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Monopsony and Labor Supply in the Army and Navy

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Abstract: Because it is differentiated from other employers, the U.S. military enjoys some monopsony power. After reviewing existing estimates of the elasticity of labor supplied to the military, we obtain new estimates for the Army and Navy covering the period from 1998-2007. We employ a control function approach to account for the potential endogeneity of enlistment incentives. Our elasticity estimates of 2.4 for the Army and .4 for the Navy suggest that the services have substantial wage-setting ability. However, the Army faces higher supply elasticity since the invasion of Iraq and higher elasticity in states with weak support for obligatory military service.

Keywords: monopsony, military, labor supply
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I. Introduction

A growing research literature provides empirical evidence of monopsonistic behavior by firms in the labor market (Boal and Ransom 1997). An appealing feature of the monopsony model is its ability to explain empirical regularities that are difficult to reconcile using a purely competitive framework. Monopsony has been used as a basis of explaining positive employment effects of minimum wages (Card 1992), inversions in the wage-tenure profile (Ransom 1993), and the gender wage gap (Manning 2003). Perhaps the most obvious approach to establishing monopsonistic behavior is to estimate the labor supply curve for a monopsonistic firm and demonstrate that supply elasticities are less than infinite. As a practical matter, however, estimating supply elasticities has proven challenging, both because of difficulties in identifying settings in which monopsony is likely to occur, and because of data constraints that make it difficult to cleanly separate supply from demand. In this paper, we consider the U.S. labor market for defense services, which provides an obvious candidate for monopsony because the U.S. Department of Defense (DoD) is the sole legal employer of military personnel. We draw from a unique database on wages and enlistments for the Army and Navy to estimate the wage-setting power of the U.S. military.

Although new military recruits represent a fairly small component of the overall young adult labor market, the DoD remains an important national employer, particularly for high school graduates who do not wish to immediately matriculate into college. In FY2006, across the active component of all services the DoD hired roughly 180,000 new personnel, almost 90% of whom were under age 25. Total active force size was approximately 1.35 million. However, despite its potential to provide interesting insights regarding non-competitive employer behavior, relatively few existing studies specifically address the military as a monopsonist. In an early contribution, Borcherding (1971) argues that monopsonistic behavior will lead to the underprovision of personnel for the military and deadweight loss, although he makes no attempt to quantify the extent of the welfare effect. Cooper (1975) considers includes monposonistic deadweight loss as one component in his comparison of the volunteer to the conscripted force. Quester and Nakada (1983) present a model of the military as a dominant-firm monopsonist and combine their model with existing estimated to calculate welfare losses comprising 10-15% of total D.O.D. wage expenditures.

Although there has been relatively limited discussion of the military as a monopsonist, since the advent of the all-volunteer force a robust literature in defense economics has developed that estimates supply elasticities of new recruits for the military services. We first briefly review a number of existing studies of enlistment supply, focusing on estimates of the wage elasticity. A consistent finding across studies is that wage elasticities are around unity, implying that the military enjoys substantial wage-setting power. We then provide new estimates of the wage elasticity for the Army and Navy, focusing on the period from 1998-2007. Employing a control function approach to account for the potential endogeneity of enlistment incentives with respect to supply, we estimate a wage elasticity of 2.4 for the Army and .6 for the Navy. Army wage elasticities have risen since the U.S. invasion of Iraq and elasticities are higher in states with low approval of the draft.

II. Prior Work Estimating Supply Elasticities for the Military

There is a substantial research literature attempting to estimate supply elasticities for particular services or the D.O.D. as a whole dating beginning in the 1970's. Table 1 catalogues a number of past studies with enlistment supply estimates.[1] The majority of existing studies focus on supply elasticities for so-called high quality recruits, which are recruits with high school credentials that have scores of 50 or above on the Armed Forces Qualifying Test (AFQT).[2] Whereas enlistment of other recruits is potentially demand constrained, the military accepts all high-quality applicants who satisfy its medical, citizenship, and moral standards.

Table 1 reveals some variation across studies in the estimated supply elasticities. Using data from 1975-1982 and estimating a linear specification with high-quality contracts as a dependent variable, for example, Dale and Gilroy (1985) obtain a supply elasticity for the Army of 3.90. Drawing from data covering a later period and estimating a log-log model, Kearl et al. (1990) obtain elasticities of only .15. Navy estimates similarly range between .13 and 2.04. Part of the variation across studies arises due to differences in empirical approaches and control variables. For example, Goldberg (1979) and Hogan et al. (1996) explicitly include controls for advertising expenditure, which may shift the supply curve outward or change its shape, while many other studies lack information on advertising. Additionally, some of the variation in elasticities may reflect demographic and institutional changes that have occurred over the past 30 years. The military experienced substantial downsizing following the end of the Cold War, and some research, such as Murray and McDonald (1999), suggest that this development may have affected enlistment supply for some services.

