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ARMED SERVICES RECRUITING RESEARCH: ISSUES, FINDINGS AND NEEDS, (U)
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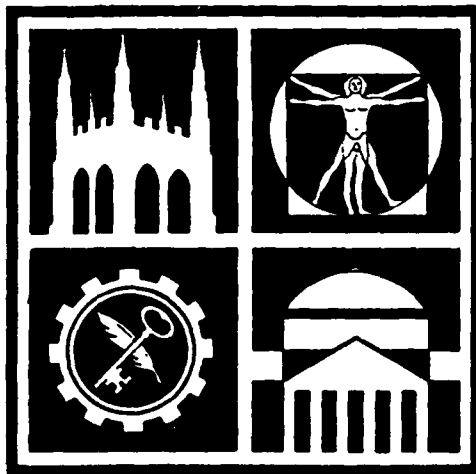
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ARMED SERVICES RECRUITING RESEARCH:
Issues, Findings, and Needs

July, 1981

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ABSTRACT FOR
ARMED SERVICES RECRUITING RESEARCH: Issues, Findings, and Needs

by

Richard C. Morey and John M. McCann

Manning the Nation's Armed Services will continue to be a crucial issue for the remainder of the 1980's. With the projected growth of the Services during this decade and the downturn in the 17-21 male population, the ability of the Services to meet their quality and quantity recruiting goals becomes of central concern. The accurate estimation of the supply for various types of recruits becomes especially important when one views the over \$720 million budgeted for FY81 and the impact that any military pay raises can have on the DOD's manpower costs of over \$40 billion annually. In addition, perceived difficulties in recruiting can impact on weapon system design decisions, authorized manning levels, and exacerbate the debate concerning the draft; hence, it is clear that few issues today warrant more attention than improving the efficiency and effectiveness of military recruiting.

This paper provides an introduction and review of some of the key issues involved in modeling and estimating the supply of military recruits. It summarizes and compares the findings of selected econometric models, all of which are based on enlistment experience since the introduction of the All-Volunteer Force in 1973. It also presents some new insights and directions for research dealing with simultaneity, validation, data base selection, and the cost-effectiveness of various types of recruiting expenditures. It concludes by listing some of the research needs to be addressed in the future.

ARMED SERVICES RECRUITING RESEARCH: Issues, Findings and Needs

by Richard C. Morey and John M. McCann

1.0 PROBLEM PERSPECTIVE AND THE RECRUITING PROCESS

The introduction of the All Volunteer Force (AVF) in July 1973 was accompanied by a dramatic increase in the level of effort expended to meet the various quantity and quality goals of the Armed Services. For example, the recruitment of enlisted men and officers with no prior service costs about \$620 million for fiscal year 1978 and is budgeted at approximately \$720 million for FY81. In addition, advertising expenditures for military recruitment have increased from \$6.7 million in fiscal year 1970 to nearly \$100 million in fiscal year 1978; even after adjustment for inflation, this represents a tenfold increase. These amounts, together with the renewed debate concerning the possible return to the draft, the projected growth of the Navy towards 600 ships during this decade, and the projected demographic reductions in the number of male 17-21 year olds until the mid 80's, render this general topic of prime interest. This is especially true when one appreciates the magnitude of manpower costs for the Nation's Armed Services, a figure over \$40 billion annually. Hence any misjudgments as to the proper setting of military compensation carry with it huge financial impacts.

Perceived difficulties in the supply of military recruits, both on a month to month basis as well as on a year to year basis, can also have long term effects that are sometime overlooked. The Department of Defense takes into account projections of the quality and quantity of new recruits that it feels can realistically be obtained in upcoming years in making key weapon system

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design decisions. Hence, the authorized manning levels of the Services and its implications in terms of the various options open to the Nation are strongly influenced by perceptions of supply. Indeed in the past few years the Department of Defense has lowered recruiting quotas, at least partially in response to severe recruiting shortfalls occurring when the quotas were higher. Hence it should be clear that better methods for estimating supply of recruits can have pervasive impacts.

Military recruiting is based on the postulated complementary nature of advertising and recruiters: advertising stimulates inquiries to a recruiter, the role of recruiters being then to "close the sale." It is argued that imbalances in either dimension will result in unmet quotas, either because of insufficient leads, or the shortages of recruiters to follow up on the leads. As a consequence of this philosophy, each service receives two separate Congressional appropriations, one for recruiters and their support, and one for advertising. Of the total amount to be spent on advertising, a certain portion is allocated to national advertising agencies for a national campaign aimed at increasing general awareness of the military. The "copy" is geared towards motivating the potential recruit to seek out more information about a military career and appeals to the training, experience, travel, educational benefits, etc. to be obtained. The balance of the advertising budget is allocated to direct mail campaigns, hand-out materials for the recruiters and for locally placed classified ads, all designed to produce leads (i.e. formal inquiries and requests for more information). These leads are managed and tracked at the headquarter's level, the pertinent information being dissiminated to the appropriate recruiters. The recruiters, following up on these leads, provide counseling, perform some screening of the applicants, and attempt to obtain a signed enlistment contract,

i.e. a legal commitment to report for service within a specified period of time. Associated with this facet is the so-called Delayed Entry Program whereby those signing contracts can delay their actual date of entry for up to 12 months from the time of the contract signing.

Hence a recruiting campaign produces three key types of outcomes: i) a number of leads, ii) a number of enlistment commitments, or so-called contracts, signed by various types, e.g. those with high school degrees, those with GED's, those deemed to be school eligible based on scores on a standardized exam, etc., and iii) the number of shipments, or so-called accessions, to Recruit Training Centers; it is this quantity on which quotas are based and shortfalls recorded. An Appendix is included which presents an overview of the growths in the budget, the variation in the level of quality enlistments obtained over the years and a detailed "snapshot" of the resources and the results for the Navy for 1978. The Appendix also includes a bibliography and comparison of the often divergent findings of twenty efforts performed since 1974 which utilize post All-Volunteer enlistment experience as the basis for their conclusions. The next Section summarizes the types of insights obtained from these efforts.

