 2 X 3 (In $ thousand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$ 689,066</td>
<td>.091</td>
<td>$ 62,705</td>
</tr>
<tr>
<td>1</td>
<td>871,235</td>
<td>.098</td>
<td>85,381</td>
</tr>
<tr>
<td>2</td>
<td>807,675</td>
<td>.146</td>
<td>117,921</td>
</tr>
<tr>
<td>3</td>
<td>577,866</td>
<td>.221</td>
<td>127,708</td>
</tr>
<tr>
<td>4</td>
<td>287,228</td>
<td>.497</td>
<td>142,752</td>
</tr>
<tr>
<td>5</td>
<td>258,029</td>
<td>.568</td>
<td>146,561</td>
</tr>
<tr>
<td>6</td>
<td>261,127</td>
<td>.604</td>
<td>157,721</td>
</tr>
<tr>
<td>7</td>
<td>242,883</td>
<td>.658</td>
<td>159,817</td>
</tr>
<tr>
<td>8</td>
<td>228,918</td>
<td>.740</td>
<td>169,399</td>
</tr>
<tr>
<td>9</td>
<td>214,331</td>
<td>.808</td>
<td>173,180</td>
</tr>
<tr>
<td>10</td>
<td>210,473</td>
<td>.856</td>
<td>180,165</td>
</tr>
<tr>
<td>11</td>
<td>202,960</td>
<td>.892</td>
<td>181,040</td>
</tr>
<tr>
<td>12</td>
<td>206,770</td>
<td>.918</td>
<td>189,815</td>
</tr>
<tr>
<td>13</td>
<td>203,608</td>
<td>.937</td>
<td>190,781</td>
</tr>
<tr>
<td>14</td>
<td>208,518</td>
<td>.953</td>
<td>198,718</td>
</tr>
<tr>
<td>15</td>
<td>207,945</td>
<td>.965</td>
<td>200,667</td>
</tr>
<tr>
<td>16</td>
<td>211,730</td>
<td>.973</td>
<td>206,013</td>
</tr>
<tr>
<td>17</td>
<td>216,106</td>
<td>.980</td>
<td>211,783</td>
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<td>.985</td>
<td>215,867</td>
</tr>
<tr>
<td>19</td>
<td>211,106</td>
<td>.989</td>
<td>208,783</td>
</tr>
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<td>20</td>
<td>137,914</td>
<td>1.000</td>
<td>137,914</td>
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<td>97,257</td>
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<td>74,097</td>
<td>1.000</td>
<td>97,257</td>
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<td>56,945</td>
<td>1.000</td>
<td>74,097</td>
</tr>
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<td>46,311</td>
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</tr>
<tr>
<td>25</td>
<td>39,094</td>
<td>1.000</td>
<td>39,094</td>
</tr>
<tr>
<td>26</td>
<td>36,439</td>
<td>1.000</td>
<td>36,439</td>
</tr>
<tr>
<td>27</td>
<td>30,432</td>
<td>1.000</td>
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</tr>
<tr>
<td>28</td>
<td>25,586</td>
<td>1.000</td>
<td>25,586</td>
</tr>
<tr>
<td>29</td>
<td>20,760</td>
<td>1.000</td>
<td>20,760</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>$7,101,565</td>
<td></td>
<td>$3,891,613</td>
</tr>
<tr>
<td>Corrected Total</td>
<td>$7,094,676</td>
<td></td>
<td>$3,887,838</td>
</tr>
</tbody>
</table>

\(^a\) Table 13.

\(^b\) Percentage of Military Personnel (Enlisted) on Active Duty 30 June 1965 Expected to Continue on Active Duty Until Retirement by Length of Service, Office of Assistant Secretary of Defense, Manpower, Actuarial Consultant, 2 August 1966.
Table 17

ENLISTED MEN: ACESSIONS AND FORCE REDUCTIONS FROM VOLUNTARISM
(In thousands)

<table>
<thead>
<tr>
<th>Service</th>
<th>Type of Force</th>
<th>Total Accessions</th>
<th>Force Size Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Volunteer</td>
<td>Draft-Induced(^a)</td>
<td>Reduction</td>
</tr>
<tr>
<td>Army</td>
<td>112.1</td>
<td>217.1</td>
<td>.484</td>
</tr>
<tr>
<td>Non-Army</td>
<td>200.8</td>
<td>247.6</td>
<td>.189</td>
</tr>
<tr>
<td>DOD</td>
<td>312.9</td>
<td>498.6</td>
<td>.372</td>
</tr>
</tbody>
</table>

\(^a\)Based on actual 1958-1965 experience rather than Decrement Tables. Numbers do not sum to DOD Decrement total because the theoretically correct Army and Marine Corps components cannot be computed from the Decrement Tables.

The formula for military manpower savings is

\[
(26) \quad TS = (1.204)(2.159) \sum_{i=0}^{30} B_i \Delta n ,
\]

where \( i \) = completed years of service.

\( B = \) basic pay as of 30 June 1968, Table 13.

\( \Delta n = \) manpower difference permitted by force size reduction, Table 18.

\( 1.204 = \) pay raise since 30 June 1968.\(^1\)

\( 2.159 = \) cost of all compensation elements as a percentage of basic pay, exclusive of the non-budget tax advantage, Table 14, column 3.

Table 18 shows

\[
\sum_{i=0}^{30} B_i \Delta n = \$475.2 \text{ million}.
\]

Multiplied by (1.204)(2.159), this yields a training saving estimate of \$1235.2 million.

\(^1\)This factor is overstated because all pay elements have not risen by this percentage; however, the total training savings estimate is still low due to the previously mentioned exclusions.
Table 18
DOD TRAINING SAVING IN ENLISTED MEN
(In thousands)

<table>
<thead>
<tr>
<th>Years of Service</th>
<th>Avg Man Years Before Training Reduction</th>
<th>Cost</th>
<th>Avg Man Years After 5.9% Training Reduction</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry</td>
<td>333</td>
<td>313</td>
<td>430,933</td>
<td>430,933</td>
</tr>
<tr>
<td>1</td>
<td>318</td>
<td>299</td>
<td>545,525</td>
<td>545,525</td>
</tr>
<tr>
<td>2</td>
<td>394</td>
<td>276</td>
<td>718,424</td>
<td>718,424</td>
</tr>
<tr>
<td>3</td>
<td>277</td>
<td>260</td>
<td>544,849</td>
<td>544,849</td>
</tr>
<tr>
<td>4</td>
<td>191</td>
<td>181</td>
<td>363,223</td>
<td>363,223</td>
</tr>
<tr>
<td>5</td>
<td>114</td>
<td>107</td>
<td>326,772</td>
<td>326,772</td>
</tr>
<tr>
<td>6</td>
<td>99</td>
<td>93</td>
<td>330,191</td>
<td>330,191</td>
</tr>
<tr>
<td>7</td>
<td>92</td>
<td>87</td>
<td>308,135</td>
<td>308,135</td>
</tr>
<tr>
<td>8</td>
<td>85</td>
<td>80</td>
<td>291,218</td>
<td>291,218</td>
</tr>
<tr>
<td>9</td>
<td>75</td>
<td>71</td>
<td>272,867</td>
<td>272,867</td>
</tr>
<tr>
<td>10</td>
<td>69</td>
<td>65</td>
<td>267,832</td>
<td>267,832</td>
</tr>
<tr>
<td>11</td>
<td>65</td>
<td>61</td>
<td>258,233</td>
<td>258,233</td>
</tr>
<tr>
<td>12</td>
<td>62</td>
<td>58</td>
<td>263,031</td>
<td>263,031</td>
</tr>
<tr>
<td>13</td>
<td>60</td>
<td>57</td>
<td>259,074</td>
<td>259,074</td>
</tr>
<tr>
<td>14</td>
<td>59</td>
<td>55</td>
<td>265,434</td>
<td>265,434</td>
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<tr>
<td>15</td>
<td>58</td>
<td>54</td>
<td>264,787</td>
<td>264,787</td>
</tr>
<tr>
<td>16</td>
<td>57</td>
<td>53</td>
<td>269,655</td>
<td>269,655</td>
</tr>
<tr>
<td>17</td>
<td>56</td>
<td>53</td>
<td>275,264</td>
<td>275,264</td>
</tr>
<tr>
<td>18</td>
<td>55</td>
<td>52</td>
<td>279,209</td>
<td>279,209</td>
</tr>
<tr>
<td>19</td>
<td>55</td>
<td>51</td>
<td>270,459</td>
<td>270,459</td>
</tr>
<tr>
<td>20</td>
<td>52</td>
<td>48</td>
<td>177,317</td>
<td>177,317</td>
</tr>
<tr>
<td>21</td>
<td>33</td>
<td>31</td>
<td>125,482</td>
<td>125,482</td>
</tr>
<tr>
<td>22</td>
<td>23</td>
<td>21</td>
<td>95,319</td>
<td>95,319</td>
</tr>
<tr>
<td>23</td>
<td>16</td>
<td>15</td>
<td>73,020</td>
<td>73,020</td>
</tr>
<tr>
<td>24</td>
<td>12</td>
<td>11</td>
<td>59,203</td>
<td>59,203</td>
</tr>
<tr>
<td>25</td>
<td>10</td>
<td>9</td>
<td>49,849</td>
<td>49,849</td>
</tr>
<tr>
<td>26</td>
<td>8</td>
<td>7</td>
<td>46,405</td>
<td>46,405</td>
</tr>
<tr>
<td>27</td>
<td>7</td>
<td>6</td>
<td>38,692</td>
<td>38,692</td>
</tr>
<tr>
<td>28</td>
<td>5</td>
<td>5</td>
<td>32,498</td>
<td>32,498</td>
</tr>
<tr>
<td>29</td>
<td>4</td>
<td>4</td>
<td>26,331</td>
<td>26,331</td>
</tr>
<tr>
<td>30</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Avg Man Years</td>
<td>2313</td>
<td>2176</td>
<td>$7,529,241</td>
<td>7,529,241</td>
</tr>
<tr>
<td>Corrected for Rounding Errors</td>
<td>2314</td>
<td>2177</td>
<td>$7,531,424</td>
<td>7,531,424</td>
</tr>
</tbody>
</table>
OFFICERS

We calculate officer retirement and seniority costs using formulas (24) and (25). Using (25), we obtain retirement cost increases of $214 million. Seniority costs are $230 million from (24). However, a saving of $420 million results from a 5.9-percent reduction in the officer force (equal to the reduction of the enlisted force) permitted by smaller training activity (Eq. 26).

COMPARATIVE COSTS

How do these incremental longevity, retirement, and training costs of +$1.5, +$1.7, and -$1.6 billion compare with the three most publicized estimates of voluntarism's costs? The DOD study by Fechter and Altman excludes longevity costs completely; this can be justified because their estimates are only the short-run costs of a system unassisted by the draft during the changeover.\(^1\) They show retirement costs of $200 to $2040 million, depending on the range of their total budgetary estimates from $3.7 to $16.7 billion. While their retirement costs appear similar to our estimates, theirs are actually underestimated by their own method; by granting careerists pay increases of 15 to 90 percent, they correspondingly raise the cost of each individual retirement benefit. As for training savings, which are excluded in their estimated increases, Fechter and Altman state they "would grow to rather substantial sums and by 1976 would range between $370 and $750 million."\(^2\)

Oi's article explicitly includes greater seniority costs. They are much less than ours because of the pay raises in the interim period, and because ours include the quarters allowance as well as basic pay. As for retirement costs, Oi excludes them by the statement "the budgetary costs of moving to an all-volunteer force would be even higher if one considered the transitional period and additional retirement benefits."\(^3\) Oi also does not quantify the training savings, though he states "the voluntary force strength would be reduced by at least 3 percent."\(^4\) Fisher's study considers none of the cost elements mentioned above.

\(^1\) However the authors themselves claim their primary concern "was estimation of the long-run costs of eliminating the draft," op. cit., p. 29, footnote 19.

\(^2\) Ibid., p. 30.