A persistent challenge in identifying the supply elasticity that arises in the military context as well as in other markets is the potential endogeneity of wages with respect to supply. For the military, other enlistment incentives controlled by the services, such as bonuses and

[1] This list is far from exhaustive. Warner et al. (2001) and Asch et al. (2007) provide a more detailed discussion of enlistment supply estimates across studies.
[2] Over the past several years, high quality recruits represented roughly 50% of all Army recruits and 65% of Navy recruits.

educational benefits, also raise endogeneity concerns. In a recent contribution, Gelber (2007) estimates a high-quality enlistment supply model that attempts to more fully account for wage endogeneity. Gelber instruments for the military wage using the statutory formula that ties pay increases to the Employment Cost Index (ECI), essentially identifying the elasticities using the component of wage variation that is due to national wage growth. Gelber finds that instrumenting increases the estimated elasticity from around .7 to 1.1.

Although the elasticities across studies for both the Army and Navy cover an appreciable range, the studies are consistent in revealing elasticities substantially below infinity. In literature reviews, Warner and Asch (1995) find an average elasticity across studies of 0.64, while Warner et al. (2001) obtain an average of 0.75. In a standard monopsony framework, these elasticities suggest rates of exploitation above 100%, which are substantially above those found in studies of other labor markets, such as coal miners (Boal 1995) and nurses (Sullivan 1989).

Although there is some evidence of a supply relationship that would permit the military to offer wages below marginal revenue product, the nature of the enlistment supply function may have been affected by the advent of the Global War on Terror and U.S. invasions of Iraq and Afghanistan. We focus below on obtaining estimates for the supply elasticity for the period between 1998 and 2007 in a manner that accounts for endogeneity of enlistment incentives.

III. Theoretical Framework

We take as our point of departure a static differentiated-employer monopsony model. The notion that military services are viewed differently from each other and from other types of employers seems intuitively plausible. Market research conducted by the military (e.g. Zucker and

Boehmer 2008) consistently finds differences in attitudes towards military service across population segments, and military advertising is heavily oriented towards establishing brand identity.[3]

Whereas standard monopsony models consider an employer selecting an amount of labor L while facing an upward-sloping inverse supply function, in our setting it is more natural to model the military as choosing a wage level w and other incentives in order to satisfy a readiness constraint at minimum cost. Employment is determined by the supply function $L(w,I,j,X)$ where I represents other incentives such as enlistment bonuses and educational benefits that are chosen by the military at the time of enlistment, j represents the exogenous actions of other firms in the market, and X represents supply-shifters such as demographic characteristics related to eligibility. $C(I)$ is the cost function for incentives other than the wage. The military's minimization problem is:

$$\min_{w,I} \quad w \cdot L(w) - C(I) \quad s.t. \quad R(L(w)) \geq \underline{R}$$

where $R(L)$ is the function mapping the number of personnel to readiness and $\underline{R}$ is the minimum required readiness. The first-order condition with respect to w implies:

$$L + \frac{\partial L}{\partial w} w - \lambda \frac{\partial R}{\partial L} \frac{\partial L}{\partial w} = 0$$

$R()$ has no natural units, but rescaling it so that $\lambda=1$ expresses readiness in monetary terms. Rearranging this first-order condition then yields the familiar expression for the "exploitation"

[3] Dertouzous and Garber (2003) provide a more thorough overview of advertising by the military.

parameter, $E = \frac{MRP - w}{w} = \frac{1}{\varepsilon}$, where ε is the elasticity of labor supply with respect to the own-firm wage. Including wages of other firms in *j* allows for Bertrand-style competition, in which firms strategically set prices conditional on the actions of their competitors and quantities are revealed. Alternatively, controlling for competitor employment levels assumes Cournot interactions.

A richer model of monposonistic behavior might consider dynamic wage-setting behavior. In our empirical implementation we focus on the market for new hires, which minimizes the dynamic nature of the supply decision given that almost two-thirds of enlistments occur when enlistees are between the ages of 18-20. Conceptually, we view our data as representing repeated realizations of equilibrium in the supply market. Additionally, although some discussions of monopsonistic behavior (Ransom 1993) model wage setting over the entire period of the employment relationship, we focus on the initial employment decision. Because the military invests heavily in training and its personnel in many cases develop skills deemed critical by the armed services, the military may be limited in its ability to extract wage surplus due to moving costs. Asch et al. (2007) discuss research that more explicitly accounts for the possibility of re-enlistment.