2.0 FACTORS STUDIED IN ESTIMATING SUPPLY OF RECRUITS

This Section discusses factors which have been found to impact contracts and/or accessions. It should be noted that the preferable dependent variable is contracts (in contrast to accessions) since advertising, recruiters, pay, unemployment, etc. have their impact not so much on when the individual reports to boot camp (i.e. an accession), but on whether or not he signs a contract and when. Hence, time series models using accessions as the dependent variable must include large lag effects to have any chance of accuracy;

on the other hand, this feature introduces multi-collinearity which can distort the parameter estimates. The thirteen factors found to be among the most important are:

i) The Unemployment Rate - Essentially all researchers include the unemployment rate for the eligible group, i.e., the male 17-21 year old group or the general unemployment rate. A few (e.g., Fernandez [10] and Greenston and Toikka [14]) also find a strong lagged relationship associated with unemployment, whereby increases in unemployment make themselves felt for many months into the future. The latter also utilized two stage regression approaches to attempt to deal with the simultaneity between the enlistment rate and the youth unemployment rate, but reported the estimates reached from such methods were essentially those obtained from single stage methods. The unemployment elasticities reported are in the range of .19 to .5.

ii) The Number of Production Recruiters - It is generally agreed that the pre-All-Volunteer studies (e.g., Gates [11]), that did not include recruiters as a variable most likely were misspecified and as a consequence overstated the impact of military pay. Essentially all studies now include the number of recruiters which, together with their support costs for autos, telephones, rent, utilities, clerical, etc., comprise over 80% of all recruiting expenditures. A few (e.g., Jehn and Shugart [19]) have utilized a factor to weight the number of recruiters by an experience factor. For quality recruits, the elasticity related to recruiters seems (e.g., [23]) somewhat higher than that for the non-quality recruit, most likely based on the differences in the level of rapport required.

Several of the cost-effectiveness studies have recommended that increasing recruiters is one of the most cost-effective options for meeting future

requirements. The elasticities range from a low of about .3 to a high of over one, with most studies concluding that recruiters exhibit diminishing returns.

iii) Advertising - The Services spend annually over \$125 million on military advertising covering such diverse media as TV/radio, magazines, billboards, classified ads, direct mail campaigns, minority campaigns, and even Joint Dod Campaigns. Amey [3] found advertising to have an elasticity of .16 - .25 for the Mental Category III, (i.e., the lowest mental category acceptable). Goudreau [13], in their cost-effectiveness analyses, utilized .06 for advertising versus .33 for recruiters. More recent efforts [23] seem to show that the optimal mix of dollar resources for advertising and recruiters might be in the range of about a 15% to 85% split, respectively. Ongoing efforts are attempting to improve the timing, media mix, and geographical placement of the advertising budget.

iv) Demographics - The variables that have been tried and found to be helpful in cross sectional analyses, in improving the predictive capabilities for quality recruits, include: i) percent Black in the region (negative correlation); ii) urban-rural mix, i.e., percent of region's population included in an SMSA (positive); iii) propensity to enlist, based upon responses to questionnaires geared to general perceptions of military in the area (positive); iv) percent of youth in college (negative); v) extent of military presence (positive); vi) number of high school seniors (positive); vii) labor force (negative); viii) density of area, i.e., population/sq. mile (positive); ix) area education level (negative); and x) per capita income (negative). These variables are particularly useful in improving recruiter allocation and in setting quotas by area. The use of dummy variables in cross sectional studies also has merit in that it captures differ-

ences in recruiter efficiency and other demographic variables omitted; it generally gives rise to lower elasticity estimates than if the geographical dummies were excluded. However, while the inclusion of area dummies certainly improves the accuracy of forecasts, their inclusion in models used to set quotas is not recommended since it would tend to penalize efficiency by raising quotas in those districts which have overperformed.

v) Seasonality - In time series models, particularly for quality high school graduate recruits, the inclusion of monthly or seasonal dummies has been found, e.g., [14], to greatly increase the explanatory power of the models and is sorely needed to not bias the estimates. The advantage of cross sectional analysis is that these effects do not have to be dealt with.

vi) Special Events - Special situations, such as the termination of the GI bill, a policy switch to utilize paid TV advertising, etc. require the analyst to attempt to adjust for these situations so as not to bias the time series models. For example, December 1976 was the month in which contracts greatly exceeded any other month because it was the last month for which signing an enlistment contract would entitle one to the benefits of the GI bill. Hence, any analysis that did not adjust for this event could result in very misleading results. Another example is the impact of the Civilian Employment Training Act (CETA) begun in 1977, whereby the U.S. Government began spending several billions of dollars aimed at providing initial employment and training for disadvantaged youth. This Program involved some 360,000 men for three-month periods and could well be one of the major causes of the substantial drop in contracts in 1978. A commonly used device, although not an entirely satisfactory one, is the inclusion of a dummy variable to allow the intercept to vary to adjust for the

impacts of special effects. One of the needs for future research [26] is to develop alternative approaches for handling such situations.

vii) Quotas - One study [19], using cross sectional data for 1973 and 1975, felt there was an inhibiting effect of quotas, even on quality enlistments. They further felt the goal setting process used by the Recruiting Command is extremely important in determining the overall efficiency of the recruiting campaign. In [23] a "moderator" approach was used in which the productivity of recruiters, in terms of quality recruits, was modeled as a function of the difference between their total monthly quota and their "dues in" from the Delayed Entry Program. The results showed expectedly that, when the recruiters were pressed to meet the monthly totals, the quality of the recruits obtained was reduced.

viii) Demand Limitations - Most researchers feel that regressions can safely be applied to the HG graduates/school eligible supply estimation area since these are not demand limited, i.e., the services will essentially take all they can obtain of those types. However, Savings [24] feels that, if there are not enough school slots at any given time for certain supply limited categories and the recruit must enter the Delayed Entry Pool, a demand limitation is still operating. To reduce these problems, he suggests performing separate analyses for each of the supply limited skill categories. A technique to combine predictions of the quality and non-quality recruits revolves around the use of simultaneous equations where quality and non-quality contracts are treated as endogenous variables. In this case, the number of non-HSG contracts signed is a function of the number of HSG contracts signed and the quotas. Estimation techniques developed for censored data may also be useful.

ix) Inter-Service Competition - Some studies such as [12] or [15] have

tried to control for the actions of other services by inclusion of other Services' recruiters, their levels of advertising or accessions. The latter study suggests that the Army, as the market share leader (at least in the amount of spending) may be helped by Navy advertising. The problem has been to develop a uniform geographical unit which facilitates cross sectional analysis of this type.

x) Delayed Entry Program - The option for a recruit to delay his actual accession or shipping date for up to a year from the time he signs an enlistment contract has become a very powerful factor in recruiting analysis. Presently over 80% of all of the Navy's accessions are through the DEP program. The attractiveness of utilizing the DEP mechanism is enhanced by the fact that time in the DEP counts against the six year reserve obligation, and counts toward longevity for pay purposes.