\(^4\) Ibid., p. 50.
Appendix D

THE SUPPLY ELASTICITY OF VOLUNTEERS

Anthony Fisher's article is notable as the first attempt to derive a supply curve of military volunteers from an underlying economic theory.\(^1\) Assuming a lognormal distribution of civilian opportunities, he argues for a military supply curve of decreasing elasticity.\(^2\) Allowing for draft pressure (annual military accessions divided by youth population), unemployment, and seasonality, he derives and fits a time series supply equation using 1957-1965 quarterly data on Department of Defense enlistments:

\[
E/P = c_0 + c_1 \ln\left(\frac{\text{W}_c}{\text{W}_m}\right) + c_2 \ln(1 - U/P) + c_3 \ln(1 - A/P) + \text{seasonal dummies},
\]

where \(P\) = male civilians aged 17 to 20 years.

\(E\) = enlistments in mental categories I, II and III.
\(E/P\) = enlistment rate.
\(\text{W}_c/\text{W}_m\) = median civilian wages to average military wages in the first term of service.
\(U/P\) = youth unemployment rate.
\(A/P\) = military accession rate.

Fisher shows that his estimated elasticities of 0.46 with a draft and 0.74 without are consistent with previous cross-section estimates. Setting draft pressure (inductions) equal to zero in his equation, however, implies that only 24 percent of enlistments are draft-induced, a


\(^2\)Previous studies by Altman and Fechter, Oi, and Altman have only loosely justified their finding of a decreasing elasticity supply curve. Their specific curve can be derived from a Pareto distribution, although the lognormal distribution is more flexible and fits income size distributions better.
finding that he intelligently questions. He then uses Eq. (27) to project both the enlistment rate in a draft-free world and the wage increase necessary to raise this rate sufficiently to stock a 2.65-million-man force in 1965. His incremental cost estimates to establish voluntarism in 1965 are between $2.4 and $6.9 billion, depending on the youth unemployment rate, the increase in comparable civilian wages, and whether wage increases are granted to the career force.

Proceeding from the specific to the general, two questions may be raised about the methods used:

1. Are the key supply parameters of Eq. (27) reliably estimated?
2. Are Fisher's results consistent with his supply theory?

ESTIMATING THE MILITARY SUPPLY CURVE

Fisher shows that his supply elasticity of 0.74 is consistent with previous findings. Earlier cross-section estimates were based upon only nine regional observations and excluded such plausible enlistment causes as regional preferences, educational levels, and variances in the income distribution. The simultaneity between enlistments and youth unemployment was recognized but not avoided. Conversely, Fisher evades simultaneity by lagging his causal variables, and his time series contains sufficient observations. We are not told, however, that (1) there is strong serial correlation in the residuals of Eq. (27); (2) there is a simultaneous equations bias in ES; and (2) there is the implied elasticity of enlistments to the unemployment rate of only 0.18.

It is well known that the enlistment rate E/P varies seasonally, but there is perhaps no need to introduce seasonal dummies into Eq. (27) because A/P, the draft pressure surrogate, is also seasonal. In fact, seasonal dummies are associated with serial-correlated residuals in Eq. (27) as shown by the Durbin-Watson statistic in Table 19. The wage coefficient remains unchanged, but its standard error increases when dummies are eliminated. The unemployment and draft pressure coefficients

---

1 For example, Altman and Fechter, and Oi.
Table 19

IMPACT OF SEASONAL DUMMY VARIABLES IN EQUATION (27)\textsuperscript{a}

<table>
<thead>
<tr>
<th>Coefficients of Eq. (27)</th>
<th>ln((W_c/W_m)_{-1})</th>
<th>ln((1-U/P)_{-1})</th>
<th>ln((1/A/P)_{-1})</th>
<th>(R^2)</th>
<th>D.W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>With dummies (27)</td>
<td>-.007 (.003)\textsuperscript{b}</td>
<td>-.009 (.010)</td>
<td>-.312 (.041)</td>
<td>0.90</td>
<td>0.31</td>
</tr>
<tr>
<td>Without dummies (27a)</td>
<td>-.007 (.005)</td>
<td>-.017 (.009)</td>
<td>-.444 (.060)</td>
<td>0.70</td>
<td>2.14</td>
</tr>
</tbody>
</table>

\textsuperscript{a}The wage and unemployment variables are lagged to avoid a simultaneous equations bias, but an unlagged wage coefficient is the same to three decimal places, so the lag is not critical. Data are taken from J. C. Hause and A. C. Fisher, The Supply of First-Term Enlisted Manpower in the Absence of a Draft, Institute of Defense Analyses, April 1968.

\textsuperscript{b}Standard errors in parentheses.

increase in absolute value. Perhaps the dummies caused Fisher's elasticity of enlistments to the unemployment rate to be only 0.18. They may also explain why his draft pressure coefficient is weak.

When Fisher sets draft pressure equal to zero in Eq. (27) (that is, inductions equal zero, so \(A/P = E/P\)), his enlistment rate decreases by only 24 percent. Presumably these are the draft-motivated enlists, but 24 percent is much lower than the 38 percent indicated by 1964 attitude surveys of first-term enlists by the Department of Defense. He gives excellent reasons for the discrepancy,\textsuperscript{1} but we have just seen

\textsuperscript{1}Another lies in the inevitably imperfect definition of draft pressure, which could reduce the absolute value of any draft pressure coefficient and hence understates the draft pressure effect. See Fisher, p. 250, and J. Johnston, Econometric Methods, McGraw-Hill Book Company, Inc., New York, 1963. The draft pressure coefficient (DPC) in Eq. (27) is \(-b_3/(1 + b_3)\) because of the identity \(A = I + E\), so a 10-percent underestimate in \(b_3\) may cause a 20-percent error in the DPC.

Also, perhaps the serially correlated nonrandom residuals in (27) are caused by the omission of an important explanatory variable such as the number of potential and unobservable enlists turned away from recruiting stations. The non-Army Services did turn category III people away during 1957-1965, and surely not all enlisted in the Army. In (27) the true enlistment rate should be \(E^T/P\), where \(E = true\)
that the seasonal dummies weaken draft pressure. In fact, using (27a) we obtain a reasonable 41 percent for draft-motivated enlistees.

To obtain the true wage, unemployment and draft effects from (27a), we must correct its coefficients for simultaneous equations bias. The military accession rate A/P is an exogenous variable set by military requirements; but E/P and I/P, the enlistment and induction rates are endogenous. Furthermore, though not perfect by any means, I/P is a better indicator of draft pressure than A/P, since A/P would be positive even with an all-volunteer armed force. We may think of I/P as a proxy for true draft pressure. Thus I/P should replace A/P in Eq. (27).

Using the argument of Fisher's Eqs. (22) through (24) we obtain

\[ E/P = b_o + b_1 \ln(\hat{w}/m) + b_2 \ln(1 - U/P) + b_3 \ln(1 - I/P), \]

where \( b_2 = b_1 a_1 \) and \( b_3 = b_1 a_2 \); \( a_1 \) and \( a_2 \) are analogous to his \( \gamma_2 \) and \( \delta_2 \). We define

\[ a_1 = ES(P_e, 1 - U/P) = \text{elasticity of the subjective probability of employment } P_e \text{ to changes in the employment rate } (1 - U/P). \]

\[ a_2 = ES(P_e, 1 - I/P) = \text{elasticity of the subjective probability of remaining a civilian to changes in the proportions of civilians not drafted } (1 - I/P). \]

The \( A_1 \) elasticity is important because it transmits a decrease in the employment rate \((1 - U/P)\) into a decrease in expected civilian earnings, making a military career relatively more attractive than before. A

number of volunteers. Thus \( E^*/P = (E/P) + (E^* - E)/P \) and the observed relation is (27) with the added variable \((E^* - E)/P\) on the right side. Its coefficient is minus one and it should be positively correlated with the included variables. However, (27) excludes \((E^* - E)/P\) so the estimated coefficients of (27) are underestimates of the true coefficients. See H. Theil, Economic Forecasts and Policy, North-Holland, Amsterdam, 1961. This phenomenon may explain the low response elasticity of E/P to Fisher's variables.
decrease in \((1 - I/P)\) also leads, through \(a_2\), to a decline in expected civilian earnings.

In a Taylor series expansion, \(\ln(1 - I/P) \approx -I/P\) as \(I/P \to 0\), so we have an identity:\(^1\)

\[
A/P = I/P + E/P.
\]

Solving Eq. (29) for \(-I/P\), inserting the result into Eq. (28), and rearranging terms gives

\[
E/P = b_0/(1-a_2) + b_1/(1-a_2) \ln (\frac{w_c}{w_m})
+ b_1 a_1/(1-a_2) \ln (1 - U/P)
- b_1 a_2/(1-a_2) (A/P),
\]

because \(\ln(1 - I/P) \approx -I/P = E/P - A/P\). When we use the results of Table 19, we obtain the following from (30):

<table>
<thead>
<tr>
<th></th>
<th>(b_1)</th>
<th>(a_1)</th>
<th>(a_2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>With dummies</td>
<td>-.010</td>
<td>1.26</td>
<td>43.94</td>
</tr>
<tr>
<td>Without dummies</td>
<td>-.013</td>
<td>2.40</td>
<td>63.40</td>
</tr>
</tbody>
</table>

Now Fisher shows that ES in (30) is of the declining elasticity form:

\[
ES = -b_1/(E/P).
\]

Since \(E/P = 0.015\) is his quarterly observation and, following the DOD survey we assume 62 percent of \(E/P\) are true volunteers, we have \(V/P = .009\), so

\(^1\)Ignoring the approximately 5000 category IV enlistments each quarter. In practice, quarterly \(I/P = 0.0077\).
(32) \[ ES = 0.010/0.009 = 1.11 \text{ (with seasonal dummies)} \text{ or} \]
\[ ES = 0.013/0.009 = 1.44 \text{ (without dummies)}. \]

Fisher's ES = 0.74 is significantly below these corrected elasticities. In (32) we have an elasticity of volunteers to wage increases of 1.44. But to what type of wage increase does this refer? Fisher defines his wage variable as the present value of first-term military compensation, but he uses first-term average compensation as a proxy for this concept. The latter is, in its turn, also a proxy.

Military wage increases have been approximately across-the-board (ATB) in the past; first-term (FT) wages and career wages have moved together with little, if any, independent variation. Enlistments have basically responded to ATB wage changes, rather than FT. FT is then a proxy for ATB, so the elasticity calculated in (32) refers more to the enlistment response to ATB wage changes. Career wages must be separately considered in the supply equation to isolate the enlistment impact of first-term wages.

The derived elasticity of volunteers to unemployment is also reasonable in model (28)-(29). Previous estimates\(^2\) indicate the elasticity of the volunteer rate to the unemployment rate is \( ES(V/P, U/P) = 0.26 \), and Eq. (27) points to an even lower 0.18. After adjusting for simultaneous equations bias, we obtain a reasonable 0.6 elasticity. In Eq. (28) without dummies,

(33) \[ b_2 = b_1 a_1 = (-0.013)(2.4) = -0.0312, \]

so with \( V/P = 0.009 \),

---

\(^1\)About 30 percent of \( P \) are physically, mentally and morally unfit for service according to O1. This correction of \( P \) does not affect the elasticity estimates; it is a proportional correction that affects only the intercept term of (30).

\(^2\)For comparison, see J. C. Hause and A. C. Fisher, The Supply of First-Term Enlisted Manpower in the Absence of a Draft, Institute of Defense Analyses, April 1968.
ES(V/P, 1 - U/P) = .0312/(V/P) = .0132/.009 = 3.43y.

Further,

ES(1 - U/P, U/P) = (-U/P)/(1-U/P) = (-.15)/(1-.15) = .18,

so, putting these two formulas together,

ES(V/P, U/P) = (3.43)(-.18) = .62,

which is twice as great as the estimates summarized in Hause and Fisher.

As for draft pressure, from (28) we have

\[ b_3 = b_1 a_2 = .013(63.4) = -.824, \]

without dummy variables. But \( \ln(1 - I/P) \% -I/P = .0077 \), so setting draft pressure \( I/P = 0 \) decreases \( E/P \) by

\[ b_3(I/P) = -.24(-.0077) = .0063, \]

a 41-percent reduction from the \( E/P \) average of 0.0153. Thus 41 percent of enlistees were draft-induced during 1957-1965. This conclusion agrees closely with the 1964 DOD survey of enlistee attitudes, which indicates that 38 percent were draft-induced.

In summary, with seasonal dummy variables excluded, and with the simultaneous system (28) and (29), we obtain larger estimates for all supply function coefficients. Conversely, Fisher's draft pressure and unemployment coefficients are small, as shown in Table 20.