IV. Data Sources and Empirical Analysis

We examine the degree of monopsony power by estimating reduced-form specifications for the supply function *L*, taking a state and quarter as the unit of observation. This approach is similar to that of a number of papers examining monposony in other industries, including Sullivan

(1989), Boal (1995), and Falch (2008), and is also the approach taken in the military manpower literature. In particular, we estimate equations of the form:

$$log(L_{it})=\beta \cdot log(w_t) + \alpha \cdot I_{it} +\delta \cdot j_{it} + \gamma \cdot X_{it} + \omega_{it} + \varepsilon_{it} \qquad (2)$$

where L_{it} measures the number of enlistments of high-quality recruits in state i in time t, and w, I, J, and X are as defined above. We parse the econometric error term into two components, a component that is observable to the military (which thus may influence short-run allocations of recruiting resources) but not to the researcher, ω_{it}, and ε_{it}, which is the purely random error component.

One challenge in empirically implementing (1) is determining the appropriate definition of the wage. The earnings concept most closely equivalent to a civilian wage for military members is Regular Military Compensation (RMC), which includes basic pay, housing and food allowances, and the preferential tax treatment of military earnings. However, potential recruits can also receive additional compensation in the form of cash enlistment bonuses and educational benefits, and the value of these benefits can be equivalent to a sizeable fraction of RMC. In our empirical implementation, we use RMC as our primary wage measure, but also control for other forms of compensation, including bonuses and educational benefits. A drawback of using RMC as a wage measure is that it is set nationally and thus precludes inclusion of a full set of year/quarter fixed effects in our regressions. We instead include time trends to account for broad changes in the recruiting environment over time. Additionally, many past studies of enlistment supply use the ratio of military to civilian wages as the wage measure, which effectively constrains the elasticity of the competitor wage to be equal to and opposite the own-wage elasticity. Given that the theory does not imply such a restriction, we include the competitor wage as a separate component in *j*.

An additional concern with simple OLS regression estimates of (2) is that if ω_{it} is correlated with the wage rate or incentives controlled by the military, estimates of β will be biased. Although there is some possibility of correlation with wages, the institutional process governing wage setting may tend to minimize such endogeneity. Military wages are only adjusted once a year and changes are authorized by Congress, with the executive branch presenting pay proposals months prior to enactment. Changes are primarily determined based upon a formula that ties increases in pay to changes in the ECI.[4] Likely more problematic is endogeneity due to correlation between ω and *I*, because *I* includes factors such as the number of recruiters in a particular location and availability of enlistment bonuses and service-level college funds that can be adjusted in the short run based upon perceived supply shocks.[5] For example, faced with a shortfall in enlistments in FY2007, the Army introduced a new $20000 "quick ship" enlistment bonus in August 2007 in order to fill its quota before the end of the fiscal year. Army recruiter counts also grew appreciably during 2005 and 2006, a period during which the war in Iraq was widely perceived as diminishing public enthusiasm for military service.

Fortunately, our data include a measure which we can use to proxy for ω_{it}. For each location and time period the military services set a goal for the desired number of enlistments, and compensation and promotion of recruiters is tied to meeting or surpassing this goal. The goal thus reflects each service's perception of the difficulty of recruiting based upon all available information. Under the weak assumption that the goal is increasing in ω_{it}, we are able to

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[4] For example, in 2002, 2004, 2005, and 2006 the actual pay raise was the same as that recommended by the formula, ECI+.5%.

[5] The Montgomery G.I. Bill is administered by the Department of Veterans Affairs and eligibility for this program is not controlled by the individual services.

eliminate the bias in estimating β. To see this, let $Goal_{it} = g(\omega_{it}, I_{it})$, then $\omega_{it} = g^{-1}(Goal_{it}, I_{it})$ Although the precise nature of $g^{-1}()$ is unknown, it can be captured non-parametrically by including a high-order polynomial in the goal and I in equation (2). This removes endogeneity arising from ω_{it}.[6] The notion that goals increase when there are supply shocks that are observable to the military but which may be otherwise unobservable seems intuitively plausible.

Our data cover 1998-2007 and are drawn from a number of sources. Data on enlistments, bonuses, and recruiters are taken from recruiting databases and microdata files on recruits maintained by the individual services. Demographic information is drawn primarily from the CPS. Table 2 provides descriptions and summary statistics for the variables used in our analysis. We include the number of production recruiters, the proportion of new recruits who are given enlistment bonuses, and the proportion of new recruits who are offered the service college funds in I.[7] We also control for casualties in Iraq and Afghanistan and the maximum G.I. Bill benefit--both variables that are measured nationally—to capture other factors likely to affect the desirability of military service. As our measure of competitor behavior we use average wages for high school graduates calculated from the CPS. All of our regressions also include population, a time trend, and state and quarter fixed effects as additional controls.