One researcher [24] has argued that the length of the wait in the DEP has a negative effect on enlistments since if a recruit isn't allowed to ship directly, (because of lack of school seats) he remains unemployed until he can. However, others, e.g., [15] and [23], have found that the size of the DEP pool has a positive effect on leads and on HSG contracts, most likely because of the peer "grapevine network" whereby those men who have committed themselves convince their friends to do likewise.

xi) Level of Military Compensation and the Symmetry Issues - Many studies have attempted to deal with this very controversial aspect of supply, utilizing either the relative ratio of military pay to civilian pay, or the absolute levels of military and civilian pay. The estimation of its correct impact is extremely important when one recognizes that, of the over \$40 billion per year in Dod manpower costs, nearly 50% of it is for basic pay. Earlier studies, whose data base was longitudinal only, had great difficul-

ties in separating out the effects of increases in military pay and increases in recruiters; this was since they tended to move together since the inception of the All-Volunteer Force.

A second aspect of the impact of pay centers on which elements to include, i. e., basic pay, allowances, bonuses, GI bill benefits, fringes, etc. and the relevant time horizon and discount rates to be used. Amey [2] found that estimates of military basic pay elasticity exceeded those associated with "in kind" compensation. The resolving of this issue becomes very important in determining the mix of pay and fringes which yields the maximum response per dollar expended. It is also thought e. g., [14] and [23], that the high quality recruit is less concerned with his short term level of pay, but responds more to the training and experience available and the impact these will have on his long term income stream.

Another difficult aspect of this problem is the so-called "symmetry" issue, i.e., are enlistment responses the same to a percent change in military compensation as to a percent change in civilian compensation. Some researchers have suggested that the military pay elasticity is significantly smaller than that for civilian pay. To demonstrate this, [14] reports military pay elasticities at 1.203 to 1.261, and civilian pay elasticities at -1.673 to -1.921. If non-symmetry is indeed the case, then conventional wisdom which suggests basing military pay raises so as to keep the ratio of military pay to civilian pay constant, could result in serious recruiting shortfalls.

Finally, estimates of elasticities for pay for enlisted personnel vary greatly, from the 1.25 used by the Gates Commission [11] at the beginning of the All-Volunteer Force to almost no impact at all, e. g., [12]. Adding another dimension, [16] finds pay elasticities of .61 and 1.18 for whites and non-whites, respectively.

xii) Federal Minimum Wage - Cooper [7] and Fernandez [10] have found a negative relationship between the level of enlistments and the minimum wage which is particularly pronounced for the lowest mental quality group, i.e., Mental Category III.

xiii) Length of the First Term - The Army and Navy have experimented with various year contracts. The impact of reducing the six year and four year contract to two or four years have appeared to result in moderate increases in enlistments; however it is not known to what extent "substitution effects" are operating.

xiv) Profile Analyses - One recent study [28], based on a longitudinal study of 1972 HSG cohorts, found that individuals most likely to enlist are those from families with middle to lower middle family incomes, and average to slightly below average math and vocabulary skills. Others [9] have computed correlations of many personal factors such as socio-economic level, education, self-perceptions of worth, attitudes toward authority, desire for "respect and dignity," "good marriage," etc. with quality enlistment rates. They found many of these to be highly correlated, both positively and negatively

xv) Size of the Eligible Pool

Most regression studies have defined the dependent variable to be the enlistment rate; in so doing they have implicitly assumed the elasticity of the eligible quality pool to be 1. However most researchers (e. g., [16] and [23]), using as an independent variable a factor such as the male high school senior population, find the elasticity for the supply pool to be substantially less than one, perhaps more of the order of .5. In addition Beswick and Cooper [21], in studies for the Air Force using cross-sectional data for April 77 - March 78, found the elasticity for high school seniors to be only .13. The rationale for this less than proportionate decline in enlistments is thusly: when the population pool susceptible to enlistments is larger than that actually

being contacted effectively, then small marginal declines in the population pool will have little effect on accessions. They further argue that only when the entire susceptible population is being contacted can accessions be expected to decline proportionally with the eligible pool. This theory, of course, has large implications for accurately forecasting supply.

3.0 SIMULTANEOUS VERSUS SINGLE STAGE MODELS: "Market" and "Allocation" Effects

With very few exceptions, practically all of the supply studies have been of the single stage variety, i.e., it has been implicitly assumed that the levels, timing, and geographical distribution of resources affect the key outcome variables of enlistments of various types, but are not affected by them. One exception to this is [14] where the simultaneity of youth unemployment, and the number of enlistments was investigated. The idea here was that the higher the number of enlistments, the lower might be the youth unemployment, and the lower the youth unemployment, the lower the number of enlistments, etc. Unfortunately, the youth unemployment rate, developed by the Labor Department, does not reflect enlistments in the military and so searches for simultaneity of this type may be fruitless.

Morey and McCann [23] used a simultaneous equation approach to separate out the "market" and the "allocation" effects, that is, to what extent are HSG contracts from certain districts the result of recruiters having been allocated there, or is it the case that recruiters were allocated there because contracts had been obtained from those districts in the past? The "market" effect has to do with the response of the market to an increase in the number of recruiters, whereas the "allocation" effect has to do with the recruiters being allocated to an apparently high potential market. Hence, it is sort of a "chicken and egg" phenomenon as to which is really the cause and effect. The same issue applies for the timing of the advertising,

i.e., are contracts signed in certain months because the advertising was pulsed in those months, or is the advertising pulsed in those months because of the past seasonal distribution of contracts or leads?

The model utilized three years of monthly data for 43 districts to build a two-year model with a year's lag of HSG contracts and leads. The past year's geographical distribution of HSG contracts was used to help explain the assignment of recruiters for the present year; the monthly distribution of the past year's leads was used to explain the feedback strategy used by the advertising agency as to when to pulse their advertising.

In formulating a simultaneous model, one first postulates various possible interactions between the endogenous factors and how the exogenous factors make themselves felt. Then, by performing multi-stage least square regressions on the empirical data base, one either confirms these interactions and quantifies them, or rejects them and hypothesizes other interactions.