Table 20
ELASTICITY COMPARISONS OF THE VOLUNTEER RATE

<table>
<thead>
<tr>
<th>Type of Elasticity</th>
<th>Fisher Equation</th>
<th>Amended Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages</td>
<td>.74</td>
<td>1.44</td>
</tr>
<tr>
<td>Unemployment</td>
<td>.18</td>
<td>0.62</td>
</tr>
<tr>
<td>Proportion of draft-induced enlistees</td>
<td>.24</td>
<td>0.41</td>
</tr>
</tbody>
</table>
A THEORY OF THE MILITARY SUPPLY CURVE

If the univariate frequency distribution of expected civilian opportunities (corrected for military aversion) determines the shape of a military supply curve, it is merely the cumulative curve of the frequency function, as Fisher indicates. After making a case for lognormality of civilian opportunities, however, he derives an elasticity formula from an underlying normal distribution. The form is quite complicated and has ranges of increasing and decreasing elasticity. The critical elasticity point is somewhere in the range between u/2 and u, where u = mean of the normal distribution.\(^1\) Computer evaluation shows decreasing elasticity sets in closer to u than to u/2 for reasonable cases.

Fisher argues that military wages \(W_m\) are sufficiently high compared to civilian wages \(W_c\) so that \(W_m / W_c \approx 1\), which indicates in his theory that observations are on the decreasing elasticity portion of his curve. Consider, however, that a military aversion factor must be subtracted from \(W_m\) (or added to \(W_c\)). Then, assuming average aversion is positive, and that only a portion of military wages are perceived, the wage ratio (corrected for aversion) is certainly less than unity and our observations could easily lie on the increasing elasticity segment of the supply curve.

The problem of what relative wages really are is easily avoided by returning to Fisher's original specification of a lognormal curve. The cumulative function of this curve exhibits decreasing elasticity over its entire range. That is, using Fisher's procedure, define

\[
(34) \quad x = \ln(W_m),
\]

and the cumulative normal distribution function equals the enlistment rate y:

\[
(35) \quad y = \left(2\pi \sigma^2\right)^{-\frac{1}{2}} \int_{-\infty}^{x} e^{-\frac{(t-m)^2}{2\sigma^2}} dt,
\]

\(^1\)Fisher, p. 253.
where \( u \) = mean of the lognormal distribution of the variable "civilian opportunities plus military aversion," and \( \sigma \) = variance of this distribution. Now by definition

\[
(36) \quad \text{ES}(y,x) = (x/y)(dy/dx) ,
\]

but from (34),

\[
(37) \quad dx = dW_m / W_m ,
\]

so putting (37) into (36) we obtain

\[
(38) \quad \text{ES}(y,x) = x(W_m / y)(dy/dW_m) = x \cdot \text{ES}(y,W_m) = lnW_m \cdot \text{ES}(y,W_m) .
\]

Thus,

\[
(39) \quad \text{ES}(y,W_m) = \text{ES}(y,x)/x = (dy/dx)/y .
\]

Also, from Eq. (35),

\[
(40) \quad dy/dx = (2\pi \sigma^2)^{-\frac{1}{2}} e^{-\frac{1}{2}[(x-u)/\sigma]^2} .
\]

Now matching normal curve tables of \( dy/dx \) and cumulative \( y \) frequencies, one may calculate a mildly declining ES for successively higher values of \( y \). That is, \( dy/dx \) rises slower than \( y \) as the latter increases.

We may now construct a theoretical, or predicted, elasticity. In the denominator of (32) we have quarterly \( V/P = 0.01 \) so annual \( V/P = 0.04 \), which is the annual voluntary enlistment rate \( y \) to be put into Eq. (39) to obtain the point ES for volunteers. When \( y = 0.04 \), however, the normal curve frequency table indicates \( x = u - 1.75 \sigma \). Inserting this value into Eq. (40) and calculating \( (2\pi)^{-\frac{1}{2}} = 0.399 \), we obtain

\[
dy/dx = 0.086/\sigma .
\]

Now from Eq. (39) we have
(41) \[ ES = \frac{.086}{.04\sigma} = 2.15/\sigma. \]

Thus, given the volunteer enlistment rate, \( y = 0.04 \), the supply elasticity of recruits depends inversely upon \( \sigma \).\(^1\) Unfortunately, \( \sigma \) is unknown and we can only make plausible guesses about it derived from guesses about the mean and variance of the assumed lognormal distribution.

Assume for the moment that Fisher's definition of wages (average first-term compensation) is correct. Fisher\(^2\) indicates that the mean and standard deviation of young men's earnings are $3500 and $1071. If we arbitrarily apply a markup factor for military aversion that in effect adds $500 to the mean and $200 to the standard deviation for military aversion, the ratio of the standard deviation to the mean becomes .33.\(^3\) Using Kendall,\(^4\) we may find the corresponding \( \sigma \) for the normal distribution of \( \ln W_c \) (where \( W_c \) is civilian earnings plus the military aversion markup) as

\[ \sigma^2 = 1 + \left( \frac{\sigma_{W_c}}{\bar{W}_c} \right)^2 = 1.11, \]

so that \( \sigma^2 = .095 \) and \( \sigma = .31 \). Thus from Eq. (41) the theoretical \( ES = 6.96 \), which is vastly greater than Fisher's 0.74.\(^5\)

The discrepancy is resolved by reorienting the theory from a wage elasticity to a perceived present value elasticity. Define

(43) \[ X = \ln \text{PPV}, \]

\(^1\)As indicated above, Eq. (41) also declines for larger \( y \): if \( y = 0.05 \), then \( ES = 2.04/\sigma \).
\(^3\)Remembering that the variable "civilian wages plus military aversion" is assumed to be lognormally distributed.
\(^5\)Our results are sensitive to different aversion correction factors, but \( ES \) remains high. For example, if the ratio of S.D. to mean is as high as 0.7, then \( \sigma = 0.65 \) and \( ES = 3.38 \).
where PPV is the perceived present value of career earnings. We may think of

$$PPV = W_c \sum_{i=1}^{40} \frac{(1 + r)^i}{(1 + d)^i},$$

where $W_c$ = initial civilian salary corrected for a military aversion markup,

$r$ = rate of expected wage increase,

d = subjective discount rate,

and a 40-year working career is assumed. The unknown mean, variance, and correlation of these three elements in the population determines the frequency distribution of PPV. If the youth population pool P has a lognormal distribution of civilian PPV, then the argument of Eqs. (34) through (41) holds for PPV also. However, $\sigma^2$ now refers to the variance of the logarithm of PPV, not of wages. If, for example, initial average $\bar{W}_c = \$4000$ (including a proportional markup for aversion), $r = 5$ percent and $d = 10$ percent, then $PPV \approx \$80,000$ for a 40-year career. The $\sigma$ of PPV should be relatively larger than the standard distribution of one year's expected earnings because the variance of a sum usually equals the sum of the component variances if the components are independent. This independence is not strictly true of year-to-year income, but a tendency probably exists to increase the variance. Since $\left(\frac{\sigma_{\bar{W}_c}}{\bar{W}_c}\right) = .33$, we then expect $\sigma_{PPV}/80,000 > .33$. The temporal compounding of $r$ and $d$ rates, which differ among individuals, may generate $\sigma_{PPV}$/PPV in the neighborhood of 0.5. With PPV = $\$80,000$, we assume $\sigma_{PPV} = \$40,000$. Now using PPV in place of wages in Eq. (40) indicates $\sigma = .47$, and Eq. (41) indicates $ES = 4.57$.

Such an ES greatly exceeds unity for reasonable $y$ and $\sigma$ values, but remember it is $ES(y, PPV)$, not $ES(y, W)$. We need another elasticity element, $ES(PPV, W')$. Define $W'$ as an across-the-board military pay variable so that $ES(PPV, W')$ is unity for volunteers who plan on a military career; a doubling of each year's pay across-the-board doubles their $W'$ and PPV since each year's expected income in the PPV stream is doubled. But unpublished Air Force surveys indicate that only about
16 percent of all true volunteers in 1964 considered a service career at the time of entry; all others were undecided or short-timers of various lengths who were seeking training or a place to mature.

Young volunteers also have a high subjective discount rate. A doubling of \( W_m' \) (each year's military wage doubles across-the-board) probably increases the PPV \( m \) of non-careerists by about 20 percent, assuming they stay for one four-year term (one-tenth of their earning life) and have a 10-percent discount rate of earnings. Thus, we assume \( \text{ES}(\text{PPV}_m', W_m') = .20 \) for this non-career group.

The aggregate \( \text{ES}(\text{PPV}, W_m') \) is then a weighted average of the elasticities of careerist and noncareerist volunteers; the weight is the proportion \( (K) \) of true volunteers who are intended careerists. Obviously this proportion is a function of relative wages, since everyone would be a careerist at very high \( W_m' \). At current relative wages, however, the proportion seems about 0.16. Since the careerist elasticity \( \text{ES}_c \) is unity and the noncareerist \( \text{ES}_{nc} \) is about 0.20, we have a crude estimate of

\[
(44) \quad \text{ES}(\text{PPV}_m', W_m') = \text{ES}_c(K) + (1-K)\text{ES}_{nc} = 1(.16) + (1-.16)(.20) = .33 .
\]

Now we may obtain a theoretical estimate of

\[
(45) \quad \text{ES}(y, W_m') = \text{ES}(y, \text{PPV}_m') . \text{ES}(\text{PPV}_m', W_m') = 4.57(.33) = 1.52 ,
\]

which is about twice Fisher's elasticity estimate for a draft-free world and about equal to our previously estimated ES = 1.44. Remember these are supply elasticities for ATB wage changes.

The theoretical ES = 1.52 is sensitive to the unknown \( \sigma_{ppv} \) parameter. Thus, if \( \sigma_{ppv} = 80,000 \) so that \( \sigma_{ppv}/\text{PPV} = 1 \), we derive an elasticity less than unity. This seems unlikely to us, so ES > 1 is theoretically indicated for most plausible situations.

If first-term wage increases are given, rather than ATB increments, then \( \text{ES}_c \) in (44) falls from 1.0 to 0.20, assuming that careerists and non-careerists expect 20 percent of their PPV on their first tour of
duty. The non-careerist $E_{nc}$ will remain at 0.20. Because non-careerists look to a civilian career, increases in FT pay will have the same effect on their enlistment behavior as ATB increases. If $E_{c} = 0.20$ in response to FT increases, then (44) falls to 0.20 also and (45) becomes 0.91. This is the elasticity of volunteers (careerists plus non-careerists) to increases in first-term pay. This guess is speculative until the parameters of the theory, such as $\sigma_{pp\psi}$, can be estimated with greater accuracy. In the text we choose elasticities of 0.50 and 1.00 to bracket the 0.91 value.
Appendix E
TOWARD AN OPTIMAL FIRST-TERM REENLISTMENT RATE AND BONUS

Figure 2 is a simple sketch depicting how the first-term reenlistment rate \( r_4 \) affects long-run total manpower costs. It is the nascent form of a complete model because it ignores training activities and the deferred return thereon, and it assumes a homogenous manpower pool.

Two assumptions accomplish this distortion. The wages of enlisted men always equal the value of their marginal product (suitably defined);\(^1\) and this product compounds at the same constant rate for each enlisted man over his service life.

Long-run costs contain both payroll and retirement payments, and \( r_4 \) affects both. A higher \( r_4 \) means increased retention and smaller required induction flows to maintain a constant force strength. This reduces the movement along an upward sloping volunteer supply curve and lowers entry wage increases. But a higher \( r_4 \) tends to increase the flow through the system to retirement, raising retirement costs. Given certain wage and retirement information, an optimal \( r_4 \) can be chosen to balance these costs and find their joint minimum. Figure 2 graphically reflects the costs.

\[ \text{Figure 2} \]

---
\(^1\)In general, \( w < \text{vmp} \) because of training activities: \( w > \text{vmp} \) in training, whereas experienced men often have \( w < \text{vmp} \) since they are paid their opportunity cost not their vmp.
Define total wage cost (TWC) as

\begin{equation}
    \text{TWC} = \sum_{i=1}^{30} W_i N_i ,
\end{equation}

where $N_i$ = number of enlisted men with $i$ years of service.
$W_i$ = their wage rate.

However, this may be decomposed as

\begin{equation}
    N_i = N_1 \prod_{t=0}^{i-1} r_t ,
\end{equation}

where $r_t$ = retention rate during $t^{th}$ service year.
$r_0 = 1$ by definition.

