Governors of the Federal Reserve System to spell out in greater detail a tax-based incomes policy. The fruitful collaboration (apparently encouraged by Leonard Silk of the New York Times) provided Weintraub with sufficient public and professional attention to attract offers to accept the verities that Weintraub had spent years analyzing. Today, his vision offers developed entrepreneurial economies the primary solution to the second great crisis of capitalism in the twentieth century—stagflation.

Editor’s Note: This Tribute will also be printed in Henry W. Spiegel and Warren J. Samuel, eds., Contemporary Economics in Perspective (Greenwicht, Conn.: JAI Press, 1984), Vol. 1.

The Military’s Monopsony Power

ALINE QUESTER* AND MICHAEL NAKADA

Introduction

Since the inception of the All-Volunteer Force (AVF) the issue of military compensation, the level of current remuneration and the size of future increases, is debated annually in Congress. Civilian sector competition forces military pay toward parity lest shortfalls and attrition take their toll. Moreover, the effectiveness and cost of military pay has brought back the debate between the AVF and the draft. Surely, given a fixed military budget, there are competing demands on these resources, i.e., hardware versus personnel procurement.

The purpose of this paper, then, is to examine the labor market behavior of the combined military services. Currently, the military attracts an average of a quarter of a million 17-21 year-old non-prior service high school graduate males annually. The total size of our armed forces numbers two million. Exclusive of military retirement payments, the size of the military’s wage bill in FY 81 was nearly 34 billion dollars. This sum was 20 percent of DoD’s total FY 81 budget of 171.2 billion dollars.

The debate between the AVF and the draft is a debate on the issue of military pay and its effectiveness in attracting needed personnel. Were the military a perfect competitor for labor, any failure on the part of the military to pay the competitive wage would doom the AVF. Indeed, the military would face a completely elastic supply curve at the market wage. An examination of empirical estimates, however, reveals elasticities of supply for this age group considerably less than infinity. Most estimates, in fact, are about unity (See Goldberg, 1981).

The only conclusion, then, is that the military does face an upward-sloping labor supply curve and, to the extent that increasing military pay increases enlistments, the military does wield some power in the labor market. This power has been analyzed within the framework of a monopsony model by Thomas Borchering (1971) and Richard Cooper (1975). Thomas Borchering “calculated” the deadweight burden associated with the monopsonistic purchase of volunteers and “compared” the magnitude of this loss to the loss associated with the over-employment of
Enlisted labor. The "calculations" and "comparisons" in the Borcherding paper are pictorial rather than numerical. Cooper provides a more detailed and numerical comparison of these two losses.

Cooper's analysis of AVF, however, devoted insufficient attention to the linkage between military and civilian wages which are developed in this paper as a basis for exploring the military's monopsony power in an economy-wide framework.

Monopsony

The U.S. military currently employs approximately 6 percent of 17-21 years old males. If we focus only on those in this age group who work full-time, the military's employment rises from 6 percent to about 20 percent. Thus, the military is a substantial employer of youth labor. In what sense, then, does the monopsony model apply to the military? Consider first the textbook monopsony model. Because a monopsonist firm faces an upward sloping labor supply curve, it must pay more if it wants more labor. In contrast, the competitive firm faces a perfectly elastic supply of labor and can obtain all the labor it wants at the equilibrium (market) wage. The presumption is that a change in the firm's demand will not influence the wage because the individual firm buys a small fraction of the available labor.

Figure 1 illustrates this pure case. The monopsonist faces an upward sloping supply of labor curve as higher wages induce workers to substitute work for "leisure." A profit maximizer, the firm equates the marginal return from labor (the marginal revenue product curve) to the marginal cost of labor. The supply curve is the average cost of labor curve.

When average costs are rising, marginal costs are above average costs. In the linear case, marginal costs are increasing at twice the rate of average costs.

This first order condition determines the level of employment. Since the employer will pay no more for the labor than he has to, he will pay his workers W. When compared to the monopsonist, a competitive solution would involve both increased employment (E) and a higher wage (W). The monopsonist will exist as long as workers lack alternative employment opportunities.

This pure monopsony model seems inappropriate for the problem at hand. Since there are alternative employers (and thus alternative wages) for youth, the military could not pay less than other employers and hope to obtain enlistees. In short, a voluntary military cannot monopsonize the youth labor market, setting its compensation in a vacuum from other firms. For the existence of a stable solution, wages for equally productive workers must be equal across employers, but the pure monopsony model assumes away other employers. A dominant firm monopsony model, based on dominant product pricing models, is appropriate.

