A DISCUSSION OF SOME APPLICATIONS OF HUMAN CAPITAL THEORY TO MILITARY MANPOWER ISSUES

M. J. Albrecht

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Since its inception, human capital theory has found a natural subject in the military. Because of its substantial investments in training, its host of essentially nontransferable skills and its unique labor contracts, the military establishment has, indeed, been a conspicuous case for application of human capital principles for policy purposes. In his seminal work, *Human Capital Theory*, G. S. Becker summarized the military manpower situation from a human capital point of view, thusly, "the military is a clear example of an organization which pays at least part of training costs and does not pay market wages to skilled personnel." Implicit in this view is the prediction that the military will have an abundance of "students" and heavy losses of "graduates." When Becker provided this insightful assessment, however, the draft and draft-induced enlistments ensured an essentially infinite supply of manpower at below comparable market wage rate and at constant cost. If one, then assumes a non-infinite marginal rate of substitution between first-term and career personnel, the policy problems of procurement, utilization, and retention could be conveniently consolidated into a single policy variable, namely, yearly draft requirements. With the advent of the all-volunteer force in 1972 and the increasing technological nature of military specialties in the mid-sixties, however, massive low-cost labor supply and manageable marginal rates of substitution between first-timers and careerists for technical specialties no longer existed and, consequently, the policy issues of procurement, training, and retention could no longer be addressed by a single policy variable, and therefore, new policy requirements were generated.

Although applied human capital research in the military manpower field had been undertaken to a limited extent prior to this time, the urgent policy requirements of the late sixties and early seventies generated a great deal of interest in the military manpower area. The following is a review of the

applied human capital research to questions of military manpower planning. The framework of the review is topical rather than historical, the focus broad rather than specific. A brief review of the underlying theory and its development is presented as a foundation for the substance of this review.

As Becker (1962), Mincer (1962), Ben Porath (1965) and others have articulated it, human capital theory is founded on three basic assumptions. First, that labor skills are durable and malleable. Second, that current productivity both contributes to current earnings and affects future productivity. And third, that there is a positive association between amounts of schooling and individual earnings. From these three follow the proposition that a possibility exists to forego some or all current income for the prospect of increasing future earnings. Thus, education either formal or on-the-job, can be viewed like any other capital investment process with investments justified to the point where the present discounted value of costs equals the present discounted value of returns. Several important empirical questions follow directly from this formulation.

First, what is the effect on the rate of economic growth of this heretofore unmeasured increase in capital stock? Put another way, how large is the allocation of resources to the training process? Since these investments may be quite sizeable, there is a reason to suspect that their inclusion in standard aggregate economic input measures of yearly growth will have a nonnegligible impact on the unexplained portion of aggregate output measures. A second empirical question is what is the rate of return on this form of investment? And third, how useful is knowledge about such investments in explaining particular features of labor force behavior? Early applied research in this area has focused, naturally enough, on precisely these issues and will be briefly discussed in turn.

The early work of Schultz (1961) and Dennison (1962) suggests that, in fact, in the U.S. education has been an important instrument of economic growth. Schultz estimated that the return to additional "educational capital" in the labor force accounts for about one-fifth of the economic growth of the period from 1929 to 1957. Dennison estimates increases in national product associated with quality improvements in labor

and relates them directly to increased earnings. Like Schultz, Dennison attributes approximately one-fifth of the economic growth of the U.S. between 1929 and 1957 to education.

The bulk of the early empirical studies focus on the income returns to schooling and, more particularly, the rates of these returns. Since, however, there is good reason to believe that benefits from education include sizable nonpecuniary returns, measures of return rates which focus exclusively on incomes will systematically tend to underestimate total returns to schooling. Since, however, these nonpecuniary benefits are difficult to measure and virtually impossible to value, changes in incomes attributable to schooling provides the only empirically tractable measure of returns to schooling and thus, the primary estimating technique.

One of the first such studies is G. S. Becker's (1960) work on estimates of the rate of return to schooling for college graduates. He found that for white males from 1940 and 1950 the internal rate of return to their educational investment was approximately 9 percent. This estimate was later revised to about 13 percent.*

Using estimates from the 1960 Census, Giora Hanoch (1967) computed rates of return without reference to either the cost of schooling or income tax rates included in Becker's analysis. Hanoch's estimation of the rate of return simply equates discounted values of earnings reported in the Census and interprets these as summary statistics of the relation between earnings and schooling. Thus, Hanoch could estimate returns across educational levels and across geographic regions. The early estimating techniques used by these two authors failed to control for the well-known positive relationship between ability and schooling and, thus, their results made it impossible to separate out the pure effect of schooling from the effect of ability as reflected in schooling.