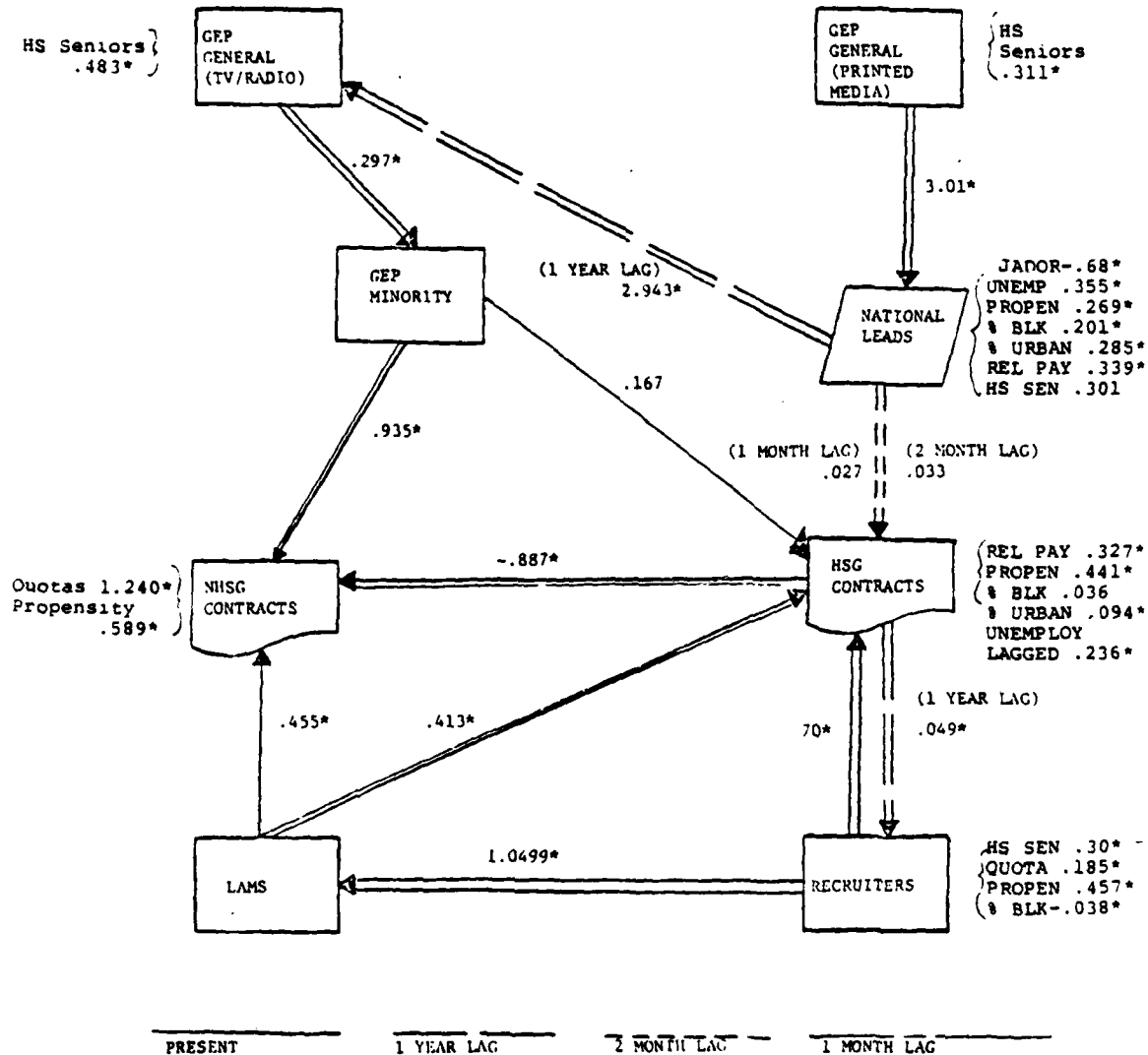
The interactions and dependencies found are depicted in Figure 1. An eight equation system was used in which the levels of HSG and non-HSG enlistments, the numbers of National Leads, the numbers and locations of recruiters utilized, and the size, timing and location of four different types of advertising constituted the endogenous dependent variables. The exogenous variables included the various demographics, quotas, and district and monthly dummy variables.

The results can be summarized as follows:

- i) For the key endogenous variable of HSG contracts, we find an elasticity related to recruiters of .901, and an elasticity for National Leads (two months lagged) of .039. We note an exogenous relative pay elasticity of 1.37 was obtained which agrees well with some results from single stage analyses (e.g., the Gates Commission estimate [11] of 1.25). Similarly, the elasticity on

FIGURE 1

INTERRELATIONSHIPS FROM SIMULTANEOUS REGRESSION
WITHOUT DISTRICT DUMMIES



DOUBLE LINES OR * DENOTE STATISTICAL SIGNIFICANCE AT THE 10% LEVEL.

Leads agrees very well with the recent cross sectional, single equation model developed by Beswick and Looper [21] for the Air Force. This work used data from April 1977 to March 1978 and found an elasticity for Leads of .04. We also note that the elasticity of .901 for recruiters obtained from the simultaneous model is about 30% higher than that obtained from single stage models using the exactly same data base. Crawley [8], in his analyses of HSG recruits for the Marine Corps, found recruiter elasticities for HSG's of between .63 and .79. From these studies one might infer that intermingling of the "market" and "allocation effect," ignored by the single stage approaches, may have led to a small under-estimation of the impact of additional recruiters.

- ii) It is also interesting to note the significant allocation effects operating--namely the geographical distribution of last year's HSG contracts affecting the geographical allocation of this year's recruiters, and the impact of last year's monthly distribution of National Leads affecting this year's pulsing of the large TV/radio budget. This concurs with the rationales used by the Services to help reach these types of decisions.
- iii) We also note that the geographical distribution of the recruiters is almost perfectly correlated with the geographical distribution of dollars spent on local advertising; this is consistent with the current practice of the Area Commander to allocate his local area advertising budget on the basis of the assigned number of recruiters. Similarly, the timing and size of minority advertising (which is largely radio) follows that of TV and radio expenditures for the general youth population.
- iv) Finally, we note the intuitive negative relationship between HSG

contracts and non-HSG contracts; this is capturing the substitution and demand limitation for non-HSG enlistments, where more HSG enlistments imply that less non-HSG enlistments are needed and will be accepted.

It is felt that the use of multi-equation systems should be expanded as more years of detailed monthly-district data become available. Better estimates of any "multiplier" effects operating are needed to forecast the consequences of any policy changes contemplated.

4.0 TIME SERIES VERSUS CROSS-SECTIONAL VERSUS POOLED METHODS

This section addresses some of the issues in the continuing debate regarding the type of data bases that should be used in supply estimation. The key choices are: 1) time series or longitudinal analysis, using national data with observations taken monthly, quarterly, or yearly; 2) cross-sectional analyses using county, district, or recruiting station observations taken from one time period; 3) a combination of the above, the so-called pooled methods, which can utilize variability both geographically and longitudinally.