For example, $N_4 = N_1 r_1 r_2 r_3$. Also assume wages grow smoothly over the service life so that

\begin{equation}
    W_i = W_1 (1 + S)^{i-1} ,
\end{equation}

where $S$ = wage growth rate. Putting (47) and (48) into (46) gives

\begin{equation}
    \text{TWC} = N_1 \sum_{i=1}^{30} \left[ W_1 (1 + S)^{i-1} \prod_{t=0}^{i-1} r_t \right] .
\end{equation}

Total retirement cost (TRC) is the cost of a man retiring after $i = 20, \ldots, 30$ years of service ($C_i$) multiplied by the number so retiring ($N_i - N_{i+1}$), ignoring service deaths: \(^1\)

\begin{equation}
    \text{TRC} = \sum_{i=20}^{30} C_i (N_i - N_{i+1}) ,
\end{equation}

\(^1\) $C_i$ is determined by actuarial tables and projections about the future course of retirement payments.
where $N_{31} = 0$. But from (47) and the definition,

$$N_{i+1} = N_i r_i,$$

it follows that

$$\text{TRC} = N_1 \sum_{i=20}^{30} \left[ C_i \left( \prod_{t=0}^{i-1} r_t \right) \left( 1 - r_i \right) \right],$$

Thus (49) plus (52) equals total cost (TC).

$$\text{TC} = \text{TWC} + \text{TRC} = f(N_1, W_1, S, r_i, C_i).$$

Now the optimal first-term reenlistment rate ($r_4$) may be found. Both $N_1$ and $W_1$ are functions of $r_4$ because higher retention reduces both the required inflow $N_1$ to stock a force of fixed size and the wage $W_1$ that must be paid to that inflow. Denote the force size constraint as $F$ so that, using (47)

$$F = \sum_{i=1}^{30} N_i = N_1 \sum_{i=1}^{30} \prod_{t=0}^{i-1} r_t = N_1 \left\{ 3 \sum_{i=1}^{30} \prod_{t=0}^{i-1} r_t + r_4 \sum_{i=4}^{30} \left( \prod_{t=0}^{i-1} r_t / r_4 \right) \right\}.$$ 

Now define

$$A = \sum_{i=1}^{3} \prod_{t=0}^{i-1} r_t \quad \text{and} \quad D = \sum_{i=4}^{30} \left[ \prod_{t=0}^{i-1} r_t / r_4 \right],$$

so that all $r_4$'s cancel out of $D$ and we have

$$F = N_1 (A + Dr_4).$$

Thus $N_1$ can be written as a function of $r_4$ through $r_{30}$, or

\footnote{For the moment ignore the quality of this force. In peacetime $F = 2.5$ million.}
\begin{equation}
N_1 = F(A + Dr_4)^{-1}.
\end{equation}

Assume the supply curve of \(N_1\) depends on \(W_1\) (ignoring unemployment) through the logarithmic form

\begin{equation}
N_1 = aW_1^b,
\end{equation}

where \(a, b\) are constants \((b = \text{elasticity of supply})\). Or, inverting and using (57),

\begin{equation}
W_1 = (N_1/a)^{1/b} = [F/a(A + Dr_4)]^{1/b}.
\end{equation}

Now put (57) and (59) into both (49) and (52), and add them to obtain (53), which is TC expressed as a function of the first-term reenlistment rate \(r_4\):

\begin{equation}
TC = F(A + Dr_4)^{-1}\left\{\frac{F/a(A + Dr_4)}{[F/a(A + Dr_4)]^{1/b}} \sum_{i=1}^{30} (1 + S)^{i-1} \prod_{t=0}^{i-1} r_t \right\} + \sum_{i=20}^{30} C_i \left( \prod_{t=0}^{i-1} r_t \right) \left(1 - r_i \right)^{-1}.
\end{equation}

The first-term reenlistment rate that minimizes TC is found by setting

\(\frac{\partial TC}{\partial r_4} = 0\) and solving for \(r_4\).

But \(r_4\) is affected by bonuses; say a logarithmic form holds:

\begin{equation}
r_4 = dX^e,
\end{equation}

where \(X\) = reenlistment bonus; \(d, e\) are constants, with \(e = \text{elasticity of } r_4\) to \(X\). Total bonus cost is now \(X\) multiplied by the number of recipients \(N_4\), but

\begin{equation}
N_4 = N_1 \prod_{t=1}^{3} r_t.
\end{equation}

\(\frac{\partial^2 TC}{\partial r_4^2} > 0\) for a TC minimum.
Use (57) and (61) to express \( N_4 \) as a function of the bonus so

\[
N_4 = F[A + D(dX^e)]^{-1} \prod_{i=1}^{3} r_t.
\]

Thus total bonus cost (BC) is \( XN_4 \), or

\[
BC = XF(A + DdX^e)^{-1} \prod_{i=1}^{3} r_t.
\]

Put (61) into (60) and then add (63) to obtain total system cost (TSC):

\[
TSC = TC + BC
\]

\[
= F(A + DdX^e)^{-1} \left\{ \frac{[F/a(A + DdX^e)]^{1/b}}{\sum_{i=1}^{30} \left[ (1 + S)^{i-1} \prod_{t=0}^{i-1} r_t \right]} \right\}
+ \sum_{i=20}^{30} C_i \left( \prod_{t=0}^{i} r_t \right) \left( 1 - r_{i+1} \right) + X \prod_{i=1}^{3} r_t = f(X).
\]

The optimum bonus \( X^0 \) that minimizes TSC is found by setting

\[
\frac{\partial TSC}{\partial X} = 0,
\]

and solving for \( X^0 \). Then insert \( X^0 \) into (64) to find minimum \( TSC^0 \).

The minimum \( TSC^0 \) could be considerably below the costs indicated in the body of this study and, if training complications are added to the analysis, the bonus should achieve even greater TSC reductions. Then the foregoing system must also consider the training and/or quality of the people retained. The force constraint \( F \) should be generalized for different skill constraints:

\[A \] minimum if \( \frac{\partial^2 TSC}{\partial X^2} < 0.\]
(65) \[ f_j = \sum_{i=1}^{30} n_{ij}, \quad F = \sum_{j=1}^{m} f_j, \]

where \( f_j \) = number of men needed on job "j."
\( n_{ij} \) = number of job "j" men with "i" service years.
\( m \) = number of jobs.

Equation (64) can be viewed then as applying to each job, and each parameter receives a j subscript:

(66) \[ TSC = \sum_{j=1}^{n} TSC_j \text{ for n jobs.} \]

We then minimize a cost function, nonlinear in bonuses, subject to the linear constraints (65).

Even more complexities appear if we allow for a matrix of bonuses where \( X_{ij} \) = bonus paid to a job j person in his i\textsuperscript{th} service year.
This last case seems to be a dynamic nonlinear programming problem.
Appendix F

SUPPLY CURVE CAVEATS

PROJECTING THE SUPPLY OF VOLUNTEERS

In 1965 the Department of Defense estimated that 317,000 enlisted men and 27,000 officers would volunteer in fiscal year 1970-71 in the absence of the draft and with no change in the military-civilian wage ratio. These simple figures represent an enormous effort, including population projections, sample surveys and econometric analysis.¹

Mathematically, a projection of true volunteers (V) is composed of three elements:

1. The size of the relevant population pool of potential enlistees (P).
2. The proportion of P who are qualified and who enlist with a draft (E/P).
3. The proportion of enlistees who are true volunteers (V/E).

Thus,

(67) \[ V = V/E \cdot E/P \cdot P. \]

Consider the crucial case of the Army volunteer. A large Army recruitment deficit remains even if there is no shortage for the other services. A sample survey taken in 1964 indicated Army V/E = .57.² Assume this proportion of true volunteers to enlistees holds also for 1970. Now one only needs an estimate for E/P and P in 1970 to forecast volunteers.

Using 1956-1965 quarterly time series data, the DOD derived an Army supply equation:³

¹ Altman and Fechter, p. 25, Table 5. They assume a 14.9-percent youth unemployment rate and no change in anti-military attitudes.
² Ibid., p. 23, Table 3 and p. 24, footnote 8. For all Services V/E = 0.62.
³ Ibid., p. 20. Dummy variables for seasonality and for periods of unusual draft pressure were also used, but they are unimportant for our argument. Their constant term is given as "0.03018," but it must be 0.003018 to obtain their results.
\[ E/P = 0.003 + 0.1357(U/P) - 0.013(D_L) \]
\[ R^2 = .67 \]

where $E$ = the number of 18- and 19-year-old enlees in categories I-III.

$P$ = the number of 18- and 19-year-old males.

$U/P$ = their unemployment rate.

$D_L$ = a dummy variable equal to zero for the period of low draft pressure (e.g., 1965 and, by assumption, 1970).

Standard deviations are in parentheses. A variable for the relative military to civilian wages is excluded, presumably because of its lack of variation and unreliable performance. The DOD assumes a 5.5-percent aggregate unemployment, which has corresponded in the past to a $U/P$ of 14.9 percent for 18- and 19-year-olds, a plausible percentage for 1970. The assumption is adopted here for illustration. If there is low draft pressure in (68), the $E/P \approx 0.04$. With $P = 3,875,000$ in 1970, the $V$ in (67) is then $V = (0.57)(0.04)(3,875,000) = 84,800$ in 1970. To this add 25 percent for mental category IV enlees (20 percent of the total) to obtain 106,000 true Army volunteers in 1970. \(^1\)

By assuming that category I-III enlistments in the other services grow at the same rate as they do in the Army, and allowing ten percent of total enlistments to be mental group IV people, the DOD estimates that 317,000 true volunteers are available in 1970 at no increase in relative wages. \(^2\)

A similar exercise is repeated for officers by projecting their supply under peacetime conditions (but with a draft) and multiplying this by the survey-determined proportion who are true volunteers. In 1970, 27,000 officers may volunteer without the draft. The officer projection is assumed independent of youth unemployment rates because officers are drawn from a different and older pool.

\(^1\)Ibid., p. 21, and p. 25, Table 5. The inclusion of category IV people is important; Oi's estimates omit this effect and consequently overstate the supply deficit.

\(^2\)Assuming $U/P = 14.9$ percent. If $U/P$ is only 11.5 percent, then (68) predicts only 272,000 will be supplied.
But what role does pay play in stimulating enlistments? Is the supply of true volunteers for military service responsive or unresponsive to military pay increases? In formal terms, is the supply curve elastic or inelastic? The answer is obviously important for estimating the budget cost of a volunteer Army. For this purpose DOD studies\textsuperscript{1} place the supply elasticity (ES) in the neighborhood of unity, implying that a 10-percent military pay increase, with civilian pay held constant, causes a 10-percent rise in volunteers. Furthermore, they allow the supply elasticity to vary for different force levels and find that it falls as the force level rises. Apparently, it is progressively harder to obtain more volunteers at larger force levels, and success is only achieved by raising military pay by progressively greater percentages.

Although the DOD supply elasticity estimates are questionable because of the small sample size used and the lack of variability in the key variables, they have acquired a degree of truth by default. They are the only figures we have. It may be argued that the existing DOD estimates of the supply elasticity are biased for two reasons: they unavoidably must omit important variables from their supply equation; even if the equation is corrected for bias, the elasticity estimate may refer to a section of the supply equation that is irrelevant to the question of a volunteer Army. Possibly the effect that the ES has on the relevant section is much greater than DOD believes, so the wage increase necessary to obtain enough volunteers may be much lower than anticipated. On this point see also Appendix D.

BIASES IN THE SUPPLY CURVE ESTIMATES

An examination of the DOD methodology indicates a probable bias in the ES estimate of military volunteers for the observable pay range. For example, the South has the highest voluntary enlistment rates and the highest ratio of military to civilian pay. But other forces, such as lower educational levels, could also raise the Southern enlistment rate. A regional preference for the military could have the same effect. Such forces cannot be considered in the DOD calculations

\textsuperscript{1}By Altman and Fechter, and O1.
because of the small sample size, but the excluded factors are correlated with the included relative pay variable, which picks up their effect on the enlistment rate. The true coefficient of relative pay is correspondingly biased and so is the supply elasticity.