Table 3 presents our basic empirical estimates for the Army. The wage elasticity is estimated to be 2.22 and is highly statistically significant. This estimate is appreciably larger than past estimates for the Army. The coefficients on the included control variables are generally of a sign and magnitude that accord with intuition. A 10% increase in production

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[6] Our control function approach has parallels in the production function estimation literature, as in Olley and Pakes (1996). Dertouzos (1985) provides a more detailed discussion of the use of goals as a control variable.

[7] Enlistment bonuses are cash bonuses given to new recruits and are typically based on the length of the contract signed, timing of entry, and the occupational role chosen by the enlistee. The Army, Marines, and Navy also maintain college funds that provide educational benefits that are added on the those provided through the Montgomery G.I. Bill program. The college fund benefits are generally used after members depart military service.

recruiters yields a 4% increase in high-quality contracts, a statistically significant effect. Contracts also increase with expansions of enlistment bonuses, service-level college funds, and increases in G.I. Bill benefits. Increases in our proxy for competitor wages are associated with decreases in enlistments, although this effect is not statistically significant. Our estimates also suggest an important effect of casualties in Iraq and Afghanistan on enlistments. During the first half of 2007 there was an average of 313 quarterly casualties, which would translate into an 11% drop in high quality contracts.

The estimates in the leftmost column of Table 3 make no attempt to account for endogeneity arising from ω_{it}. The major concern regarding w_t and ω_{it} is one of reverse causality, in which low numbers of enlistments induce policymakers to increase the military wage. One simple diagnostic for reverse causality is to include leads of the wage variable as additional explanatory variables in (2). If wage adjustments are being driven by a poor recruiting environment, we would expect to observe larger wage increases after periods of fewer recruits, which would induce a correlation between current enlistments and future wages. However, when we estimated a version of (2) including a lead of the wage as an additional explanatory variable, the estimated coefficient on the lead term was -.005 with a t-statistic of only -0.03.

The right column of Table 3 attempts to account for endogeneity of other variable recruiting resources using the control function approach described previously. We include a polynomial with a full set of first- through third-degree interactions between goals, recruiters, enlistment bonuses, and service-level college funds as our control function. Although α is not identified when including the control function in (2), β, δ, and γ can be consistently estimated and then α can be recovered by regressing $log(L_{it}) - \hat{\beta} \cdot log(w_t) - \hat{\delta} \cdot j_{it} - \hat{\gamma} \cdot X_{it}$ *on* I_{it}.

As expected, attempting to account for endogeneity increases the estimated wage elasticity. The increase is modest, however, with the elasticity rising .2 to 2.42. The new elasticity does not lie outside of the 95% confidence interval of the original estimate. Many of the coefficients on the other control variables remain similar under the control function specification.

Table 4 examines the robustness of these findings to changes in specification. Specification 1 includes the employment rate in place of the average civilian wage as the measure of competitive behavior. Specification 2 re-estimates the model including a full set of state-specific time trends. Specification 3 adds additional controls for demographic factors that may affect supply, including the veteran and non-citizen share of the population, the crime rate, and the obesity rate. Veterans and immigrants have been shown to be more likely to recommend military service to young adults and obesity and prior criminal activity can directly disqualify individuals from military service. Specifications 4 and 5 separate the sample into the periods before and after the invasion of Iraq in Q2-2003 to examine whether this important policy shift affected supply response for the Army.

Controlling for employment as opposed to wage increases the estimated elasticity somewhat, but it remains relatively large and statistically significant. The unreported coefficient on local employment is also statistically significant and implies that a 1% increase in the local employment rate generates a 2.5% decrease in high-quality enlistments. Allowing a more flexible form for the time series of enlistments similarly decreases the elasticity estimates, although they remain above 2. Controlling for a wider set of demographic factors that may affect the supply curve (specification 3) actually increases the elasticity slightly.

The difference in wage elasticities between the pre-invasion and post-invasion period is striking. In the pre-invasion period, the estimated elasticity of 1.35 is close to the recent estimates of Warner and Simon (2005) and Gelber (2007). Elasticities are around 2 in the post-invasion period, an increase of roughly 50%. Our finding of an increase in elasticities since the beginning of Operation Iraqi Freedom is consonant with the analysis of Warner and Simon (2007), who estimate a greater relative pay elasticity in 2004-2005 than in previous years. The increase in demand for personnel arising from the expansion of combat operations appears to have shifted equilibrium towards a more elastic region of the supply curve. It also seems plausible that changes in the non-pecuniary aspects of Army service, such as the prospect of long deployments and increased risks to personal safety, may now limit the ability of the Army to attract those who add high amounts of value relative to the offered wage.