The key considerations in this debate appear to be:

i) Cross sectional methods alone face severe problems in deriving estimates of elasticity of military pay since they cannot observe variations in military pay over time. Fechter and Amey [2] point out that cross-sectional approaches are constrained to deriving pay elasticities from only civilian pay variations. This has associated with it the possibility of bias associated with potential systematic measurement errors in the civilian pay variable. In particular, they claim that if one works with cross-sectional methods only, there can be a significant downward bias in the pay elasticity since variations in the civilian pay are probably inversely correlated with factors (such as cost of living) that represent the set of non-pecuniary dis-

taste for the military; [23] obtained larger pay elasticities using a pooled data base than those obtained without the longitudinal variation.

ii) In time series analyses, the high correlations between military pay raises and increases in the number of recruiters have made it almost impossible to separate out their effects. In fact, in recent analyses by Fernandez [10], using data for the period of 1970 to 1979, neither variable was significant by itself, but the combination was jointly significant.

iii) Time series models typically have given higher elasticities than those using cross-sectional methods, perhaps because of the reasons suggested earlier due to their not accounting for military distaste. Time series models that have not included recruiters unequivocally have yielded higher elasticities for the military pay variable than those that have included a measure of recruiting effort.

iv) In cross-sectional analyses, [2] points out that it is almost impossible to separate out regional differences in civilian wages, unemployment and propensity to enlist; they strongly suggest the use of pooled data bases.

v) If one is interested in estimating the lag structure or "stock of good will" associated with advertising or unemployment, one must, of course, use a data base with variation over time. Knowledge of such a lag structure is important in determining the proper timing for the advertising budget and in separating out short term and long term effects. A popular device for accomplishing this is the Koyck distributed lag model (e.g., see [20]) which utilizes an autoregressive term on the right hand side of the regression to measure the rate of decay of various factors.

vi) In pooling particularly, it is necessary to determine if the data are from the same population. Pooled data is best treated by statistical techniques that automatically control for autocorrelation of the error terms and allow heteroscedascity.

5.0 RESULTS OF A RECENT VALIDATION EFFORT AND A COST-EFFECTIVENESS ANALYSIS

Morey and McCann [23] developed two supply equations, one for all High School Graduate enlistments and one for bright HSG enlistments; the latter group consisted of those recruits scoring in Mental categories 1-III A on the Armed Forces entrance exam. The predictive equations were developed using data from the period January '76 through December '78. This involved a pooled cross-sectional and time series data base consisting of monthly data for 43 districts, or 1,548 observations. A log log model was used so the resulting coefficients could be interpreted as elasticities. The Koyck distributed lag model was used to model the long term effects. A heteroscedastic regression technique known as the Park's Model (e.g., see [20]) was utilized which automatically adjusted for autocorrelations and unequal variances. A recursive, two equation system resulted where the first equation expressed national leads as a function of advertising and demographics. The second equation expressed enlistments as a function of leads, recruiters and other factors. No district dummies were used in the regressions; instead, district demographic characteristics were used to capture the differences among the regions. Monthly dummies were used to handle the strong seasonal nature of recruiting for quality recruits.

After verifying the reasonableness of the coefficients, in terms of the direction and magnitudes of the elasticities with those of past studies and expert opinion, the equations were used to predict the monthly and geographical levels of enlistments for the independent period of January 1979 - September 1979. The actual levels of advertising in the November-December 1978 periods, the estimated length of the advertising lag, as well as the actual levels of advertising, recruiters and demographics for each month in question, were

utilized in the equation; the demographics included the size of the high school male senior population, the area's unemployment rate, the area's percent black, the area's urban-rural mix, and the ratio of military pay to civilian pay in the area.

Summaries of the forecasting errors are shown in Table 1 for both HSG enlistments, and for bright HSG enlistments. Recall that no geographical dummies were used so that differences in the forecasts and actuals may be due to real differences in the operating efficiencies among the districts. It should be pointed out that at least a partial reason for the HSG enlistment model to apparently outperform the Upper High School Graduate enlistment model is a difference in the rigor and completeness of the data bases used for the two groups. These problems notwithstanding, it is felt the validation efforts were quite successful, even at the regional and monthly level, and offer some real potential for aiding in the geographical allocation of recruiters and in the timing of advertising expenditures. The reader is referred to [22] which discusses budget allocation models designed explicitly to utilize these types of response functions.

Estimates of Elasticities and of Relative Cost-Effectiveness of Various Types of Recruiting Expenditures

Having established a degree of confidence in the estimating procedure, the equations were re-estimated using the entire 45 months of data, including the independent nine months held out for the validation effort. The long term elasticities are shown in Table 2. Note that the really important controllable factors appear to be recruiters and local advertising.

Table 3 shows the estimated marginal costs to obtain an additional contract of each type if all the additional funds were expended on only one type of resource; the other levels would be assumed to have been held constant. Hence, while the elasticities utilized are based on the 45 months of data,

Table 2
 Long Term Elasticities
 Based on Monthly District Data
 Over Period January 1976 - September 1979

Factor	All HSG Enlistments	Upper Mental HSG Enlistments
1) No. of Bright High School male Seniors in area	N.A.	.0552
2) No. of High School male Seniors in area	.2398	.2301
3) No. of Recruiters in area	.718	.7406
4) Dollars of Local Advertising Impacting in area (constant dollars)	.0557	.0604
5) Dollars of TV/Radio/ Billboards from GEP Budget Impacting in area (constant dollars)	.0051	.0016
6) Dollars of Magazines Advertising Impacting Area (constant dollars)	.0067	.0021
7) Dollars of Direct Mail Impacting Area (constant dollars)	.0032	.001
8) Perception of Military in area	.6056	.586
9) Percent Black in area	.0033	-.061
10) Percent Urban/ Rural in area	.137	.147
11) General Unemploy- ment Rate in area	.2552	.1792
12) Ratio of Military Pay to Civilian Pay in area (average first year)	.1787	.0254

TABLE 3

ESTIMATED MARGINAL COST PER ADDITIONAL
ENLISTMENT IN FY79 IF ADDITIONAL
DOLLARS SPENT IN ONLY ONE RESOURCE

EXPENDITURE TYPE	LEVEL OF ACTUAL EXPENDITURES IN FY79*	ESTIMATED LEVEL REQUIRED FOR 1 ADDITIONAL HSG ENLISTMENT	ESTIMATED LEVEL RE- QUIRED FOR 1 ADDITIONAL UPPER MENTAL HSG ENLISTMENT
1) Recruiters and support materials	3,405 man-years plus \$ 3.779 million in brochures, etc.	.0833 Recruiters man-years*	.1224 Recruiters man-years**
2) Locally placed classified ads	\$ 1.024 million	\$ 323	\$ 452
3) TV/Radio/ Billboards (Includes minorities advertising)	\$ 4.635 million	\$ 13,619	\$ 65,765
4) Magazines and Supplements	\$.229 million	\$ 601	\$ 2,903
5) Direct Mail	\$.235 million	\$ 1,291	\$ 6,257

* The advertising costs represent only the actual placement cost of the advertising and do not include copy costs, overhead or profits of the ad agencies.