In his summary of nine different rate of return studies, Gintis (1971) found that the reduction in the schooling coefficients achieved by an

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*Becker, *Human Capital*, 1964.

ability correction ranged from 4 to 35 percent, with a mean value of approximately 10 percent. By controlling for regional market difference, as well as ability, Hanushek (1971) estimated about a 5-percent return to schooling. Probably the best effort to measure the combined effects of schooling and ability was undertaken by Griliches and Mason (1972) where Armed Forces Qualification Test scores were used to measure mid-career ability. Earlier biases in the school effect due to a lack of control for initial ability (Gintis and Hanushek) were thereby identified. Griliches and Mason's results concerning the contribution of ability to income is virtually the same as that of Hanushek. Their findings on the contribution of schooling to income corrected for ability (AFQT), however, is reduced by almost 16 percent. Griliches and Mason's research underlined the fact that ability is a very significant determinant of income, but that the absolute size of the effect is small. Biases in estimates for rates of return to investments in schooling were estimated to be less than 10 percent due to a correction error for initial ability. In sum, early applied research on sources of income returns to schooling demonstrate that controls for ability and/or for family background appear to reduce the measured contribution of income to schooling but they do not reduce it significantly.

A logical extension of applied research into rates of return to schooling is that of race differences in returns to schooling. Welch (1973) among others noted that, on the basis of 1960 Census data, returns for schooling for blacks were significantly lower than for whites. These results contradicted earlier theories which simply argued that there was no discrimination effect in schooling, but rather that minorities tended to systematically underinvest in human capital. The underinvestment theory suggests that for those who do invest in skills for groups where skills are scarce, the expected returns to schooling should be higher rather than lower. Welch's results demonstrated that for comparable cohorts, four years of high school or college increased median incomes by 40 percent for whites and only 30 percent for blacks. Becker (1957) and later Arrow (1972) argued that the rate of returns variation by race is

simply one of taste. Since workers and employers are sensitive to racial composition of work forces and consumers are not, employers discriminate by paying higher wages for the prefered whites, at the expense of profits and thus, serve to depress the rates of return to schooling for blacks. Elaborations on these issues have tended to focus on theories of discrimination rather than theories of human capital and thus are beyond the scope of this work. To reiterate, the preceding discussion has provided a broad overview of the basic applied research in human capital theory emphasizing the magnitudes of investments in education and their impact on economic growth, specific income rates of return to schooling adjusted for ability and market differences in earnings.

The second portion of this review will deal specifically with applied research in the military manpower area with special attention to human capital theory applications. Although there are many examples of human capital theory applications in the military manpower field, we will deal with three fundamental topics which are central to the notion of investment in human beings and which have absorbed the attention of many working with human capital theory as applied to military manpower issues. The topics are:

1. Estimating the net investment in military training.
2. Assessing the transferability of military-acquired skills to the civilian sector.
3. Estimating training premiums from military-acquired training.

To a large extent recent interest in these topics has generated from the change from a draft to an all-volunteer force. With the resultant increase in relative and absolute manpower costs, cost minimizing policy issues such as capital labor substitutions, first term-careerist trade-offs, and formal versus on-the-job training for specialists could no longer be controlled for by the draft variable. In response to the all-volunteer

force manpower planners, operating in a relative research vacuum,* implemented policies aimed at overcoming perceived inefficiencies and initiated research into the nature of these relationships and evaluations of new policies. It is from this body of applied research that the following topics are drawn:

I. ESTIMATES OF NET INVESTMENT: MILITARY TRAINING

Since data are readily available on costs of formal training, research questions regarding net investment have focused on either the nonformal or OJT costs or on the related issue of labor productivity estimates in the first term of service as contrasted with careerists. Research dealing with estimates of OJT costs are addressed first.

Unlike similar research in the civilian sector which measure only that portion of OJT costs which are born by the employee (Mincer (1962) and Rasmussen (1969)), interest in the military sector largely centers on that portion of OJT costs financed by the employer. Thus, estimating techniques and methodologies appropriate in the civilian context will not necessarily be so in the military, particularly when the issues are concerned with attendant opportunity costs.