Table 5 presents elasticity estimates for the Navy estimated similarly. The first column estimates the basic specification accounting for endogeneity, the second column includes a broader set of controls, and the third and fourth columns bifurcate the sample into pre- and post-invasion periods. Navy elasticities are appreciably below those of the Army. Controlling for a broad set of demographic factors, the Navy supply elasticity is .6 with a p-value below .01. One explanation for this pattern concerns differentiation—although the military services are in general fairly different from other employers, within the military the Army and Marines are relatively similar. The Navy, in contrast, has different occupations and deployment patterns than the other services. Sea duty is likely to attract different types of recruits. The greater degree of employer differentiation of the Navy may mute supply responses to changes in its offered wage.

Unlike the Army, there is also little evidence that supply elasticities for the Navy have changed appreciably since the beginning of the Iraq War. The post-invasion elasticity estimate of .51 is not statistically distinguishable from the pre-invasion elasticity of .46. Given that the tempo of operations for the Navy has been less affected by the conflicts in Iraq and Afghanistan and risks to naval personnel have not changed substantially, this stability of the supply relationship is perhaps not highly surprising.

Might supply elasticity vary across states? Individuals with a high sense of obligation towards military service might be inclined to enlist regardless of the financial incentives of service. Labor would be elastically supplied to the military in locations with many such individuals.[8] As an additional test of our estimation approach, we identify a proxy for tastes for military service and ask whether we can obtain elasticity estimates that are consistent with our expectations as to which groups should be most responsive to pay.

In June 2005 SurveyUSA conducted a poll of 600 adults in each of the 50 states asking, "Do you think the United States needs or does not need a military draft?" Individuals who believe that the military should be able to compel citizens to serve should be willing to supply labor regardless of the wage, which would translate into a low labor supply elasticity. In states in which there is less support for obligatory military service, we would expect that small departures from the competitive wage would have large negative effects on enlistments. Average approval in the poll was 25% with a 4% margin of error. We code states with 30% or higher approval as being highly supportive of the draft and those with 20% or fewer citizens approving as having low support of the draft.[9]

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[8] For example, recruiting has been highly successful in Guam, a U.S. territory in the Pacific which was occupied by the Japanese during World War II and which has a deep-rooted tradition of military service. An Army National Guard recruiter in Guam recently stated, "I have got 12 people who want to join up this month, but I can only process three of them because of lack of doctors to give them physicals. We can afford to be picky." (Hardin 2008)

[9] An alternative interpretation of the survey responses is as an indication of the respondent's impression of the likelihood that the military will be able to meet its personnel requirements. If respondents believe that individuals in their state are unlikely to respond to incentives (low elasticity), they may perceive a greater need for a draft. If they believe that changes in pay will yield large changes in recruits, they may find a draft less important. In either case, we predict higher elasticities in areas with low draft support.

Table 5 reports our estimates for the Army and Navy allowing for different elasticities according to draft support. As predicted, labor supply elasticity is decreasing in the support for the draft for both services. For the Army, the elasticity estimates of 3.5 for low approval states and 1.0 for high approval states are statistically different from the elasticity in the average state. For the Navy, although we are unable to reject the null hypothesis of equal elasticities in the average and high approval states, elasticities are statistically significantly higher in the low approval states. These elasticity differences across states are also practically large, and imply that the Army has considerably lower wage-setting power in states with low support for mandatory service. More generally, it is interesting to observe that we can connect measured supply elasticities to reported attitudes towards military service.

V. Conclusion

Is the U.S. military a monopsonist? Common sense and a large body of empirical evidence suggest an affirmative answer. Consonant with prior research, in this paper we estimate wage elasticities that are fairly low relative to other industries for both the Army and Navy. The relative insensitivity of wage with respect to enlistments suggests that the military may be able to offer wages that are below the marginal recruit's value. However, there is evidence the Army faces higher supply elasticities since the onset of hostilities in Iraq, which would tend to erode the Army's ability to obtain this surplus. In the Navy, which is more highly differentiated than the Army and which has been less impacted by Iraq, supply elasticities have remained more stable.