To understand this, we will examine the DOD methodology. The DOD is interested in the long-run ES of volunteers to changes in the ratio of military to civilian pay. The impact of unemployment on this supply is also noted in their decreasing elasticity equation fitted to regional data in 1963:

\[
\log C_i = a_1 \log \left( \frac{W_m}{W_p} \right)_i + a_2 \log U_i + e_i ,
\]

where \( C_i \) = 1 - \( V_i/P_i \) or 1 - true volunteer rate in the militarily qualified group in the \( i \)th region.

\( V_i \) = true volunteers in the \( i \)th region.

\( P_i \) = full-time labor force males 16 to 20 years old in categories I-III in the \( i \)th region.

\( (W_m/W_p)_i \) = ratio of military pay of all enlisted men over first four years of service to civilian pay of 16- to 21-year-olds in the full-time labor force in the \( i \)th region.

\( U_i \) = unemployment rate of the qualified group in the \( i \)th region.

\( e_i \) = disturbance term.

Since \( C_i \) is the complement of the voluntary enlistment rate, the supply elasticity of volunteers is not \( a_1 \), but a more complicated form that declines as "C" declines (as the true volunteer rate rises). In fact, \( ES = -a_1 [C/(1-C)] \). Equation (69) must contain few variables if it is to be estimated because only nine regional observations are possible; but, aside from the small sample problem that clouds the findings, there are several phenomena that seem to bias the ES estimate.

\[\text{See Altman, pp. 52-55. Solve (69) for } V/P, \text{ differentiate with respect to } (W_m/W_p), \text{ and insert the result into the elasticity definition to obtain the text result.}\]
Ordinary least squares (OLS) estimates of (69) are biased if the "independent" variables \( \log \left( \frac{W_m}{W_p} \right) \) and \( \log U \) are correlated with the disturbance term \( e \). This may occur for a number of reasons, though two are especially salient for the volunteer Army problem. First, some relevant variables may be omitted from (69): for example, (a) age structure of the 16- to 20-year-old population; (b) length of unemployment; (c) educational level; (d) family wealth; (e) family education; (f) regional prices; (g) regional preferences for the military; (h) different regional mental category I-III distribution; and (i) potential enlistees turned away from recruiting stations because quotas may be filled. One could make a case for any of these variables; indeed Department of Defense studies imply many of them are significant factors in the voluntary enlistment decision. For example, call factors (c), (d), and (e) the education (D) effect, and denote (g) by \( R \). Then (69) becomes

\[
\log C_i = \alpha_0 + \alpha_1 \log \left( \frac{W_m}{W_p} \right)_i + \alpha_2 \log U_i + \alpha_3 \log D_i + \alpha_4 R_i + \epsilon_i ,
\]

where \( R_i = 1 \) if \( i \) is a Southern region, \( R_i = 0 \) if \( i \) is a non-Southern region.

Now if (70) is the true relation, but (69) is incorrectly fitted by OLS, the \( \alpha_1 \) and \( \alpha_2 \) have expected values \( E(\hat{\alpha}_1) \) and \( E(\hat{\alpha}_2) \) defined as

\[
E(\hat{\alpha}_1) = \alpha_1 + \alpha_3 m_{11} + \alpha_4 m_{21} ,
\]
\[
E(\hat{\alpha}_2) = \alpha_2 + \alpha_3 m_{12} + \alpha_4 m_{22} ,
\]

where \( m_{11}, m_{12}, \) and \( m_{22} \) are constants defined by the regressions of each excluded variable on all the included explanatory variables:

\[
\log D_i = m_{11} \log \left( \frac{W_m}{W_p} \right)_i + m_{12} \log U_i ,
\]
\[
R_i = m_{21} \log \left( \frac{W_m}{W_p} \right)_i + m_{22} \log U_i .
\]

\(^1\)Theil, Chapter 6.
Both $\alpha_1$ and $\alpha_2$ are biased in (71) and (72) for plausible behavioral assumptions.

Second, bias also appears in OLS estimates of (69) or (70) if they are part of a simultaneous system. Relative wages, volunteer rates and unemployment rates are probably mutually related within a region to some degree. For example, a partial simultaneous model may be

\[(75) \quad \log C = \alpha_0 + \alpha_1 \log (W_m/W_p) + \alpha_2 \log U + e_1,\]

\[(76) \quad \log (W_m/W_p) = \beta_0 + \beta_1 \log C + \beta_2 \log U + e_2,\]

\[(77) \quad \log U = \gamma_0 + \gamma_1 \log C + \gamma_2 \log (W_m/W_p) + e_3.\]

Now $e_1$ influences $\log (W_m/W_p)$ in (75) through its effect on $\log C$. In (75) $e_1$ disturbs $\log C$, which in turn affects $\log (W_m/W_p)$ in (76).

With $\beta_1 > 0$, this transmitted correlation between $e_1$ and $\log (W_m/W_p)$ is positive, so the bias in the OLS estimate of $\alpha_1$ is also positive. Now $\beta_1 > 0$ is likely, since $C = (1 - V/P)$ and a rise in volunteers ($V$) depresses $C$; also the supply of labor to the private economy is reduced and $W_p$ rises ($\log W_m/W_p$ falls). Thus $\log C$ and $\log W_m/W_p$ move together indicating $\beta_1 > 0$. With $\alpha_1 < 0$, ES = $-\alpha_1[C/(1-C)]$ and $\beta_1 > 0$, it follows that the supply elasticity is understated. The extent of this bias is unknown, but it is probably small since true volunteers are estimated as only 10 percent of the 17- to 22-male age groups, and they should have little impact on relative wages.

Another possible negative bias concerns the experimental design used to obtain an estimate of true volunteers. The ES is understated if the proportion of true volunteers is overestimated: $V/P = (1-C)$. Since $V/P$ was derived from survey results after candidates were inducted, one cannot expect unbiased answers to "volunteer" questions.
SHAPE OF THE TRUE SUPPLY CURVE

The foregoing discussion is important only if one believes that the true supply curve, in the range of observed wage variation, may be extrapolated to the higher wage ranges necessary to obtain a volunteer army. It is not at all evident that such an extrapolation is legitimate; in fact there are good reasons for believing the supply curve is much more elastic at competitive military wages, as the following might indicate. Instead of a progressive inelasticity as in Fig. 3, the supply curve may have successive ranges of elasticity, inelasticity, elasticity and finally inelasticity as in Fig. 4.

![Figure 3](image)

![Figure 4](image)
Figure 3 represents the DOD estimate of ES ≤ 1, but it may be only the observed portion of the curve in Fig. 4, point \( W_0 \). The annual flow of mentally and physically qualified males into the draft-eligible pool will be about 1.5 million in the 1970's.\(^1\) Now the DOD estimates its annual flow of true volunteers will be about 300,000,\(^2\) so that their ratio of the flow of volunteers to the flow of total supply is 20 percent. But we also know from DOD surveys that only one-third of male high school seniors believe they would "dislike the military life very much."\(^3\) Since two-thirds are not averse to it, two-thirds of the 1.5-million flow (one million) should also not be averse to military life.

At the current subsistence-like military pay for first-termers, the 300,000 true volunteers are probably the unemployed, the poorly paid, the preferers of military life, the excitement seekers, and the training-induced. Fisher shows that 14 percent of high school seniors think they would like military life "very much." Assume this 14 percent is true also for the 1.5-million-man flow. Since about 10 percent of all males in this age group are unemployed, we might expect about 10 percent of the eligible flow to be unemployed. The unemployed and pro-military men are then 14% + 10% = 24%, where 1% (= 14% x 10%) approximates those who are both unemployed and pro-military. This approximates the 20 percent that the Department of Defense estimated as true volunteers at 1963 relative wages. Of course, there are "slippages" working both ways, and increases in military/civilian wage relatives could be expected to meet readily the small additional accessions required for a steady-state military that Oi estimates as 333,500.\(^4\)

---


\(^2\) Altman and Fechter, p. 25.

\(^3\) Fisher, p. 8.

\(^4\) Oi, p. 46.
Raising the subjective evaluation of military wages to, for example, the competitive average of the qualified 16- to 20-year-old pool (about $3500)\(^1\) may move us to the elastic range of the supply curve. The populous lower-middle ranges of the frequency distribution of civilian earners could be induced into the military. The added cost of a volunteer military may be relatively small if there is greater supply elasticity immediately above current military pay levels. This argument depends on the peculiar shape of curve B, Fig. 4, and we now demonstrate its plausibility.

Young enlisted men discount future income at an extremely high rate,\(^2\) so for simplicity we will consider only their beginning pay rather than the present value of their future income. Assume they volunteer if military pay ($W_m$) exceeds civilian pay ($W_p$) plus the dollar value of their military aversion A: $W_m > W_p + A$. The frequency distribution of $W_p$ in the qualified flow of volunteers is shown in Fig. 5, with the unemployed in the cross-hatched regions. Based on the normal curve distribution of abilities of 1.5 million, expect 0.1, 0.2, and 1.2 million to be in categories I, II, and II-IV, respectively. The unemployment rate of about 7 to 10 percent for the pool is relatively highest in the lowest mental group. Also assume some difference in average income between groups. Ignoring military aversion, and preferences, it is likely that $W_m = $3000 brings in only the unemployed, the below-average wage earners, and the training-induced, mostly categories III-IV.\(^3\) These people have, or think they have, rather limited civilian opportunities. The cumulative frequency (supply) curves in Fig. 6 are a function of $W_p$. These curves are similar to those of Fig. 4. Note that for a given military wage $W_m$ the supply elasticity of category III people is the highest and that of category I the lowest.\(^4\)

---

\(^1\) Altman, p. 43.

\(^2\) About 20 to 30 percent; see Chaney, p. 3.

\(^3\) The length of unemployment also affects the enlistment decision. Probably unemployed category I's have the shortest unemployment so they may not volunteer even if they are unemployed. This does not change the main point of the text, however. Considering aversion, those strongly preferring military life should also enlist.

\(^4\) Altman, pp. 51 and 54, finds this to be the case.
Fig. 5 -- Frequency distribution of different mental categories

Fig. 6 -- Derived supply curves by different mental categories
The figures merely formalize our common sense about volunteers, but they carry common sense further to suggest that a fuller examination of military supply may be in order. Most important, the diagrams show that supply may respond more elastically to higher wages, especially in categories III-IV. For example, in Fig. 5, at the current low military wage, $w_{m_1} = 1800$.\(^1\) We have 10,000 category I volunteers, 50,000 category II's and 240,000 category III's, a total of 300,000 (about the DOD's projected amount). Raising military pay 50 percent to $w_{m_2} = 2700$ doubles category III-IV volunteers to 480,000; that is, category III ES = 100%/50% = 2.0. The supply response of categories I and II remains inelastic, but the total supply of volunteers from all categories, 487,200, is now enough to maintain a steady-state volunteer force of 2.65 million.\(^2\)

DOD elasticity estimates apply to sections of the supply curve below $w_{m_1}$ so they quite correctly find inelastic responses; but at the higher wages necessary to acquire a volunteer force, the supply curve may become elastic. Aside from other corrections that might be made, this elasticity correction might cut the DOD $4-$ to $8-$billion cost estimate approximately in half, since the category III-IV ES between $w_{m_1}$ and $w_{m_2}$ is approximately twice its value between zero and $w_{m_1}$.

\(^1\)Apparently enlistees subjectively value their total pay package at $1500. Their income stream of cash and in-kind allowances (quarters, subsistence, and tax advantage) is $1900, $2000, $3000, and $3400 for the first four years. Of and the DOD study used a four-year simple average which, discounted at their time preference of 25 percent, is $1800. Their four-year average can thus be faulted on two counts—failing to discount and failing to reduce the income base to fully weighted perceived dollars before applying fully weighted cash increases.

\(^2\)Of, p. 47, estimates only 333,500 annual accessions are required.
Appendix G

COST ESTIMATES OF THE PRESIDENTIAL COMMISSION ON AN ALL-VOLUNTEER
ARMED FORCE

The President's Commission on an All-Volunteer Force estimates that $3.1 billion (excluding Reserves and tax returns) is the incremental budget cost to achieve a volunteer force of 2.5 million men in 1971. This estimate refers to the short-run cost; our comparable short-run estimate is $0.75 to $1.2 billion for a slightly larger force of 2.65 million.