* This represents \$1,766 to \$ 2,582, depending on the types of cost included. At the margin this is equivalent to an added recruiter, attaining an additional 11.998 HSG enlistments per year, when the actual average was 16.71.

** This cost is \$ 2,594 to \$ 3,794. At the margin an additional recruiter would be estimated to add another 8.17 upper mental HSG enlistment per year, the average in FY79 being 11.03.

the level of contracts and level of resources utilized are for FY79.

Note that local advertising seems to be the most cost-effective mechanism with recruiters and magazines as second choices. Advertising in local classified ads, while it does not appear to have any impact on national leads, does appear to generate visits to the local recruiting stations. Its main advantages are that it is relatively inexpensive and impacts the reader when he is very motivated to find employment. Also note the diminishing returns operating where an additional recruiter could be expected to add only about eight bright HSG enlistments per year compared to the 11 bright enlistments each recruiter averaged in FY79.

6.0 NEEDED RESEARCH

The following are some suggestions for the directions of future research and the issues to be addressed; the list is by no means complete.

- a) Analysis and integration of "local leads" into the enlistment equations:

Until very recently the only lead data base available was for so-called NOIC or national leads. These leads are the result of national advertising campaigns, the elasticity for quality enlistments on NOIC leads being about 4-5% and lagged about 2-3 months.

Another lead data base, which began for the Navy in January 1980, offers the potential of being significantly more valuable in predicting enlistments. This data base has the acronym of LEADS (Local Effect Accession Delivery System) and tracks inquiries to a local recruiting station. It contains information by month and district on the total unduplicated number of such leads, the number of those qualified for the Navy and the numbers of those who ultimately

sign a contract. It is also suggested that there may be a simultaneous, synergistic effect operating between national and local leads which needs to be analyzed.

- b) Impact of other Services Advertising and Recruiters: As mentioned earlier, most studies geared to predicting enlistments for a given branch of the Armed Services, have not included the level of recruiters and advertising used by other services. Exceptions to this include [12] and [15] which seem to show that there is no unfavorable effect on Navy recruiting resulting from the efforts of other Services; indeed it appears that Air Force efforts appear to have a positive influence on Navy accession. It is recognized that differing district boundaries and data availability problems compound the difficulties in this area, but it would appear such knowledge would be extremely helpful, especially at the Department of Defense level; this is especially true when it's recognized that all services must "win" to some extent and that there cannot be any big "losers."
- c) Pay-Related Issues: Since the issue of the proper level of military pay needed to insure the viability of the All-Volunteer Force has such tremendous dollar implications, it behooves researchers to be especially diligent in analyzing this particular facet. Some of the unresolved questions related to pay and recruit supply are:
 - i) Are there differences in the responsiveness to pay and key demographics, such as the unemployment rate, by service? Preliminary models [8] seem to indicate that enlistments in the Army appear most responsive to changes in relative pay and enlistments in the Marine Corps the least responsive.

- ii) Do military and civilian pay exhibit non-symmetric elasticities? This [5] has been reported to be true for the reserves where estimates have been made that a doubling of the reserve's salary would have to occur to prevent shortages there.
- iii) Are there differences in the first term pay elasticity for whites and non-whites? This question is especially important when one appreciates that most of the large drop forecasted in the 18 year old HSG populations over the late 1980's, is for the white segment of the population. Indeed the non-white portion of this population is forecasted to grow by several percentage points. Some studies (e.g., [16]) calculate for upper mental category HSG enlistments, a pay elasticity for Blacks equal to four times that of non-Blacks.
- iv) How does the elasticity for basic pay compare with that for "in-kind" compensation? A unique feature of military services is that the serviceman receives, in addition to basic pay, many benefits such as allowances for quarters and subsistence, medical benefits, pension, use of recreational facilities, commissary and exchange privileges, etc.

A knowledge of the perceived impact of these benefits is important in determining the best mix of these forms of compensation to obtain the maximum enlistment and retention response.

- d) Impact of quotas: As mentioned earlier, the goal setting process can be very important in determining the overall outcomes of the recruiting campaigns. Ongoing efforts are addressing the question

of setting contract goals for the recruiting districts (as well as on shipments) and improved management of the Delayed Entry pool. Other efforts are aimed at financially rewarding recruiters who meet or exceed quotas for critical types of recruits, and tracking by recruiter, the fraction of his recruits who do not attrit in "boot camp."

- e) Quantification of Uncertainty: Most all of the enlistment forecasting models developed to this point have not dealt with the important question as to the level of confidence in the estimates generated. The uncertainty is of two basic types: the lack of knowledge as to what the demographics (such as the unemployment rate) will be for the period in question, as well as the lack of precision for the models which utilize the factors as inputs. While we can perhaps do very little about the former, the latter type of uncertainty can certainly be addressed using the standard errors, covariances and autocorrelations generated by the estimation techniques. Simulations may prove to be a useful approach to utilize the statistical outputs being produced to obtain the confidence intervals needed for informed decision making.
- f) Use of controlled experiments: Because of difficulties associated with collinearity, the notion of large regional experiments geared towards systematically increasing and reducing recruiters and advertising expenditures has great appeal. A large experiment has recently been performed under the direction of V. Carroll of the Wharton Applied Research Center and preliminary results [26] agree with the earlier econometric modeling results. Other experiments [25] have dealt with the use of shorter enlistment contracts and expanded educational benefits, but the results have not been conclusive. For example, it is not known to what extent any increases

in the enlistment rate were the result of a "substitutions effect" where individuals enlisted earlier than they would have otherwise. Clearly, more efforts are economically warranted in this type of investigation.

This list is by no means complete, but is given as an indication that there are still many significant, unresolved questions in the area of Dod supply estimation. Only in the last few years, under pressure from Congress and the General Accounting Office (e. g., see [1] and [18]) have the Services devoted the resources and energies to developing the types of data base and analytical efforts needed to address these critical issues. It is hoped this overview will help stimulate and facilitate other researchers in this problem area which is so vitally important to our Nation.