In some respects standard monopsony models appears less satisfactory in explaining the behavior of the military. Using the "exploitation" parameter as a simple measure of monopsony gains would imply that even in a period of eroding support Army gains have ranged from 50-74% of the wage bill. For the Navy, our supply curve estimates imply persistent gains of over 100%. However, one difficulty in literally interpreting a monopsony model in the case of the military is ambiguity regarding how different levels of personnel map into the military's objective function. We have modeled the military as attempting to satisfy a uni-dimensional readiness constraint, but in actuality the military is likely to simultaneously pursue multiple objectives regarding its force structure. For example, the observations that the services expend resources to promote racial diversity and engage in little to no price discrimination despite possessing considerable amounts of information about potential recruits seem at odds with a depiction of the military as a strict monopsonist. Non-pecuniary considerations may lead the military to operate more closely to the competitive equilibrium than is suggested by monopsony models.

Additionally, although a substantial body of research has focused on estimating supply elasticities for the military, we know much less about why wage elasticities differ across groups and across time. From a social standpoint a higher elasticity may imply that the Army must operate closer to the competitive equilibrium, which could benefit future service members. At the same time, the changing nature of enlistment supply is likely to impact the costs of providing high-quality national defense going forward.

References

Asch, B., Hosek, J. and Warner, J. (2007). “New Economics of Manpower in the Post-Cold War Era”. In Hartley, K., Sandler, T. (Eds.), *Handbook of Defense Economics, Vol. 2*. Elsevier, Amsterdam, pp. 1076–1138.

Ash, C., Udis, B. and McNown, R. (1983) "Enlistments in the All-Volunteer Force: A Military Personnel Supply Model and its Forecasts." *American Economic Review* 73(1) 145-55.

Berner. K., and Daula, T. (1993). “Recruiting Goals, Regime Shifts, and the Supply of Labor to the Army.” *Defence Economics* 4(4) 315-328.

Boal, W. (1995) "Testing for Employer Monopsony in Turn-of-the-Century Coal Mining." *RAND Journal of Economics* 26(3) 519-36.

Boal, W. and Ransom, M. (1997) “Monopsony in the Labor Market.” *Journal of Economic Literature* 35(1) 86-112.

Bohn, D., Schmitz, E. (1996). *The Expansion of the Navy College Fund: An Evaluation of the FY 1995 Program Impacts*. Navy Recruiting Command, Arlington, VA.

Borcherding, T. (1971) “A Neglected Social Cost of a Voluntary Military.” *American Economic Review* 61(1) 195-196.

Card, D. (1992) “Do Minimum Wages Reduce Employment? A Case Study of California, 1987-1989.” *Industrial and Labor Relations Review* 46(1) 38-54.

Cooper, R. (1975). *The Social Cost of Maintaining a Military Force*. R-1758-1-ARPA. RAND, Santa Monica, CA.

Dale, C. and Gilroy, C. (1985) “Enlistments in the All-Volunteer Force: Note.” *American Economic Review* 75(3) 547-551.

Daula. T., and Smith, D. (1985). “Estimating Supply Models for the US Army.” In Ehrenberg, R. (Ed), *Research in Labor Economics* (Volume 7). JAI Press, Greenwich, CT, pp. 261-309

Dertouzos, J. (1985). *Recruiter Incentives and Enlistment Supply.* R-3065-MIL. RAND, Santa Monica, CA.

Dertouzos, J., Garber, S. (2003). *Is Military Advertising Effective? An Estimation Methodology and Applications to Recruiting in the 1980s and 1990s*. MR-1591-OSD. RAND, Santa Monica, CA.

Falch, T. (2008) “The Elasticity of Labor Supply at the Establishment Level.” Manuscript, Norwegian University of Science and Technology.

Gelber, A. (2007) “The Supply of Military Enlistments.” Manuscript, Harvard University.

Goldberg, L. (1979) *Recruiters, Advertising, and Navy Enlistments*. Center for Naval Analysis, Alexandria, VA.

Hardin, B. (2008). “Guam's Young, Steeped in History, Line Up to Enlist.” *Washington Post*, January 27, 2008, pp. A15.

Hogan, P., Dali, T., Mackin, P., Mackie, C. (1996). *An Econometric Analysis of Navy Television Advertising Effectiveness*. Systems Analytic Group, Falls Church, VA.

Kearl, E., Horne, D., and Gilroy, C. (1990) “Army Recruiting in a Changing Environment.” *Contemporary Policy Issues* 8(4) 68-78.

Mannning, A. (2003) *Monopsony in Motion: Imperfect Competition in Labor Markets*. Princeton University Press: Princeton, NJ.

Murray, M., McDonald, L. (1999). *Recent Recruiting Trends and Their Implications for Models of Enlistment Supply*. MR-847-OSD/A. RAND, Santa Monica, CA.