Table 21 compares the long-run and short-run items considered in our study and in the Commission report. It indicates that the Commission does not, for example, give differential enlistment bonuses to the Army. In fact, it does not recommend bonuses for any Service. Also, the base from which wage increases are calculated is the DOD's "total income" concept rather than the perceived present value concept used here. However the major difference in short-run costs is our use of the draft during the transition period. Whereas the Commission advocates a premium wage to attract the large number of accessions required before longer enlistment tours and higher reenlistment rates lower accession requirements, we advocate paying the estimated wage for a steady-state volunteer military and drafting the residue for several years until longer tours and high reenlistment rates take their effect and reduce accession requirements.

Note further that (1) the Commission's cost sensitivity calculations are tied only to variations in force size, and (2) its long-run calculations do not consider retirement costs or the full weight of seniority costs. Even so, their steady-state costs are $2.3 billion (excluding the Reserves and the savings from increased Treasury tax returns) versus our estimate of $2.1 to $2.5 billion.

---

Table 21
COMPARISON OF COST STUDIES

<table>
<thead>
<tr>
<th>Items</th>
<th>Presidential Commission</th>
<th>Canby-Klotz</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Short-Run Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Volunteer Projections from Surveys and Population Growth</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>2. Higher Volunteer Reenlistment Rates</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3. Training Savings</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>4. Large Army Recruiting Deficit</td>
<td>Yes&lt;sup&gt;a&lt;/sup&gt;</td>
<td>No</td>
</tr>
<tr>
<td>5. Theory of Supply (see Appendix D)</td>
<td>Yes&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Yes</td>
</tr>
<tr>
<td>6. Econometric Supply Curve</td>
<td>Yes&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Yes</td>
</tr>
<tr>
<td>7. Enlistment Bonuses</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>8. Army Receives Differential Treatment</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>9. Pay Base is Perceived Present Value Concept</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>10. Miscellaneous Costs and Savings</td>
<td>Yes&lt;sup&gt;b&lt;/sup&gt;</td>
<td>No</td>
</tr>
<tr>
<td>11. Cost Sensitivity Analysis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Force Size</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>b. Supply Elasticity</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>c. Unemployment Rate</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>d. Pay base (PPV or Total Income)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>e. Reenlistment Rate</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>f. Attitude Shift</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Long-Run Steady-State Costs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Retirement Costs</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>13. Seniority Costs</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>14. Training Savings</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>15. Cost Sensitivity Analysis</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

<sup>a</sup>To be published in 1970.

<sup>b</sup>About $0.5 billion, including increases for proficiency and reserve pay and the fraction of wage increases repaid to the Treasury in taxes.

<sup>c</sup>Only eight-year transition costs are computed until 1977-79.
Appendix H

COST AND SENSITIVITY ANALYSIS

STEPS IN THE COST ESTIMATE

Table 22 summarizes our costs for eight alternative cases, which contain different assumptions about wage variables, youth unemployment and the elasticity of supply. The calculations for the first case (Column 1) are discussed in detail to illustrate our methodology. Our costs for the cases presented range from $2.1 to $2.8 billion, and are fairly insensitive to a marginal change in one assumption.\(^1\) The following alternatives are considered to test the cost system for sensitivity:

1. The pay variable: perceived present value (PPV) or DOD "total income"?
2. The youth unemployment rate (U/P): 14.9 or 11.5 percent?
3. The effective force level: 2.65 or 3.0 million men?
4. The elasticity of supply (ES): unity or one-half?
5. The true volunteer rate: correctly surveyed or 16-percent overstated?
6. The average DOD first-term reenlistment rate (r): 30 or 36 percent?
7. The cost changes: long-run or short-run?

From these seven points a plausible assumption set follows:

a. Pay = PPV.
b. U/P = 14.9 percent.
c. Force = 2.49 million in 1970-1971, which, because of the 5.9-percent force drawdown permitted by reduced training loads, has the same effective combat manpower as a draft-induced force of 2.65 million.
d. ES = 1.
e. The true volunteer rate is correctly surveyed: in peacetime 62 percent of enlisted men and 59 percent of officers are true volunteers.\(^2\)

We already explained a, d, and f in the main text. The remaining assumptions, b, c, and e, are somewhat related. We assume the Vietnam war deescalates in 1970; combined with tight money, this causes a mild

\(^1\) Fairly insensitive compared to the range generated by several other studies.
\(^2\) Altman and Fechter, pp. 23-24.
Table 22

<table>
<thead>
<tr>
<th>Measure</th>
<th>Perceived Present Value of Wages</th>
<th>DOD Wage Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.0 ES</td>
<td>0.5 ES</td>
</tr>
<tr>
<td></td>
<td>U/P</td>
<td>U/P</td>
</tr>
<tr>
<td></td>
<td>14.6%</td>
<td>11.5%</td>
</tr>
</tbody>
</table>

I. Pay rationalization of the enlisted men inflow (in $ millions): $C_1$
(14.6% FFV increase)

II. Army cost increases over (1)

A. Enlisted men

1. Army enlisted men (1-3) required inflow
   2. Requirements after 9.6% training saving
   3. Less 20% permissible category IV proportion
   4. Category I-III requirements: (2(2)-2)
   5. Category I-III supply at no change in relative pay
   6. Percentage deficit in category I-III (2(3)-2)(3)(4)
   7. Percentage 4W required
   8. Less 16.5% pay rationalization
      (under I), and 20% relative enlisted men pay gain since 1963
   9. Required FFV increase in Army enlisted men
   10. Dollar value to be paid with
      FFV = $8600; DOD = $13,400
      a. Bonus paid per man
      b. Enlistment bonus (in $ million) ($2000 limit) cost for 112,100
         enlistees
      c. Remaining FFV to be paid
      d. Amount to be absorbed in profile under 2 years' service (maximum
         is $460 or $865 when paid in 2 equal installments of $470, as
         $1450 has already been filled in (1))
      e. Cost of under 2 years' profile absorption (in $ million)
         (112,100 Army enlisted under 2 years' service)
      f. First-term pay increase
      g. Cost of first-term pay increase
         (in $ million) (112,100 Army enlisted)
      h. Wage inversion
      i. Cost of wage inversion (in $ million)
   11. Total Army increase over (1) (in $ million): $b + e + g + i$

B. Officers

12. Officer requirements
   13. Supply of officers
   14. Deficit: (12)-(13)
   15. Percentage deficit: (14)/(13)
   16. Percentage APPY required
   17. Less 7.5% relative pay gain for officers since 1963
   18. Required percentage APPY: (16)-(17)
   19. Dollar value of bonus with FFV of 2d item = $16,170; DOD = $7400 x 3
      years (Appendix B)
   20. Multiply (19) by 10,800 officers
      inflow - officer bonus cost (in $ millions)
<table>
<thead>
<tr>
<th>Measure</th>
<th>Perceived Present Value of Wages</th>
<th>DOD Wage Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.0 ES</td>
<td>0.5 ES</td>
</tr>
<tr>
<td></td>
<td>U/P</td>
<td>U/P</td>
</tr>
<tr>
<td></td>
<td>16.9%</td>
<td>11.5%</td>
</tr>
</tbody>
</table>

### III. Non-Army Cost Increases

#### A. Enlisted Men

21. Non-Army enlisted men (1-4) required inflow

- 208,700

22. Requirements after 3.6% training savings

- 200,800

23. Less 10% permissible category IV proportion

- 20,100

24. Category I-III requirements: (22)-(23)

- 180,700

25. Category I-III supply at no change in relative pay (Table 2)

- 189,900

26. Percentage deficit in category I--III: ([22]/[22]-1) * 100%

- 0.0

27. Less 14.5% AFV (or 10.7% DOD) pay rationalization (under 1) and 7.0% relative enlisted men pay gain since 1963

- 21.9

28. Required bonus to Non-Army enlisted men

- 0.0

29. Cost (in $ million)

- 0.0

#### B. Officers

30. Officer requirements

- 21,500

31. Supply of officers (DD-945--Army)

- 18,000

32. Deficit: (30)-(31)

- 3500

33. Percentage deficit

- 19.5

34. Percentage of AFV required

- 14

35. Less 7.2% relative pay gain for officers since 1963

- 6.8

36. Required percentage AFV: (34)-(35)

- $100

37. Dollar value of bonus with AFV of 21% = $16,170; DOD = $7600 x 3 years

- $24

38. Multiply (37) by 21,500 officer inflow = officer bonus cost (in $ million)

- $481

### IV. Short-run cost increase for volunteers

39. Wage increase (in $ million)

- $481

40. Long-run cost increase (all in $ million)

- $481

41. Enlisted men seniority cost

- 1343

42. Officer seniority cost

- 1343

43. Long-run wage increase: (40)+(41)+(42)

- 2054

44. Retirement costs

a. Enlisted men

- 1512

b. Officers

- 214

45. Training savings

a. Enlisted men

- 1235

b. Officers

- 420

46. Long-run total cost increase: (43)+(44)-(45)

- 2125

### Notes

a. Altman and Fechter, p. 25, Table 5. They give 106,000, but 20 percent of this is category IV, so only 84,800 are categories I-III.

b. Ibid. They give 91,000, but 20 percent of this is category IV, so only 71,800 are categories I-III.

c. The 14.9-percent AFV increase is only a 10.7-percent DOD wage increase.

d. ES = 37/26 = 1.42, Altman and Fechter.

e. ES = .71, a halving of the Altman and Fechter estimate.

f. The actual short-run transition costs during 1970-71, either with a draft or a Vietnam phasedown, will be approximately 20 percent greater, corresponding to the 20 percent larger inflows required to maintain force levels temporarily until the higher reenlistment rates and longer tours of volunteers are realized.
recession and a rise in the youth unemployment rate from 13.8 percent (January 1970, and it is rising) to 14.9 percent, the 1960-1965 average. If the war lasts longer and voluntarism is introduced later, the cost estimates can be lower (assuming 1970 wages hold) because the manpower pool continually increases through the 1970s. With "peace," the force level is assumed reduced to the 1960-1965 effectiveness level of 2.49-million enlisted men and officers. The true volunteer rate of 1964 is then assumed to apply.  

Short-Run Costs

The immediate post-Vietnam cost impact of a volunteer force is not great, as reflected in the short-run increases summarized in Table 22. As mentioned earlier, we concentrated on the case presented in Column 1. The pay of enlisted men (especially Army recruits) and officers is raised, but fewer are required. Although it is cheaper to give all military wage increases as bonuses, it seems desirable to flatten the pay profile of all enlisted men (Fig. 7) by increasing the first-term pay to the Federal minimum wage of $1.65 per hour. The extremely low first- and second-year "total income" salaries of $2440 and $2857, which would exist in 1970 if present standards were maintained, could be raised to $3168 and $3585 in 1970 by meeting the minimum wage level (i.e., there would be equal increases of $728 each

---

1 Determined by the Defense Department survey of first-term enlisted men.

2 This may be reasonable despite the military aversion that apparently sets in after a war. Aversion undoubtedly occurs, but the reaction may be merely a return to peacetime aversion levels. The wartime exhaustion of manpower pools should also cause enlistment declines, which could be confused with increasing aversion. As opposed to vocal subgroups during the initial stages of a war, evidently pro-military sentiment is engendered among the young, so any reaction may well be a fall from a high plateau to a more normal level. A lower true volunteer rate is considered later. A currently unpublished DOD study indicates a V/E of 0.5, lower than the .62 proportion of 1964, but this merely reflects Vietnam's sharply higher military demands and the relatively fixed pool of true volunteers when military wage relatives are not increased.

3 The current Federal minimum wage of $1.65 per hour for a 40-hour, 48-work-week year is $3168.
MONTHLY EARNINGS OF ENLISTED MEN IN:

Fig. 7 -- Pay progression of enlisted men
year). At the assumed discount of 25 percent, the present value of these increases is $1310, which raises the 1970 PPV\(_m\) (=\$8800) by 14.9 percent to \$10,110. Because relative military wages have climbed 7 percent since 1963, this amounts to a 21.9-percent relative wage increase over the 1963 data base. The $728 increase costs $445 million, when multiplied by the 312,900 annual required inflow of new enlisted men and the 299,300 flow for the second year.\(^1\) This cost appears in line 1 of Table 22.

When necessary to avoid recruiting deficits, additional wage increases are given for Army enlisted men (line II-A, Table 22), Army officers (II-B), non-Army enlisted men (III-A), and non-Army officers (III-B).\(^2\) The wage increases that are given in bonuses to raise PPV by an equal amount are small, so no wage inversion occurs.\(^3\) Short-run cost increases are then $481 million, the sum of the wage increases on lines I+11+20+29+38.