APPENDIX A-1: SURVEY OF MAJOR DOD RECRUITING SUPPLY STUDIES

RESEARCHERS	DATA AND CATEGORIES STUDIED	THRUST	RESULTS AND VARIATIONS TRIED
1) MOREY and MCCANN (Duke) December, 1980	Pooled cross sectional/time series over period Jan. 76-Sept. 79, involving 1,935 district-monthly cells; utilized log linear, distributed lag model.	Measures elasticity of 6 various types of advertising, recruiters, and 6 demographics for MSG contracts and upper mental MSG contracts. A validation effort tested the equation for an independent time period and was within 3% of the actuals.	Increasing of Local advertising expenditures seems to offer a very cost-effective mechanism for increasing quality recruits and magazine advertising also effective. It appears that too much is currently being spent on TV/radio.
2) HANSEN and LEVITEN (UCIA and Navy) September, 1980	Pooled cross sectional/time series for period Jan. 76-Dec. 78	Investigates elasticity for contracts going into direct shipments, and those going into delayed entry program. Detailed advertising variables included.	He finds size of delayed pool very important as well as quotas.
3) GOLDBERG (CNA) April, 1980	Cross-sectional data Separate single year analyses for FY's 1977, 78 and 79.	Separates districts into those that made annual goal and those that didn't.	Military pay was insignificant. A statistical test was done to determine if the districts that made goal could be pooled with those that didn't.
4) SAVINGS (Resources Research Corp.) April, 1980 (Prepared for Air Force)	Quarterly 1956-77	Studies Mental Categories I-III, and claims sensitive to measure of wages.	States that even for high quality recruits, one should deal with possible demand limitation by doing analyses on separate skill categories. Also claims that the waiting period in the Delayed Entry Program hurts enlistments.
5) MARKET FACTS March, 1980	Fall 1979 Survey	Examined 3 enlistment incentives: 1) educational assistance (i.e., eliminating present monthly contribution 2) increase in current monthly starting pay (\$50, \$100, \$200) 3) change in bonus policy.	All have some positive impact, especially for those not predisposed to military. All 3 appear to have about same impact; recommendation is to increase starting pay by \$100, but keep other incentives as is. More extreme changes are likely to produce only small increases.

6) FERNANDEZ (RAND)
February 1980

3rd quarter of 1970 to
3rd quarter of 1979,
4 services, quarterly
accessions.

Utilizes log linear model
and concentrates on
HSDG, MC I-II,
HSDG, MC IIIA,
HSDG, MC IIIB
by service; utilizes pay,
minimum wage, recruit and
unemployment as independ-
ent variables.

Finds high unemployment
elasticities; makes pre-
dictions of enlistments
for 1982-86 for different
economic scenarios.

7) MOREY (Duke)
January, 1980

Jan. 1976 - Dec. 1978
HSG Contracts on a
monthly-district basis.

Performed, using a non-linear
programming model, budget
generation analysis for
FY 1982-1986 for 3 economic
scenarios and projections
of male high school seniors.
Utilized elasticities obtain-
ed from period 1976-1978,
and various quotas for
HSG enlistments.

The range of the percent
increase, in constant
dollars, for generating
in FY-86 the same level
of HSG enlistments as that
obtained in 78, is from 4%
to 20% depending on the
unemployment rate situa-
tion. This reflects main-
ly the smaller HS senior
pool.

8) LOOPER & BENSICK
(Univ. of South Carolina)
January 1980
(Prepared for Air Force)

All enlistment contracts for
April 77 to March 78 (cross-
sectional for 538 recruit
offices).

A partial validation effort
was done using 269 recruit
offices held out of the sample.
Independent variables includ-
ed national leads, recruiters,
and number of high school seniors.

The R^2 between the model
predictions and the actual
values was .68. The res-
ponse functions were used
to allocate recruiters
and the allocations compar-
ed to recommendations from
extensive field audits for
one squadron involving
1600 recruiters. Changes
in recommendations concu-
red with model's in direc-
tion but staff recommenda-
tions were somewhat more
conservative.

9) GOLDBERG (CNA)
November, 1979

Time series, 3rd quarter of
71 to 4th quarter of 78,
quarterly accessions for
Regular Navy.
Education and Mental Cate-
gories studied:
a) HSG's
b) MC I-III A

Attempts to forecast quality
enlistments, using total
enlistments as explanatory
variable. Utilizes a linear
model with log model for
advertising.

Obtain elasticity of adver-
tising of 25% and elas-
ticity of recruiters for
mental categories I-III A
of 1.17.

10) CRAWLEY, W.
(Center for Naval Analysis)
September, 1979
(Prepared for Marine Corps)

Shipments for FY 78 for 238
Marine Recruiting Station;
shipments are broken down
by HS degree and mental
category.

The elasticity for youth pop-
ulation is a free parameter
in that he forecasts enlist-
ments (in contrast to an en-
listment rate); utilizes re-
cruiting station detail to
reduce correlation between
recruiters, population and
quotas. Investigates linear,
log linear and logit models;
includes dummy variables for
northern districts.

Finds no impact of quotas
for upper mental HSG ship-
ments; youth population
has elasticity of .4 to
.5; states that results
approximately same for all
3 models but prefers log
linear models; can find no
impact of unemployment
rate.

11) DE VARY & SHUGART
(Resources Research Corp.)
July, 1979
(Prepared for Air Force)

June 69 - June 76

Elasticity of enlistment quality ratio to pay is .206. Elasticity of supply of accessions to pay, at constant quality, is .5. Pure supply elasticity to pay, removing downward bias from effects of retention, is .735.

2 stage, least squares, simultaneous model with wait and quality as endogenous variables.

12) HUNTER & SICILIA (OSAD)
December, 1978

1971 - 1972

Notes the negative effect of DEP option on Individual Ready Reserve. Some 13,370 man-years were spent in DEP in FY 77 prior to entry on active duty which then represented losses to the IRR program.

About half of 18 year-old youth have graduated from high school. One half of these enter college. To maintain a 6% HSDG rate, the Services must enlist 267,000 or 15% of the HSDG who do not enter college. The remaining 120,000 enlistments are drawn from the 1 million non-high-school-graduates in each 18 year-old cohort. Putting these two categories together, there are 790,000 18 year-olds who are not going to college and 236,000 of these or 30% of the cohort is needed.

13) GREENSTON & TOIKKA
(Urban Inst.)
October, 1978

Quarterly accessions
3rd quarter 1970-
4th quarter 1977
I-II HSG
I-III, NHSG
III, HSG
III, NHSG
IV, HSG
IV, NHSG
(excludes reservists)

It concentrated on impact of military pay. Utilized ratio of first 4 years of base pay to 4 years of civilian pay.