The Dominant Firm Monopsony

The model begins with three relationships:

1. A U.S. supply of labor curve for homogeneous labor (mental group, HSG, etc.),
2. A demand for labor by the military, and
3. A demand for labor by the other small firms.

Let

\[ D_{\text{MIL}} = \text{demand curve for the combined armed services} \]

\[ D_{\text{MIL}} = \text{demand curve for the U.S.} \]

\[ M_{\text{MIL}} = \text{marginal cost of labor curve for the United States} \]

\[ M_{\text{MIL}} = \text{marginal cost of labor curve for the U.S.} \]

\[ S_{\text{MIL}} = \text{supply curve to the combined armed services} \]

\[ S_{\text{MIL}} = \text{supply curve to the U.S.} \]

\[ Q_{\text{MIL}} = \text{quantity of labor demanded by the combined armed services} \]

\[ Q_{\text{MIL}} = \text{quantity of labor demanded by the small firms} \]

\[ Q_{\text{MIL}} = \text{equilibrium quantity of labor hired by a pure monopsony} \]

\[ Q_{\text{MIL}} = \text{equilibrium quantity of labor hired under perfect competition} \]

\[ W_{\text{MIL}} = \text{equilibrium wage under a dominant firm monopsony} \]

\[ W_{\text{MIL}} = \text{equilibrium wage under perfect competition} \]

\[ W_{\text{MIL}} = \text{equilibrium wage under a pure monopsony} \]

The labor supply curve for the military is derived by subtracting the demand for labor by the small firms from the total supply of labor. (In the diagram on the following page, the supply of labor to the military, S_{\text{MIL}}, is the horizontal difference between S_{\text{MIL}} and D_{\text{MIL}}.) Since the average cost of labor is rising, the military, as the dominant employer, is in a position to exert some power (see figure 2).

To determine employment, Q_{\text{MIL}}, the military can choose an equilibrium in the market for labor. This is analogous to the absence of a supply curve for a monopsonist in the product market. For expositional ease, however, we will refer to MRP curves in the rest of the paper as demand curves.
One general complaint about dominant firm models lies in its failure to explain how a particular firm achieves the dominant position. This problem seems less severe here as there is no confusion about how the military becomes the dominant firm. As a substantial employer of youth labor, the military can reduce costs by pursuing a monopolistic strategy. The solution is stable and profit- or value-maximizing. Whether or not it is appropriate that the military behave as a monopolist is the next issue. Consider first the question of equity.

The Monopolist Military: Equity and Efficiency

When the military behaves as a dominant firm monopolist rather than as a competitive employer, youth wages are lowered (see figure 2). Youth employment is also lower, but this is a voluntary response to a reduced wage. One can think of this lower wage as being a uniform tax on youth, a tax which helps pay for defense. Everyone benefits from national defense. Hence, in a life cycle framework, the "tax" is fair. (That is, during our youth, we all "paid" the "tax"). Moreover, youth wages would be considerably lower if the military stopped demanding youth labor which makes it difficult to argue against the monopolistic model on equity grounds.

Since monopolist solutions are not competitive Pareto optimal, they present questions of efficiency. Figure 3 illustrates the welfare or dead weight loss associated with the military behaving as a dominant firm monopolist. Before investigating the size of this welfare loss, consider the military's possibilities for price discrimination.

If the military acted as a perfect price discriminator, the supply curve would become the marginal cost curve. There would be no welfare loss, and the solution would differ from the competitive only in the distribution of the surplus (all labor surplus is extracted by the military). The extent to which price discrimination is practiced determines the extent to which the marginal cost and average costs of labor differ. Cooper (1975) argues that the military does price discriminate:

Enlistment bonuses for the combat arms occupational specialties are limited to individuals who are high school graduates and who score average or above average on the mental aptitude examinations. Those individuals one would expect to have higher reservation wages. Similarly, those with higher mental aptitude scores and educational achievement generally receive the better jobs. Finally, recruiters are usually authorized only a limited number of slots for the shorter enlistment tours, with the result that these shorter enlistments are given only to those individuals who appear otherwise reluctant to join—hence, those with higher reservation wages. These are but a few of the many ways the military has of discriminating according to supply price. Rand R-1758-ARPA.