In perhaps the earliest effort to measure military OJT costs Simon Arzigian (1970) sought to estimate rough measures of these costs by summing monthly estimates of OJT costs for trainees prior to attaining journeyman status (defined by pay grade). Monthly estimates were derived from an assumption of a monotonomically increasing ratio of direct productivity to training from 0 to 100 percent over time, valued by average pay rates for these months. Similarly, supervisory costs were estimated in five percent increments of supervisory pay (averaged between E-6 and E-7) per month, held constant for the entire "training" period.

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*A notable exception is the influence of G. Smith's "Occupational Pay Differentials for Military Technicians," (1964) on the implementation of VRBs.

These estimates represent clearly crude measures, based largely on questionable assumption and uncertain data and should be used merely as suggestive of tendencies rather than point estimates.

Utilizing a similar methodology, but relying on survey data, Alan Dunham (1972) sought to estimate OJT costs by focusing on foregone trainee and supervisor productivity. In addition to these "opportunity costs" Dunham included other such costs as time spent waiting for security clearances or time spent keeping records. However, if Dunham's estimates for time spent waiting for security clearances (a variable which is highly specialty dependent) are excluded, his estimates of foregone productivity directly attributable to training accounts for 90 percent of all OJT costs. Like Arzigian, however, Dunham ignores the fact established long before by Mincer in his formulation of OJT costs, that both training and directly productive activities occur during OJT periods and thus, using these estimates to derive implications about opportunity costs may be very misleading. Moreover Dunham's study is subject to severe data limitations.

In another study, Weiher and Horowitz (1970) compared the cost of training to proficiency for exclusively on-the-job training with a program mixing formal school and OJT. For both types of training, costs were estimated from survey data on Navy enlisted men and included both measures of direct trainee productivity as well as foregone productivity of both trainees and supervisors due to training. The summation (undiscounted) of these elements as well as formal schooling costs, where applicable, comprised the estimate of OJT costs. Noting a potential bias in their sample strata, namely ability differences reflective of the fact that individuals with higher AFQTs tend to be sent to technical school more often than others, an adjustment was made in the cost estimates by weighting costs by the reciprocal of the proportion of men in each training mode who would pass a journeyman examination if the training mode were randomly selected. Two important contributions from the Weiher and Horowitz study are worth reiterating. First, they explicitly consider not only costs due to foregone productivity but also returns from direct

productivity. And second, they make explicit allowances for systematic differences in the ability of trainees.

In a similar study, Robert Gay (1972) utilized survey data from one Air Force specialty to estimate both costs and returns to OJT. Unlike Weiher and Horowitz, however, Gay's measures of OJT costs are made for specific individuals rather than for a concept on "the average trainee," thus, allowing for the relationship between training costs and trainee characteristics to be estimated. Furthermore, Gay's estimates are discounted, reflecting the fact that the productivity training ratio is directly related to time.

In sum, we have seen that the applied human capital research on costs of OJT in the military sector differs from those in the civilian sector by focusing attention on costs to employers rather than employees. We can also see that these estimates are most credible when they are made for specific individuals controlling for personal characteristics including ability measures and when they include discounted values of both foregone and direct productivity. Studies which focus exclusively on productivity measures, however, differ both in concept and method, relying more on production theory than human capital theory, and thus, are not examined here. However, there is one study which uses human capital concepts to aggregate cost and productivity measures in an attempt to illuminate a particular policy problem.

This study, by Gorman Smith (1964), addresses the specific policy issue of pay differentials for military technicians. By utilizing survey data to estimate average training time to journeyman status and compensation data for estimates of the value of the marginal product, both discounted, Smith constructs military specialty specific marginal rates of substitution of first termers for careerists from which a series of reelistment premiums are derived. What Smith fails to do is to account for the changes in expected service for both first term and careerists when these premiums are offered. Furthermore, his cost and productivity estimates are totally insensitive to personal characteristic since they are, on the one hand, merely subjective estimates of average training times and, on the other, based on the assumption that a productive man-

year is a homogeneous factor across years of service. What is of importance in the Smith study, however, is the attempt to address a specific policy problem, namely the efficient allocation of resources among alternative labor factors.

II. TRANSFERABILITY OF SKILLS ACQUIRED IN THE MILITARY TO THE CIVILIAN SECTOR

Implicit in Gary Becker's early prediction regarding military "students" and "graduates," namely that the military will have a surfeit of students and a paucity of graduates, is the assumption that graduates can realize a higher return on their military-acquired human capital in alternative labor markets, namely the civilian labor market. By specifically addressing the question of the effect of military training on civilian wage offers and civilian utilization a host of policy issues may be clarified.