**Long-Run Costs**

Long-run costs must consider three factors: increased seniority costs caused by shifts in the length-of-service composition of the officer and enlisted men forces due to increased retention; increased retirement payments; and training savings. All three are derived in Appendix C and summarized in Section V of Table 22. In the long run, officer and enlisted men seniority costs increase by $230 and $1343 million, respectively (lines 42 and 41).

Total retirement costs (line 44) increase $1726 million because of a higher first-term reenlistment rate. This impact will not be felt for 20 years, however, until the true volunteers begin to retire. Total training savings are $1655 million (lines 45a and b).

\(^1\) Table 3, Column 5.

\(^2\) Note that the non-Army services experience no recruiting difficulties. Deficits are obtained from Table 2.

\(^3\) No senior soldiers are paid less than their juniors.
Our total long-run cost of $2125 million is much lower than that of most previous studies due to training force savings (from the reduced inflow necessary to stock the volunteer force), the use of the present value of perceived pay, and enlistment bonuses. These elements also prevent wage inversion. The recent Presidential Commission also estimates long-run costs of $2.3 billion but, as noted in Appendix H, they exclude retirement costs and do not consider the full impact of seniority costs.

Since Army manpower deficits are the most serious, efforts are needed to increase the supply and retention of Army personnel. This may be accomplished through reenlistment bonuses or through improvements in the quality of Army life, especially if wage discrimination among the Services is not permitted. Alternatively, the Army's demand for manpower could be reduced by shifting some of its functions to the other Services.

SENSITIVITY OF THE ESTIMATES

A glance across lines (39) and (46) of Table 22 indicates that neither short-run nor long-run cost increases vary by more than $1 billion for changes in our assumptions about the youth unemployment rate, the elasticity of supply, or the correct wage variable. The worst case (column 8) has short-run costs of $1140 million and long-run costs of only $2784 million. The worst case is unlikely because youth unemployment has been high in the past; it was 13.8 percent and rising in January 1970, for example. Higher minimum wage laws tend to reduce the number of unskilled youth demanded at the very time more are entering the labor market.

Bonuses are limited to $2000 for enlisted men and $4000 for officers in this study. If in some future scenarios the required wage increase would be greater for Army enlisted men, then successive pay increments (discounted where necessary) could be spliced into the wage profile of Fig. 7, and would involve the expenses shown on lines (10d) to (10h) of Table 22. Splicing, combined with enlistment
bonuses, prevents a uniform upward shift in the pay of all military personnel and would be an economical way to keep cost increases under control.

Halving the supply elasticity from $ES = 1$ to $ES = 0.5$ with a given recruitment deficit has the same cost effect as doubling the deficit (in percentage terms), given that $ES = 1$. Wage increases required to close the deficit are the same in both cases. As an example, assume post-Vietnam war aversion reduces the volunteer rate by 16 percent. For our calculations then, this is equivalent to a 16-percent overstatement of the true volunteer rate in the 1964 DOD survey. Table 22 indicates such a supply variation would not seriously increase cost; one merely moves from one case to another one, identical in all respects except that ES is smaller. At low unemployment, costs increase $326 million in moving from column 2 to 4 in Table 22, for example.

Greater use of mental category IV people will ease any moves to a force level higher than 2.49 million. The Air Force is now receiving 20 percent category IV's, over twice its past average, and the other services are doing likewise. Also, lines (24) to (28) of Table 22 indicate an excess supply of non-Army enlisted men at the pay package we propose. Men probably queue up to enlist, so inflows may be increased rapidly up to a certain point. Of course large buildups could be handled by the existing draft machinery.

**ALTERNATIVE SCENARIO: LOWER RETENTION RATES**

Given the force size, inflow requirements are a function of the first-term reenlistment rate of volunteers. These rates were previously derived in Eq. (1) (and displayed in Table 9 of Appendix A) by assuming the reenlistment rate of the draft-motivated (DM) enlistees equalled that of draftees (9.2 percent):

$$DM(9.2) + (1 - DM)(x) = (1)(FT).$$

But we assume that the draft-induced enlistee, by the very fact of his enlistment, is less averse to military life than the draftee.
Assume that the reenlistment rate for DM enlistees is some weighted average of the reenlistment rates of draftees and volunteers. With the former rate of 9.2 percent and the latter equal to \( X \) percent, assume that the DM rate lies halfway between the two. Thus in Eq. (1) the 9.2-percent DM rate becomes \( 1/2(9.2 + X) \), and (1) becomes

\[
(78) \quad DM[1/2(9.2 + X)] + (1 - DM)X = (1)FT.
\]

Using the DM fractions of Table 8 of Appendix A, the new volunteer rates (\( X \)) become those shown in Table 23.

Table 23

<table>
<thead>
<tr>
<th>Service</th>
<th>True Volunteer Retention Rate</th>
<th>Increase in Retention Rate(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>28</td>
<td>18</td>
</tr>
<tr>
<td>Navy</td>
<td>27</td>
<td>12</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>18</td>
<td>4</td>
</tr>
<tr>
<td>Air Force</td>
<td>38</td>
<td>15</td>
</tr>
</tbody>
</table>

\(^a\)[(true volunteer rate : first-term rate of a draft-induced force)] - 1 \times 100.

The DOD rate (a weighted average of the rates in Table 23) is now 30 percent. Of course, these retention rates are smaller than the corresponding rates in Table 9 of Appendix A. The percentage increase in first-term retention rates shown in Table 23, as compared with the draft-induced rates, implies corresponding increases in the manpower frequencies of Table 10, Appendix A. Each term in the Army is increased 18 percent for years 3 to 30, the Air Force by 15 percent for years 4 to 30, and so on. With the new retention rates of Table 23 and the force sizes postulated in Table 6 of Appendix A, we derive the enlisted inflow requirements of Table 24.
Table 24

REQUIRED INFLOW OF ENLISTED MEN, WITH LOWER RETENTION RATES
(In thousands)

<table>
<thead>
<tr>
<th>Service</th>
<th>Number of Enlistees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>140.4</td>
</tr>
<tr>
<td>Navy</td>
<td>94.0</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>31.2</td>
</tr>
<tr>
<td>Air Force</td>
<td>107.1</td>
</tr>
<tr>
<td>Non-Army</td>
<td>232.3</td>
</tr>
<tr>
<td>DOD Total</td>
<td>372.7</td>
</tr>
</tbody>
</table>

Comparing these numbers with the inflows required to support a draft-induced force in Appendix A, Table 12, column 2, we find the following flow reductions:

<table>
<thead>
<tr>
<th>Service</th>
<th>Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>35.3%</td>
</tr>
<tr>
<td>Navy</td>
<td>4.8%</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>9.0%</td>
</tr>
<tr>
<td>Air Force</td>
<td>6.5%</td>
</tr>
<tr>
<td>Non-Army</td>
<td>6.2%</td>
</tr>
<tr>
<td>DOD</td>
<td>25.3%</td>
</tr>
</tbody>
</table>

These decreases imply corresponding savings in training and other support personnel:

<table>
<thead>
<tr>
<th>Service</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>7.1%</td>
</tr>
<tr>
<td>Navy</td>
<td>1.1%</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>3.1%</td>
</tr>
<tr>
<td>Air Force</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

Applying such secondary force reductions to Table 24 gives the new accessions required to maintain a 2.65-million-man effective force level, as shown in Table 25.
Table 25

NET REQUIRED ACCESSIONS OF ENLISTED MEN
(In thousands)

<table>
<thead>
<tr>
<th>Service</th>
<th>Number of Enlistees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>130.4</td>
</tr>
<tr>
<td>Navy</td>
<td>93.0</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>30.2</td>
</tr>
<tr>
<td>Air Force</td>
<td>105.5</td>
</tr>
<tr>
<td>Non-Army</td>
<td>228.7</td>
</tr>
<tr>
<td>DOD Total</td>
<td>359.1</td>
</tr>
</tbody>
</table>

Allowing 20 percent of the Army enlistments and 10 percent of the non-Army enlistments to be category IV personnel, we obtain the required category I-III accessions. Compared with DOD projections of category I-III volunteers (Table 3 of the text) we have the figures shown in Table 26.

Table 26

RECRUITING DEFICITS FOR CATEGORY I-III ENLISTEES
(In thousands)

<table>
<thead>
<tr>
<th>Group</th>
<th>Demand</th>
<th>Supply U/P=14.9%</th>
<th>Supply U/P=11.5%</th>
<th>Percent Deficit U/P=14.9%</th>
<th>Percent Deficit U/P=11.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>104.3</td>
<td>84.8</td>
<td>72.8</td>
<td>23(6)(^a)</td>
<td>43(23)</td>
</tr>
<tr>
<td>Non-Army</td>
<td>205.8</td>
<td>189.9</td>
<td>162.9</td>
<td>8(0)</td>
<td>26(11)</td>
</tr>
</tbody>
</table>

\(^a\) The corresponding recruiting deficits generated by the original, more optimistic retention rates (Table 22, II-6) are in parentheses.

The wage increase necessary to eliminate these deficits is not great, especially if one accepts the theory and empirical estimate of ES = 1.5. Conversely, with the most costly set of assumptions,\(^1\) the procedure of Table 22 generates a short-run wage increase of only $3122 million, as seen in Table 27.

\(^1\) ES is 0.5 instead of 1.5, U/P is 11.5%, and the DOD wage definition is in effect.
Table 27

COST OF SHORT-RUN WAGE INCREASE
(In $ million)

<table>
<thead>
<tr>
<th>Line of Table 22</th>
<th>Item</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>pay rationalization</td>
<td>$445</td>
</tr>
<tr>
<td>II-A-II</td>
<td>total Army increase</td>
<td>1600</td>
</tr>
<tr>
<td>II-B-20</td>
<td>Army officers</td>
<td>65</td>
</tr>
<tr>
<td>III-A-29</td>
<td>non-Army (enlisted)</td>
<td>940</td>
</tr>
<tr>
<td>III-B-38</td>
<td>non Army (officers)</td>
<td>72</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>$3122</strong></td>
</tr>
</tbody>
</table>

Appendixes A and C detail steps for calculating the long-run cost increase. Table 24 indicates a 372,700 inflow is needed with the 30-percent retention rate, but normal first-year losses cause the first year to average 358,555 men. The new force profile appears in Table 28. Now compare the column 2 total of Table 28 with the column 4 total of Table 13 in Appendix C, and put these into Eq. (24) to derive a seniority cost increase of $860 million.

Retirement cost increments are calculated from Eq. 2 of Appendix A, using the information of Tables 13 and 28. This increment is $1376 million for enlisted men. Training savings come from Eq. (3) of Appendix A. The manpower reduction is 3.7 percent (Table 24 versus Table 25). This saves $285 million in base pay (Table 28), but Eq. (3) inflates this to a $740-million training saving.

Assuming officer cost increments are unchanged, total long-run costs are thus only $4642 million for the most pessimistic case illustrated in Table 29.¹ If the supply elasticity were about 1.5, however, as argued in Appendix D, the wage increases of Table 29 would fall to about $1000 million and total costs would be only $2600 million.