While Cooper's examples suggest that the military is able to vary compensation (to provide a more attractive package to recruits with higher reservation wages), this is not necessarily price discrimination. Price discrimination involves compensating equally productive individuals differentially; it does not mean compensating differentially productive employees differently. These two phenomena must be distinguished in order to evaluate possibilities for reduction in the size of the welfare loss.

There are two cases. The first assumes the military regards the productivities of all first term enlistees as identical while the civilian sector recognizes heterogeneity in the labor productivity of this age group. The second case assumes identical evaluations of productivity by the civilian and military sectors. The important point is that both sectors have the same point of view.

Homogeneous Military Productivity and Heterogeneous Civilian Productivity

This assumption, although rarely explicitly stated, appears fairly common in the litera-
Identical Evaluations of Productivity by the Civilian and Military Sectors

In this case, the military and the civilian sectors find individuals of given demographic characteristics equally productive. Consider eight labor categories, each defined by high school graduation (or not) and by mental groups (I-IV). Assume, next, that for each of these eight labor markets, the military makes its hiring and wage decisions based upon the dominant firm monopsony model illustrated in figure 2.

This process generates eight equilibrium wages: military and civilian wages equalize for comparable employees. Note that while military base pay is the same for enlistees in all of the eight productivity groups, total compensation is not. The mechanisms that Cooper refers to as price discrimination tools are instead the mechanisms by which the military adjusts pay to bring its compensation structure into line with the private sector's. Individuals whose private sector alternative wage is below base pay are assigned jobs with negative non-pecuniary aspects; individuals whose private sector alternatives are greater than base pay are assigned to occupations with large training components, given their location preferences, etc. Bonuses or shorter enlistments are not evidence of price discrimination. Instead, these mechanisms are the tools which the military uses to maintain pay comparability, to keep itself competitive with the private sector.

What scope is left, then, for price discrimination? Could the military price discriminate on any of these supply curves, supply curves which are drawn for individuals with the same alternative civilian wage offers? The answer is no. In order to do so, the military would need some mechanism to reveal how these individuals value their time, and how their reservation wages, given civilian wage offers, differ. Since no such mechanisms exist, a monopsonistic military has few possibilities for price discrimination.23

Hansen and Weisbrod (1967) are an exception. In discussing the discriminatory and allocative effects of the draft, they explicitly draw a 'supply curve' of labor in which an individual's position on the curve is determined by his civilian productivity. They then show that the usual civilian output foregone under a lottery draft is considerably greater than would be necessary. The efficient solution is to select the lowest civilian productivity individuals into the military, given a base level of competence defined by mental group or education.

Hansen and Weisbrod's argument is correct only under the assumption that military productivity is constant across individuals, e.g., that it is invariant to civilian productivity. That is, they can draw one supply curve for military labor only if all individuals on that supply are homogeneous in the production of military output.

The fact that Cooper places these individuals on the same supply curve (for which the military has just one demand curve) means that the military regards these individuals as homogeneous in production.

The military supply curve is derived by the horizontal addition for the difference between overall supply and the other forces' demand for each type of labor; the degree of non-homogeneity in civilian productivities determines the number of terms in the summation.

We do not explicitly discuss the career force. We do feel, however, that the military also has little scope
The military's benefits are evaluated in a long run. We assume, the military's demand for labor is given by the equation:

\[ A = a_0 + b_1 + b_2 + b_3 \]

The elasticity of the wage rate is implicitly defined in the long run. The wage rate is determined in the market for labor, and the elasticity of substitution between capital and labor is a function of the supply of capital and labor. This implies an elasticity of substitution between labor and capital.

**Figure 4:**

- **Military pay (dollars):**
  - $20,000
  - $18,000
  - $16,000
  - $14,000
  - $12,000

- **Non-prior service obligations (thousands):**
  - $0
  - $2,000
  - $4,000
  - $6,000
  - $8,000
  - $10,000
  - $12,000
  - $14,000
  - $16,000
  - $18,000
  - $20,000

**MC** at $20,000 is $0.40 and at $18,000 is $0.45. The value of labor is $20,000 and $18,000. The value of labor is $20,000 and $18,000. The value of labor is $20,000 and $18,000. The value of labor is $20,000 and $18,000.
important. Such a comparison, however, would require calculating an additional dead weight loss since all evidence indicates that the military also faces an upward sloping supply curve for careerists. The size of this total loss relative to the total FY 81 DoD budget would be smaller than the estimated 10 percent, but not as small as Harberger’s.