- a) 1% change in relative pay produces .5% change in average AFQT score.
- b) Military pay plays stronger role among lower quality categories.
- c) Eligible pool size and unemployment are dominant in Cat. I-III. The pool size has an elasticity of .5 and hence declining pool not as severe as it might be.
- d) Formulation with relative pay not appropriate.
- e) Military pay elasticities of .38-.46 for Cat. I-II and .96 for NHSG III.
- f) Simultaneity problem between enlistment and youth unemployment not a serious problem.

14) COOPER (RAND)
March, 1978

1951-76; 18-19 year-old
males,
18-24 year-old males.

Develops regression
model of youth unem-
ployment as function of
overall unemployment,
fraction of male youth in
total male civilian force,
and minimum Federal wage
as percent of average
hourly wage in non-
agricultural and non-
supervisory workers.

Obtains linear relation-
ship where youth's share
of total civilian labor
force is an important
determinant in youth
unemployment rate.

15) GOUDREAU, SOMMERS, ALLEN
et al. (GRC)
March, 1978
(Prepared for Pres.
Commission on Military
Compensation)

Utilizes military pay
elasticity of .8,
Recruiter elasticity of .33,
Advertising elasticity of
.06.

Analyzed 5 alternatives
for attracting and holding
required number of quality
enlistees
1) provide a general across-
the-board-percentage
increases in enlisted
pay and allowances (RMC)
2) provide an incremental
increase in enlisted
pay and allowances to
all enlisted personnel
3) increase recruiting and
advertising
4) increase use of enlist-
ment bonuses
5) increase number of quality
women enlistees for each
option, each other held
at FY 78 levels.

The increase in women
enlistees is most
efficient, followed very
closely by "more enlist-
ment bonuses" and "in-
creased recruiting/ad-
vertising", followed by
increased incremental
salaries and last by
across-the-board per-
centage increases. Stated
that military pay elas-
ticities would have to be
of order of 25-30 (com-
pared to estimated .8) in
order for across-the-
board pay increases to
be as attractive as the
other mechanisms studied.

16) HUCH & ALLEN (GRC)
September, 1977
(Prepared for ASOD)

Cross-sectional by state for
CY 75.

HSDG, MC I-IIIA
White and Non-White and for
each service. Does not
assume the eligible pool has
an elasticity of 1.

Obtains an elasticity of
.43 for the eligible pop-
ulation. Hence, as the
eligible pool declines,
the impact on shortfalls
is only about half of what
it would be otherwise,
i.e., there is less than
a proportional decline in
quality enlistments as for
the decline in the eligible
youth population.

Navy Elasticities

	WHITE	NON-WHITE
eligible pool	.44	.35
recruiters	.56	.63
unemployment	0	-.53
civilian pay	.61	1.18

The -.53 is the result of
substitution effects, i.e.
as unemployment goes up,
more white males enlist
and hence less slots for
non-whites.

17) JEHN & SHUGART (CNA)
December, 1976

Cross-sectional on districts
for CY 73 and CY 75. Regular
Navy, HSG school eligible.

Found a negative elasticity of enlistments to other services which means Navy enlistments are at expense of enlistments to other services. Also found including experience of recruiters made no difference compared to simply using number of production recruiters. They also felt quotas inhibited production of recruiters.

18) AMEY, FECHTER, HECK &
MIDLAM (GRC)
October, 1976
(Prepared for Navy)

Pooled cross-sectional time
series, on census tracts over
1970-74, on MC I-II, HSG
MC III, HSG
MC I-III, NHSG

Analyzed impacts of QMA,
civilian pay, youth un-
employment, recruiters,
paid advertising, and
black population.

For the Navy, only re-
cruiters and QMA signifi-
cant with elasticities in
range of .6-1.0 and mar-
ginal cost per recruit
of \$2,300. States that
time series show that
unemployment considera-
tions exceed pay considera-
tions and is consistent
with their risk-averting
behavior.

19) AMEY, FECHTER, GRISSMER & SICA
(GRC)
June, 1976

SICA

1970-75 (monthly) I-II, HSG
accessions III, HSG
I-II, NHSG
I-III

Investigated possible non-
symmetry of pay elasticity.
Tried various discounting
schemes and horizons rela-
ted to the pay variable.

- a) Military pay elasticity at 1.1-1.2.
- b) Civilian pay elasticity higher.
- c) Estimate of military cash pay elasticity exceeds that of "in-kind" elasticity.
- d) Quality Blacks and quality non-Blacks have very different pay elasticities for pay i.e., 3.5 for the former versus .9 for the latter.
- e) There can be a bias in cross-sectional studies of pay elasticities since variations in civilian pay likely to be inversely correlated with factors (such as cost of living) that represent nonpecuniary distaste for Military. (Gray found large pay elasticities when he adjusted for cost of living.)
- f) Existing models on accessions do not adequately deal with causes of short run variations in enlist-

20) SYSTEM DEVELOPMENT CORP.
April, 1976
(Prepared for Army)

Enlistments from 6/1/74 to
12/31/74 across district
recruiting commands.

They utilize weighted
quality index where

MC I, HSG = 6

MC II-III, HSG = 6

MC I, NHSG = 3

MC II-III, NHSG = 3

MC IVA or IVB, HSG = 2

MC IVA or IVB, NHSG = 1

Computes correlations between
factors and enlistment rate
and quality enlistment rate
where latter defined as ratio
of sum of weighted enlistments
by DRC to sum of weighted
impact of environmental fac-
tors such as socioeconomic
level, education and educa-
tional facilities available,
advertising by magazine
(month and theme), recruiters
(experience, age, and grade)
self perception, and life
style desired.

- ment behavior.
- g) Elasticities from time
series models larger
than those from cross-
sectional models.
- h) Elasticities from ab-
solute pay models gener-
ally larger than those
using relative pay.
- i) The Army generally has
highest pay elasticities
for each group, fol-
lowed by Navy, Air
Force, and Marine Corps

Correlation of recruiters
with quality enlistment
rate is .5. Attitude to-
wards authority (ease
with which one can take
orders) had a correlation
of .21, "dignity and res-
pect importance" had
correlation of .27.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This paper provides an introduction and review of some of the key issues involved in modeling and estimating the supply of military recruits. It summarizes and compares the findings of selected econometric models, all of which are based on enlistment experience since the introduction of the All-Volunteer Force in 1973. It also presents some new insights and directions for research dealing with simultaneity, validation, data base selections, and the cost-effectiveness of various types of recruiting expenditures. It concludes by listing some of the research needs to be addressed in the future.