First, by assessing occupational group by occupational group civilian utilization and concomitant training premiums, research may provide information for policymakers in, for example, setting variable reenlistment bonuses. With estimates of the training premiums which accrue to separatees, policies can be designed which not only reflect current losses, but which reflect specific wage differentials which generate these losses. Such insight would allow manpower planners to separate out loss effects due exclusively to wage differentials as distinct from losses due to other factors such as personal freedom, job satisfaction, etc. where other policy factors such as improved work conditions or altered work schedules may be more cost effective.

Secondly, explicit consideration of civilian utilization of military acquired skills aids policymakers in assessing potential beneficial externalities accruing to the civilian sector and, thereby, in designing both military and civilian policies which otherwise may conflict either in purpose or outcome. Finally, such analysis may be of use to civilian employers in assessing their wage offerings and in their policies regarding hiring veteran applicants and training. There have been many

attempts to analytically deal with these issues, utilizing a variety of methodologies and a variety of data. This section will deal with several exemplary cases.

Basically, studies which have looked at transferability of military skills or training premiums fall into three methodological categories. First, there are those studies which utilize survey data to sample the opinion of separates, in order to determine the percentage of enlistees who utilize their military skills in a post-service occupation. A second methodology involves cross tabulations of military and civilian occupations with the same aim as the first. A third methodology utilizes multiple regression analysis to compare the earnings of various separatee groups including both those formally trained and those not. These estimates are, in turn, used to determine whether military vocational training or experience results in a higher wage than that for comparable nonmilitary groups. We will discuss each method in turn.

Results from studies which utilize survey data on separates to determine the transferability of military-acquired skills are extremely sensitive to differences in sample strata. These differences include the size of the sample, the specialty mix reflected in the sample, and the time reference of the sample, both in terms of the time frame of the military experience (World War II, Korea, Vietnam) and in length of time from separation. Estimates range from samples of World War II and pre-World War II veterans with 20 or more years military service (Biderman and Sharp, 1966) to studies which sample only recent first term separatees (draft or draft-induced) within two years of their separation (Military Training Study, 1969, Jurkowitz, 1968). Samples vary likewise in specialty selection ranging from exclusive focus on high skill specialties (Thorndike and Hagen, 1957; McCall and Wallace, 1967) to samples reflecting a broad range of specialties including infantrymen (Military Training Study, 1970). Although the strata differ significantly, the nature of the surveys are fairly homogeneous focusing on whether or not the separatees utilize their military-acquired skills in subsequent civilian employment or if their civilian employment was in a related field, and further whether they felt military training had a positive effect on his civilian wage offers.

Estimates from these range from a 3 to 67 percent utilization of military-acquired skills in subsequent civilian employment, noting a significant positive differential for higher skill specialties receiving substantial amounts of training. Data limitations in these type inquiries are severe. Inability to control for substantial cohort differences in terms of initial military status, draftee or enlistee, final military status, one term or careerist, specialty, method of determination of military utilization, enlistment for a specific specialty or arbitrary assignment, render results from these studies useless for any other purposes than simply noting tendencies or specific sample estimates.

Utilizing data from various post-service files and occupational categories derived from the *Dictionary of Occupational Titles*, a second method of estimating the transferability of military-acquired skills involves cross-tabulating military specialty occupational codes with subsequent civilian employment occupational codes. The problem with this approach is that of levels of aggregation. For example, considering only two place occupational codes, Army vehicle operators who, in fact, receive both training and experience in vehicle repair, when separated and hired as auto mechanics, are considered to be making a career shift and not included in the percentage overlap.

The best example of this type of analysis is the Winkler and Thompson (1971) study of Air Force skill transfers for first term separatees. Their estimates indicate an overall direct transfer rate of approximately 27 percent and a rate near 40 percent for high skill specialties. Using one-digit and two-digit codes, Massell and Nelson (1974) estimated a rate of under 25 percent direct transfer. A similar study (Richardson, 1967) estimated even a lower rate. A study by Thorndike and Hagen (1957), while more thorough in considering occupational disaggregation, suffers from the problem of utilizing occupational codes published in 1948, which, for example, do not include occupational categories for most electronics fields such as television.

On the military side, likewise, differing levels of military occupational aggregation generates different estimates. While Winkler and Thompson used all five AFSC characters, others like Curtright and Freeman

(1972) aggregate all military specialties into one group. Clearly, this method of approach to the transferability problem suffers from severe data limitations due to available occupational codes and variable levels of occupational aggregation. While suggestive of potential transferability, estimates for specific military occupational specialties should be regarded with a great deal of skepticism.