Olley, G. S. and Pakes, A. (1996) "The Dynamics of Productivity in the Telecommunications Equipment Industry." *Econometrica* 64(6) 1263-1297.

Quester, A. and Nakada, M. (1983) “The Military’s Monopsony Power.” *Eastern Economic Journal* 9(4) 295-308.

Ransom, M. (1993) "Seniority and Monopsony in the Academic Labor Market." *American Economic Review* 83(1) 221-33.

Smith. D., Hogan, P., Chin, C., Goldberg, L., and Goldberg, B. (1990) *Army College Fund Effectiveness Study Final* Report. Systems Research and Applications Corporation, Arlington, VA.

Sullivan, D. (1989) "Monopsony Power in the Market for Nurses." *Journal of Law and Economics* 32(2) S135-78.

Warner, J. (1990) “Military Recruiting Programs During the 1980s: Their Success and Policy Issues.” *Contemporary Policy Issues* 8(4) 47-57.

Warner, J., Asch, B. (1995). “The Economics of Military Manpower”. In Hartley, K., Sandler, T. (Eds.), *Handbook of Defense Economics, Vol. 1*. Elsevier, Amsterdam, pp. 347–398.

Warner, J., Simon, C. (2005). “Estimates of Army Enlistment Supply 1988–2005”. Briefing presented to the military recruiting summit, November 2, 2005, Clemson University, SC, Arlington, VA.

Warner, J., Simon, C. (2007). “Managing the All-Volunteer Force in a Time of War.” *Economics of Peace and Security Journal* 2(1) 20-29.

Warner, J., Simon, C., Payne, D. (2001). “Enlistment Supply in the 1990s: A Study of the Navy College Fund and Other Enlistment Incentive Programs”. DMDC Report No. 2000-015. Defense Manpower Data Center, Arlington, VA.

Zucker, A. and Boehmer, M. (2008) *Youth Poll 13 Report.* Department of Defense Defense Human Resources Activity, Joint Advertising, Market Research and Studies, Arlington, VA.

Table 1: Prior Studies Estimating Military Labor Supply Elasticities

Study	**Population**	**Elasticity Estimate**
Gelber (2007)	DoD	1.50
Warner and Simon (2007)	Army	0.70
Warner, Simon, and Payne (2001)	Army	1.05
Bohn and Schmitz (1996)	Navy	1.64
Hogan et. al. (1996)	Navy	0.55
Berner and Daula (1993)	Army	0.48
Kearl, Horne, and Gilroy (1990)	Army	0.15
Warner (1990)	Army, Navy	0.51—Army 2.04—Navy
Smith et. al. (1990)	Army	1.20
Daula and Smith (1985)	Army	0.82
Dale and Golroy (1985)	Army	3.90
Ash, Udis, and McNown (1983)	DoD, Army, and Navy	0.66—DoD 0.88—Army 0.88—Navy
Goldberg (1979)	Navy	0.13

Table 2: Variables and Summary Statistics

Variable	N	Mean	Std	Min	Max
Military-Wide					
Basic Pay	1900	25723	2300	21812	29746
Maximum G.I. Bill Beneift	1900	28226	6303	17483	35647
Casualties in Iraq/Afghanistan	1900	108	118	0	362
Army					
High-Quality Contracts	1900	478	383	7	1664
# of Recruiters	1900	239	184	5	693
% Receiving Enlistment Bonus	1900	0.379	0.152	0.000	0.870
% Receiving Army College Fund	1900	0.135	0.057	0.000	0.447
Navy					
High-Quality Contracts	1900	366	321	3	1290
# of Recruiters	1700	199	175	3	614
% Receiving Enlistment Bonus	1750	0.479	0.127	0.026	0.938
% Receiving Navy College Fund	1750	0.103	0.089	0.000	0.609
Demographic					
Population Aged 18-30	1900	406839	451188	36963	2713587
Average Weekly Wage--HS Grad	1900	558	46	372	775
Non-Military Employment	1900	382463	422225	34898	2556206
% Male	1900	0.514	0.008	0.476	0.550
% White	1900	0.634	0.161	0.202	0.969
% Black	1900	0.144	0.094	0.005	0.451
% Hispanic	1900	0.159	0.140	0.007	0.501
% Veteran	1900	0.150	0.024	0.090	0.219
% Noncitizen	1900	0.117	0.077	0.000	0.283
% Adults Obese	1896	0.207	0.032	0.087	0.320
Crime Rate (Crimes/100000 Pop)	1900	3626	844	1560	6428