Concluding Comments

Should the military, as a provider of a public good, ignore its potential monopoly power because of resulting inefficiencies? More basically, does the military currently “profit maximize” and exploit its monopoly power? In product markets one compares price and marginal cost. Here one should compare the enlistee’s marginal revenue product with his wage. Unfortunately, data deficiencies preclude such comparisons. Thus, although one cannot prove the military exploits what power it has, it is commonly assumed to do so.

Cooper’s 1975 analysis has shown that the draft is not the better alternative to the AVF. He demonstrates that the welfare loss associated with a draft will exceed the welfare loss associated with the All Volunteer Force. Clearly, the military, and society in general, can be made better off by moving to the competitive equilibrium, the Pareto optimal solution. However, even if the competitive solution is not politically possible, the present monopoly solution for the AVF is preferred to a draft.

Appendix A

The Dominant Firm Monopoly

<table>
<thead>
<tr>
<th>General</th>
<th>Linear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Let ( Q ) = quantity; ( W ) = wage</td>
<td></td>
</tr>
<tr>
<td>( Q^* = f_1(W) ); ( W^* = g_1(Q) )</td>
<td></td>
</tr>
<tr>
<td>( Q^* = Q = a + bw ); ( W^* = \frac{1}{b}Q - \frac{a}{b} )</td>
<td></td>
</tr>
<tr>
<td>( Q^* = f_2(W) ); ( W^* = g_2(Q) )</td>
<td></td>
</tr>
<tr>
<td>( Q^* = Q = c + dw ); ( W^* = \frac{1}{d}Q - \frac{c}{d} )</td>
<td></td>
</tr>
<tr>
<td>( Q^* = f_3(W) ); ( W^* = g_3(Q) )</td>
<td></td>
</tr>
<tr>
<td>( Q^* = Q = e + fw ); ( W^* = \frac{1}{f}Q - \frac{e}{f} )</td>
<td></td>
</tr>
</tbody>
</table>

V. Solve for quantity of labor employed by the military. First order condition: military’s demand for labor equals military’s marginal cost of labor.

A. Military’s Cost of Labor, \( C_{\text{avf}} \)

\[
C_{\text{avf}} = Q \cdot W_{\text{avf}} = Q \cdot g_3(Q) \quad C_{\text{avf}} = Q \left( \frac{1}{h}Q - \frac{k}{h} \right)
\]

B. Military’s marginal cost of labor

\[
\frac{dC_{\text{avf}}}{dQ} = W_{\text{avf}}^2 + Q \cdot g_3'(Q) \quad \frac{dC_{\text{avf}}}{dQ} = \frac{1}{h}Q - \frac{k}{h} + Q \left( \frac{1}{h} - \frac{2}{h} \right) \frac{k}{h - 2f}
\]

C. First order condition: solve for \( Q^* \)

\[
g_3(Q^*) = W_{\text{avf}}^2 + Q \cdot g_3(Q) \quad \frac{1}{f}Q - \frac{e}{f} = \frac{2Q}{h} - \frac{k}{h}
\]

\[
g_3(Q^*) = Q^* \cdot g_3(Q^*) \quad Q^* = \frac{he - fk}{h - 2f}
\]

VI. Solve for wage military pays: substitute \( Q \) from step C into military’s supply of labor.

\[
W_{\text{avf}} = g_3(Q^*) \quad W_{\text{avf}} = \frac{1}{h}Q - \frac{e}{h} \quad W_{\text{avf}}^2 = \frac{he - fk}{h} - \frac{k}{h}
\]

\[
W_{\text{avf}}^2 = \frac{eh \cdot fk - k(h - 2f)}{h(h - 2f)} \quad W_{\text{avf}}^2 = \frac{he + fk - kh}{h(h - 2f)}
\]

VII. Quantity demanded by firms

\[
Q^* = f_3(W_{\text{avf}}) \quad Q^* = Q - \frac{he + fk - kh}{h(h - 2f)}
\]
VIII. For the linear case only, show $Q_{D0} = Q_{D00} + Q_{D0}^p$ (Step IV).

$$a + b \left[ \frac{he + fk - kh}{h(h - 2f)} \right] + c \left[ \frac{he + fk - kh}{h(h - 2f)} \right] + d \left[ \frac{he + fk - kh}{h(h - 2f)} \right]$$

$$a(h - 2f) + b(h + c)(h - 2f) + (h + d)(he + fk - kh)$$

Show: $ah - 2f + b(h + c)(h - 2f) + (h + d)(he + fk - kh)$

But $k = a - c$ and $h = b - d$ from IV.