¹Compare this with Table 22, lines 40-46, column 8. There, using identical assumptions except higher reenlistment rates, the cost is $2784 million.
Table 28

BASIC PAY AND NUMBER OF PERSONNEL FOR VOLUNTEER FORCE,
BY YEARS OF SERVICE

<table>
<thead>
<tr>
<th>Years of Service</th>
<th>(1) Avg Annual Basic Pay</th>
<th>(2) Number in Force (In thousands)</th>
<th>(3) Cost (In $ thousand)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry</td>
<td>$1440</td>
<td>358.6</td>
<td>$516,319.2</td>
</tr>
<tr>
<td>1</td>
<td>1973</td>
<td>311.3</td>
<td>653,722.0</td>
</tr>
<tr>
<td>2</td>
<td>2762</td>
<td>311.7</td>
<td>860,887.8</td>
</tr>
<tr>
<td>3</td>
<td>3009</td>
<td>215.2</td>
<td>647,410.4</td>
</tr>
<tr>
<td>4</td>
<td>3401</td>
<td>101.0</td>
<td>343,412.6</td>
</tr>
<tr>
<td>5</td>
<td>3515</td>
<td>87.9</td>
<td>309,052.9</td>
</tr>
<tr>
<td>6</td>
<td>3797</td>
<td>82.2</td>
<td>311,995.7</td>
</tr>
<tr>
<td>7</td>
<td>3864</td>
<td>75.4</td>
<td>291,167.9</td>
</tr>
<tr>
<td>8</td>
<td>4106</td>
<td>67.0</td>
<td>275,262.1</td>
</tr>
<tr>
<td>9</td>
<td>4210</td>
<td>61.3</td>
<td>257,997.2</td>
</tr>
<tr>
<td>10</td>
<td>4393</td>
<td>57.6</td>
<td>253,230.1</td>
</tr>
<tr>
<td>11</td>
<td>4424</td>
<td>55.2</td>
<td>244,116.3</td>
</tr>
<tr>
<td>12</td>
<td>4655</td>
<td>53.4</td>
<td>248,656.1</td>
</tr>
<tr>
<td>13</td>
<td>4691</td>
<td>52.2</td>
<td>244,964.0</td>
</tr>
<tr>
<td>14</td>
<td>4904</td>
<td>51.2</td>
<td>251,006.3</td>
</tr>
<tr>
<td>15</td>
<td>4970</td>
<td>50.4</td>
<td>250,423.4</td>
</tr>
<tr>
<td>16</td>
<td>5127</td>
<td>49.7</td>
<td>255,042.6</td>
</tr>
<tr>
<td>17</td>
<td>5291</td>
<td>49.2</td>
<td>260,354.2</td>
</tr>
<tr>
<td>18</td>
<td>5423</td>
<td>48.7</td>
<td>264,094.7</td>
</tr>
<tr>
<td>19</td>
<td>5582</td>
<td>45.9</td>
<td>256,141.2</td>
</tr>
<tr>
<td>20</td>
<td>5776</td>
<td>29.1</td>
<td>168,070.0</td>
</tr>
<tr>
<td>21</td>
<td>5947</td>
<td>20.0</td>
<td>119,029.2</td>
</tr>
<tr>
<td>22</td>
<td>6264</td>
<td>14.4</td>
<td>90,351.9</td>
</tr>
<tr>
<td>23</td>
<td>6384</td>
<td>10.8</td>
<td>69,151.5</td>
</tr>
<tr>
<td>24</td>
<td>6508</td>
<td>8.6</td>
<td>56,020.9</td>
</tr>
<tr>
<td>25</td>
<td>6668</td>
<td>7.1</td>
<td>47,149.4</td>
</tr>
<tr>
<td>26</td>
<td>7504</td>
<td>5.8</td>
<td>43,875.9</td>
</tr>
<tr>
<td>27</td>
<td>7627</td>
<td>4.8</td>
<td>36,563.8</td>
</tr>
<tr>
<td>28</td>
<td>7758</td>
<td>4.0</td>
<td>30,706.2</td>
</tr>
<tr>
<td>29</td>
<td>7758</td>
<td>3.2</td>
<td>24,879.9</td>
</tr>
<tr>
<td>30</td>
<td>7324</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Total: 2,312.9 $7,681,055.5

---

\(a\) 30-percent retention rate assumed.

\(b\) Items may not add to totals because of rounding.
Table 29
LONG-RUN COST INCREASE: "WORST" CASE
(In $ million)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wage increase</td>
<td>$3122</td>
</tr>
<tr>
<td>Seniority cost</td>
<td></td>
</tr>
<tr>
<td>Enlisted men</td>
<td>860</td>
</tr>
<tr>
<td>Officers</td>
<td>230</td>
</tr>
<tr>
<td>Retirement Cost</td>
<td></td>
</tr>
<tr>
<td>Enlisted men</td>
<td>1376</td>
</tr>
<tr>
<td>Officers</td>
<td>214</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$5802</td>
</tr>
<tr>
<td>Less training saving</td>
<td></td>
</tr>
<tr>
<td>Enlisted men</td>
<td>740</td>
</tr>
<tr>
<td>Officers</td>
<td>420</td>
</tr>
<tr>
<td>Subtotal</td>
<td>$1160</td>
</tr>
<tr>
<td>Total</td>
<td>$4642</td>
</tr>
</tbody>
</table>

Assuming ES=0.5, U/P=11.5%, R=.30, Wage=DOD
"total income."

A THREE-MILLION-MAN FORCE

What would the long-run cost increment be if world tensions indicated a 3.0 million volunteer force were necessary? This level is 14 percent greater than the 2.65 million previously assumed. Steady inflows and the manpower frequencies at each seniority level would be increased 14 percent (Appendix A), so that retirement and seniority costs would also rise 14 percent, as would training savings. Take column 1 of Table 22 as an illustrative case. With ES = 1.0, U/P = 14.9% and using the PPV definition of wages, these three major cost elements (lines 41, 42, 44, 45) now sum to $1.88 billion. The long-run wage increase (line 40) must be derived and added to this sum to obtain long-run total costs.

Assume the total force increase of 14 percent corresponds to an Army expansion of 20 percent and a non-Army growth of only 11 percent for both officers and enlisted men. 1 Army requirements for categories

1 The Army share typically rises in a general force expansion.
1-III enlisted men are now 197,600 (line II-4 of Table 22), and a 26-
percent manpower deficit arises. But line 8 indicates that only a 4-
percent pay increase is necessary in addition to the pay rationaliza-
tion of line I. Working through Table 22, we obtain wage increases
(line 40) of $1.13 billion. Since seniority and retirement elements,
minus training-saving, are $1.88 billion, we obtain a cost increment
of $3.01 billion to establish a volunteer force with the same number
of men in combat units as a 3-million-man draft-induced force.

In a real sense, the cost of a 3-million-man volunteer force
seems to be politically irrelevant. A world in which defense needs
are this great would probably be considerably different from the rela-
tively tranquil world of the 1957-1964 period. Supply and cost may
dramatically increase or decrease depending upon the popularity of the
particular conflict. Military supply curves may be quite unstable
and/or inelastic in a world in which the United States engages in lim-
ited conflicts. Thus a considerable band of uncertainty surrounds the
$3-billion cost increment for a 3-million-man force. A high tension
world would probably find the United States constantly preparing for a
police action or else actively engaged in one. In either case, the
Government would most probably reinstitute the draft lottery to build
up and maintain a large military force. It is plausible to assume
that it would shift gears from a volunteer system back to the current
mixed volunteer-draft system as required force levels rose toward 3
million.
Appendix I

COST IMPLICATIONS OF ALTERNATIVE ENLISTMENT AND RETENTION POLICIES

A major constraint on our volunteer budget cost estimate and on other published estimates has been the acceptance of existing institutional manpower practices. This can be termed the "muddling through" version of voluntarism, which attempts to reduce the impact of voluntarism upon the military institution by leaving other practices unchanged. Consequently, muddling through is a high-cost version of voluntarism. Removing the institutionally imposed manpower constraints can only reduce costs.

Two broad alternatives to the present policy are possible: (1) to relax many existing constraints while still operating within institutional preferences; and (2) to challenge existing manpower concepts. Alternative 2 would require a complete restructuring of Service incentive, compensation, and promotion policies. This appendix explores alternative 1--only modifying existing enlistment and retention policies.

Basic manpower policies today are unchanged from 1950 before the era of standing forces and mutual deterrence. They were designed to support a mobilization strategy. Manifestations of this theme are large reserves, "up or out" promotion policies, early retirement, "generalist" and high rotation policies for officers.

The draft itself has caused certain practices that may be undesirable in a volunteer era. As long as the Services depend upon draftees and draft-induced volunteers, tours of duty will be relatively short. Thus the Services emphasize high trainability through an extensive formal schooling system which minimizes training time and gains a reasonable pay-off period for its human capital investment. This contributes to such practices as enticing high caliber youths into expensive training programs, even though as a group such individuals have low reenlistment rates. If the draft were eliminated, the relatively short enlistments should also be eliminated.
While it is true that longer enlistments imply higher pay because of seniority and the disutility of longer enlistment contracts, higher pay does not necessarily imply higher total costs. Major elements in total costs are productivity, training, and retirement. Though military productivity has remained elusive, longer pay-off periods after training imply longer on-the-job experience and higher productivity. And longer pay-off periods reduce training costs. Military retirement is also expensive, averaging 89 percent of basic pay for the individual retiree. The Army and Marine Corps have valid reasons for maintaining a relatively youthful force for their ground combat arms (as does the Air Force and Navy in their pilot corps). Thus, the Services need to lengthen their payoff periods but not to the extent that too many men are attracted to retirement or that their combat branches become overaged.

The policy guidelines are therefore (1) an increase in initial enlistments from their current 3 and 4 years to 6 to 10 years and (2) a curtailment of reenlistments. Figure 8 compares the years-of-service profiles of three enlistment systems: A, the current draft-induced force; B, the standard muddling through version of voluntarism; and C, an 8-year enlistment system with retentions limited to 20 percent at the 8-year point. The salient feature of the graph is the shift from A, with low experienced and low productivity individuals, to C, with longer term and more highly productive individuals. The standard volunteer system largely accomplishes this shift by substituting long-term personnel for individuals with less than 3 years of completed service. The 8-year enlistment system substitutes 4- to 8-year men

---

1 Long enlistment contracts themselves are disputed because they carry connotations of contractual labor. Such contracts also reduce labor mobility. However, longer contracts give the Services an incentive for greater investments in human capital, not all of which need be specific to the military.

2 This substitution mainly affects the Marine Corps and Army—the Services whose requirements drive the DOD manpower system. The Air Force and Navy already have 4-year enlistments and a draft-induced profile resembling their volunteer profile. Higher reenlistments for these two services will depress their projected first-term strength 19 percent and raise their career force 15 percent.
Fig. 8 -- Enlisted strength profile for three force alternatives
for those with less than 3 or more than 8 years of completed service. A force like C would suit all the Services better than either the draft-induced or standard volunteer force. It approaches the optimal force profile for the Army and Marine Corps; however, for the Air Force and Navy even fewer first-termers and more careerists would be desirable if longer service could be transformed into higher productivity and lower Manning levels.

Table 30

<table>
<thead>
<tr>
<th>Measure</th>
<th>Standard</th>
<th>20% Retention</th>
<th>10% Retention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accession costs</td>
<td>+ 0.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longevity costs</td>
<td>+ 1.34</td>
<td>+ 2.00</td>
<td>+ 1.12</td>
</tr>
<tr>
<td>Retirement costs</td>
<td>+ 1.51</td>
<td>- 1.44</td>
<td>- 2.55</td>
</tr>
<tr>
<td>Training savings</td>
<td>- 1.24</td>
<td>- 2.04</td>
<td>- 1.59</td>
</tr>
<tr>
<td>Reenlistment bonuses</td>
<td>unchanged</td>
<td>- 0.33</td>
<td>- 0.33</td>
</tr>
<tr>
<td>System cost</td>
<td>2.08</td>
<td>-1.81</td>
<td>-3.35</td>
</tr>
</tbody>
</table>

Table 30 shows the incremental cost of three different force alternatives, using the draft-induced force as the base. Longevity, retirement, and training costs can be computed from the methodology outlined in Appendixes A and C. A longer enlistment also obviates a reenlistment bonus. The question marks represent the unknown personnel costs needed to induce enlistees into a longer enlistment tour.\(^1\) While unknown, this cost would probably not be much greater than the $500 million for accessions to the standard force. The reason is the sharp drop in accessions from 313 thousand for the standard force to 215 and 258 thousand for the 8-year, 20- and 10-percent retention systems. With smaller accession requirements, a smaller premium is necessary to attract enough volunteers. Part of the

\(^1\)Included in this cost would be a gratuity for successful completion of the enlistment tour and the cost of commercially valuable training given to prepare servicemen for a remunerative civilian career beginning at approximately age 26.
incremental premium necessary to offset a longer enlistment tour will therefore derive from the original $500 million premium of the standard volunteer force and the discontinuance of reenlistment bonuses.

The major shift in costs is due to reduced retirements. The result is that, even though accession costs are unknown, total system costs would be substantially reduced and a youthful force would be maintained. Moreover, productivity would be increased. Longevity costs are a rough proxy for productivity: in the case of 20-percent retention, productivity is almost certainly increased; for 10-percent retention productivity approximates that of the standard volunteer force. In all three volunteer systems, productivity is higher than in the draft-induced force.


Selected Manpower Statistics, Directorate for Statistical Services, Office of Secretary of Defense.