Table 3: Enlistment Supply Estimates for the Army

Explanatory Variable	(I)	(II)
Log(Military Wage)	2.22**	2.43**
	(.160)	(.194)
Log(Recruiters)	.440**	.435**
	(.0518)	(.0491)
Log(GI Bill Benefit)	1.22**	1.21**
	(.0970)	(.101)
% Receiving Enlistment Bonus	.261**	.264**
	(.0490)	(.0523)
% Receiving College Fund	.351**	.339**
	(.103)	(.106)
Log(Market Wage)	-.0727	-.0390
	(.0634)	(.0796)
Log(Population)	-.398	-.193
	(.288)	(.308)
Casualty Count	-3.73E-4**	-3.17E-4*
	(1.25E-4)	(1.56E-4)
N	1900	1900
R^2	.975	.977
Include polynomial of Army goal as a control function?	No	Yes

Notes: This table reports coefficient estimates from a regression of log total high quality enlistments on log military wage and additional controls. The unit of observation is a state and quarter and observations cover the period from Q1-1998-Q2-2007. Each column reports coefficient estimates from a unique regression. Specification II includes a third-order polynomial with interactions between goals, recruiters, share receiving enlistment bonuses, and share receiving the Army college fund as a control function. In addition to the reported controls, both regressions include a set of state fixed effects, quarter dummies, and a time trend as additional control variables. Regressions are population weighted; estimation without weighting yields similar results. Standard errors clustered on state are reported in parenthesis. * denotes statistical significance at the 5% level and ** at the 1% level.

Table 4: Additional Specifications

Specification	Estimated Elasticity	N	R^2
1. Control for competitor employment (Cournot)	1.91**	1900	.985
	(.143)		
2. Include state trends	2.07**	1900	.984
	(.155)		
3. Include additional controls	2.29**	1895	.978
	(.161)		
4. Limit sample to pre-Iraq invasion	1.35**	1050	.985
	(.363)		
5. Limit sample to post-Iraq invasion	2.02**	850	.988
	(.269)		

Notes: See notes for Table 3. Specification 1 replaces the control for log market wage with the log employment rate. Specification 3 includes the log crime rate; adult obesity rate; log veteran and noncitizen population shares; and male, Black, White, and Hispanic population shares as additional control covariates.

Table 5: Navy Estimates

Explanatory Variable	(I)	(II)	(III)	(IV)
Log(Military Wage)	.418**	.613**	.456*	.509*
	(.156)	(.125)	(.229)	(.215)
Log(Recruiters)	.550**	.540**	.316**	.591**
	(.0434)	(.0440)	(.0819)	(.0472)
Log(GI Bill Benefit)	-.0523	-.146*	1.17**	.160
	(.0586)	(.0608)	(.309)	(.134)
% Receiving Enlistment Bonus	.163**	.151**	.0742	.138**
	(.0289)	(.0287)	(.0530)	(.0305)
% Receiving College Fund	.0433	.00374	.641**	.0694
	(.103)	(.104)	(.131)	(.113)
Log(Market Wage)	-.152**	-.0534	-.125†	.0333
	(.0587)	(.0560)	(.0725)	(.0889)
Casualty Count	-2.92E-4**	-4.45E-4**	-3.85E-4**	1.59E-4
	(6.94E-5)	(6.66E-5)	(1.21E-4)	(2.84E-4)
N	1700	1695	850	850
R^2	.989	.991	.993	.990
Include polynomial of Army goal as a control function?	Yes	Yes	Yes	Yes
Include state trends and additional controls?	No	Yes	No	No
Limit to pre-invasion period?	No	No	Yes	No
Limit to post-invasion period?	No	No	No	Yes

Notes: This table replicates the analyses from Table 3 and 4 for the Navy. See notes for Tables 3 and 4. The additional controls included in column II are the same as those in specification 3 of Table 4. The time period of available data for the Navy is Q1-1999-Q2-2007.

Table 6: Estimates by Degree of Approval for the Draft

Elasticity for States With:	Army	Navy
Low draft approval	3.47**	1.10**
	(.201)	(.115)
Average draft approval	2.07**	.640**
	(.160)	(.131)
High draft approval	1.00**	.472
	(.171)	(.469)
N	1900	1700
R^2	.984	.991

Note: This table reports wage elasticity estimates from regression of log high quality enlistments on log military wages interacted with state-level indicators for low, average, and high support of the draft. Army and Navy elasticities are estimated separately. See notes for Table 3. Draft approval is based upon the results of a June 2005 survey in which 600 residents of each state were asked, "Do you think the United States needs or does not need a military draft?" Average approval was 25% with a 4% margin of error. States with low draft approval are states in which 20% or fewer residents agreed with the statement; states with high approval have 30% or greater agreement. These regressions include the control variables used in Table 3 and a full set of state trends.