III. ESTIMATES OF TRAINING PREMIUMS FROM MILITARY-ACQUIRED TRAINING

Perhaps the most straightforward application of human capital techniques to the issue of military-acquired skill transferability involves estimating training premiums for military skills by utilizing regression analysis on post-service income survey data. These studies can be divided into two classes on the basis of the reference group they use. One class examines post-service earnings for vocationally trained specialists in relationship to a post-service control group, namely infantrymen; the other uses non-veterans as a reference group.

Studies which compare post-service earnings of infantrymen with those of vocationally trained specialists do so in order to control for a potential service effect in estimates of returns to military training since, by and large, infantrymen receive little or no training which is directly applicable in the civilian sector. The *Military Training Study* (1970) which used this method found, further, that controls for pre-service experience were justified since vocationally trained specialists taken together showed no significant income differences from infantrymen, but when disaggregated by specialty uniformly showed a positive income effect of military training in future earnings. This pre-service adjustment provided results that suggested that pre-service experience was a significant factor in post-service earnings especially in cases where individuals had both pre-service and service training in an occupation, however, for these individuals they estimated a *negative* effect of service training on earnings when they compared separatees who had both pre-service experience and military training with those who had only pre-service experience. Explanations for this somewhat anomolous result range from problems of draft

inducement to problems of post-service OJT and finally to problems of time-linked biases in post-service earning estimates stemming from premature measurements of separatee earnings which allow insufficient job adjustment time for separatees in civilian occupations.

Another study (Freeman, 1972) utilizing regression analysis focuses on the broad effects of different types of institutional training on earnings rather than the effects of occupational specific training and subsequent training specific employment. His findings suggest that while most formal civilian occupational training has a positive effect on earnings, Army vocational training does not. Without specific occupational considerations, however, these results are of limited value in either assessing transferability of military-acquired skills or estimating training premiums for specific military specialty training. A third study (Olson, 1974) utilizing similar methodology and data as Freeman, but controlling for race, finds a positive relationship between all occupational training including military training and earnings.

Accounting for regional differences in estimating the effect of military-acquired training on earnings, Hanushek (1973) also reported that military-acquired training does not have a significant effect on earnings. However, Hanushek's data is confined to separatees with only two years of service, who are less likely to have received much training, and to earning reports insensitive to whether or not separatees used their military training in their civilian employment.

McCall and Wallace (1967) found, however, in examining one Air Force specialty and controlling for such factors as previous education and AFQT score that military training does have a positive effect on earnings irrespective of whether or not training is specifically used in post-service civilian employment.

Clearly, the results of these studies are inconclusive and contradictory owing largely to data differences in sample stratification, level of aggregation for both civilian and military occupations, and breadth of explanatory variables.

To recapitulate, the theory of investment in humans centers on the proposition that there exists the possibility to forego all or part of current earnings for the prospect of increased future earnings. Empirical research which has focused on the magnitudes of these investments and their implications for growth models, on estimating income rates of return to these investments, and on explaining particular labor force behavior, particularly race differences in earnings, has served to verify many hypotheses central to this theory.

Applications of these principles to military manpower management and training problems have, likewise, focused on estimates of the magnitudes of net investments in first term personnel, the rates of return to these investments for various occupations and individuals, and, finally, the transferability and value in the civilian labor market of military-acquired training. Where general empirical research and military specific research differ is in methodology, especially as it regards costs. General research focuses on the net investment from the employers' point of view.

Military applications have suffered, however, due to severe data limitations which stem from the fact that relevant data come from two distinct and different sources, namely, active service records and post-service civilian careers. Longitudinal studies suffer from an imbalance of accuracy and detail between service records and post-service civilian data, the latter being significantly less useful. Cross-sectional studies, however, suffer from adequate controls for individuals' differences and adequate data on occupational categories.

Future applied research must strive to overcome these data problems if it is to be of sufficient utility to policymakers to justify continued support. Either by more successfully bridging the military/civilian data gap for longitudinal or cross-sectional studies, or by more thoroughly investigating the net military training investment over the life-cycle, applied research in military investment in humans has the potential of being of significant policy relevance to manpower planners concerned with

issues of procurement (who and for what jobs?), training (how much and what kind?), retention (for which specialties and why?) and compensation (how much and for whom?).

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