IX. Let $Q_{D00} = \text{equilibrium quantity employed under pure competition}$

$W_{K00} = \text{equilibrium quantity employed under dominant firm monopsony}$

$W_{K0} = \text{equilibrium wage under pure competition}$

$W_{K00} = \text{equilibrium wage under dominant firm monopsony}$

Find $Q_{D00}$ and $W_{K00}$ for linear case only.

A. Find $Q_{D0}$ and $W_{K0}$ by equating demand and supply of labor by the military.

$$W_{D0} = W_{K0}$$

$$Q_{D0} = \frac{h - 2f}{h}$$

$$W_{K0} = \frac{he - fk}{h - f}$$

$$Q_{K0} = \frac{1}{2f}$$

$$W_{D0} = \frac{he - fk}{h - f}$$

$$W_{K0} = \frac{1}{2f}$$

$$Q_{D0} = \frac{h - f}{h - 2f}$$

$$Q_{D0}^p = \frac{h - f}{h - 2f}$$

$$Q_{D0} = \frac{h - f}{h - 2f} < 1; \quad h - f > 0$$

Appendix B

I. Welfare Loss, $WL$, by area of triangle:

$$WL = \frac{1}{2} Q_{D00} W_{K00}$$

$$WL = \frac{1}{2} (2000)(7500)$$

$$WL = 100,000,000$$

II. Welfare Loss, $WL$, by Ursala Hick’s formula:

$$WL = \frac{1}{2} e_0 \epsilon \frac{R}{N}$$

$$WL = \frac{1}{2} (1.31467) (5200 \times 242700)$$

$$WL = 1,976,40,450$$

where $R$ = amount of "tax" revenue

$N$ = total amount paid including "tax"

$e_0$ = elasticity of demand for labor

Bibliography


Foreign Students' Demand for United States Higher Education

VINOD B. AGARWAL*

Introduction

The demand for college education is expected to decline absolutely in the decades ahead as the size of the young college-eligible population declines. However, the supply of student slots in higher education is relatively inelastic due to a large fixed capital stock and a high proportion of tenured faculty. The result is likely to be excess capacity in American higher education in the coming decades.

In response to this potential decline in demand and the difficulties in reducing their existing capacity, institutions of higher education are expected to explore alternatives for increasing or maintaining their enrollment levels. The feasible alternatives are to lower admission standards, reduce tuition charges, and recruit students from new sources. The most likely and widely accepted alternative would appear to be energetic recruitment from new sources.

Potential sources of additional enrollments include, among others, continuing education enrollments as discussed in Bishop and Van Dyk (1977), and Education Opportunity Programs to attract minorities. Another unexploited source is students from other countries, the focus of this study. This paper estimates the demand for U.S. higher education by foreign students to shed light on how this goal might best be accomplished. Most previous studies on the estimation of educational demand or the prediction of student enrollment have often overlooked enrollment of foreign students (Campbell and Siegel, 1967; Galper and Dunn, 1969).

Increasing enrollment of foreign students may be attractive to U.S. colleges and universities not only because this may allow them to avoid painful "retrenchment," but also because they typically need not worry about employment of graduates.

Most studies of the demand for higher education assume individuals are utility maximizers who invest in higher education when the benefits exceed the costs. This theory implies enrollment demand should vary positively with the expected monetary and other yields of education and negatively with the monetary and other costs of education. In addition, since personal income is often used to finance the investment, demand is expected to increase with real household income.

Several studies have been carried out to date on the domestic demand for higher education. One of the earliest was by Campbell and Siegel (1967) who found an income elasticity of 1.2 and a price elasticity of -0.4 for time-series data covering the United States enrollments between 1919 and 1964. Elaborations of the Campbell-Siegel model have been presented by Galper and Dunn (1969), Radner and Miller (1970), and Corazzini, et al.

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This finding is based on projections made by U.S. Office of Education (1973), p. 15.