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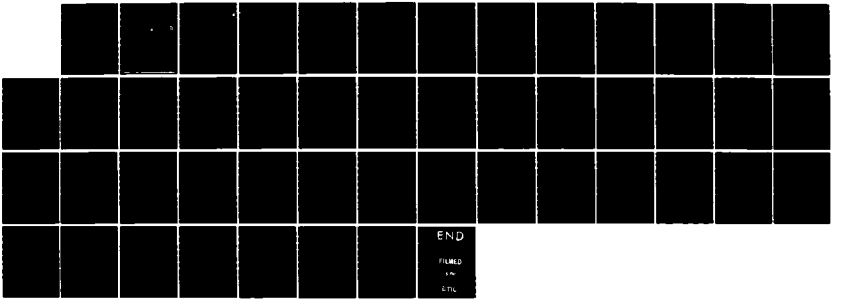

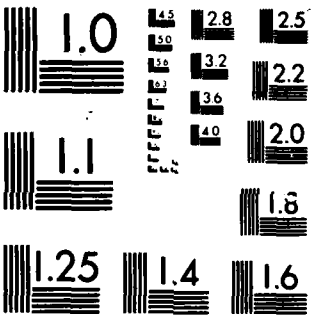

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ESTIMATING LOCAL AREA MANPOWER
SUPPLY FOR THE RESERVES

by

Jules I. Borack, Stephen L. Mehay, George W. Thomas

September 1985

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Fort Sheridan, Illinois 60037

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ESTIMATING LOCAL AREA MANPOWER SUPPLY FOR THE RESERVES

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OUTLINE

ABSTRACT

Because military reserve centers are constrained to a fixed location, a portion of reserve manpower supply depends on conditions in the local, rather than the national, labor market. A second aspect of manpower supply that is unique to the reserves is that serving in the reserves is in many respects similar to a part-time job. These two characteristics of reserve manpower supply create numerous recruiting problems not faced by the regular branches of the service. The purpose of this report is to outline a methodology for estimating manpower supply to the reserves. The techniques rely upon economic theories of part-time and second job holding to identify factors affecting the potential labor supply at the local labor market level. The paper identifies alternative empirical models appropriate to specify reserve supply functions, and available data sources. While the emphasis in the paper is on the U.S. Army Reserve, certain aspects of the proposed methodology also would be relevant to other reserve branches.

ESTIMATING LOCAL AREA MANPOWER SUPPLY FOR THE RESERVES

I. Introduction

The manning and readiness levels of the Reserve and Guard have become an increasingly important factor in achieving force capability objectives. The strategic role of the Reserve and Guard in the event of mobilization has been strengthened by the total force policy, and DOD has recently implemented actions to increase manning, training and readiness of reserve forces. During the past decade, the end strength of the reserve components has grown 14 percent, while that of the active components has fallen by one percent. It is planned that the end strength of the U.S. Army Reserve will increase from 275,000 in FY 1984 to approximately 310,000 by FY 1990, while enlisted end strength for the Naval Selected Reserve is programmed to increase by 80 percent. This increased commitment arises at a time of growing recruiting difficulties brought on by a drop in the size of the prime military age group. Obtaining full reserve unit manning, a major requirement in maintaining desired levels of readiness, is becoming a more important goal at the same time that it is becoming more difficult to achieve.

There are three unique aspects of manpower supply to the reserves that distinguish it from the regular services. First, manning the reserve centers located throughout the country requires that non prior service supply be drawn from local labor markets rather than from a national market. Thus, a close relationship exists between reserve units and the demographic characteristics of the communities in which they are located. For example, the size of the qualified military available population as well as the education and skill levels of the labor force will vary substantially across reserve market areas.

Similarly, demographic and economic changes over time tend to be more volatile for some local areas than for the nation as a whole. Thus, manpower planning for the reserve forces, at least for those with no prior service, may require better forecasting techniques than for the regular service branches.

A second unique aspect of reserve manpower supply is the reliance on prior service personnel. In the fiscal year ending September 1984 approximately 59 percent of the accessions in the USAR were prior service personnel, compared to only 7.5 percent for Army active duty accessions (DMDC,1985). However, reliance on non-prior service individuals has been increasing in recent years. Hence, a manpower supply study for the reserves must carefully consider two disparate markets: prior service and non-prior service.

A third unique aspect of the reserves is that serving in the reserve is generally not an individual's primary job. At any given time, 90 percent of reservists hold full-time jobs (McNaught, June 1981; McNaught, July 1981; and Burright, et. al., 1982), which means that, unlike the regular services, the reserve decision not only involves choosing a military job, but also choosing to "moonlight." This aspect of reserve manpower supply creates numerous recruiting and management problems not faced by the regular branches of the services. For example, turnover tends to be much higher in part-time employment than in full-time employment. This is reflected in the relatively high turnover rates in the USAR, where annual attrition rates averaged 28 percent for all USAR recruiting brigades in a recent year (FY 1982; USAREC data). In addition, well over one-half of all Army reservists fail to complete their initial contracts.

The purpose of this report is to develop and evaluate alternative techniques for estimating reserve manpower supply at the local labor market level. Section II surveys previous research on reserve supply. The major shortcoming in these studies is that they estimate supply at a highly aggregated level, such as at the

national or the state level. Section III discusses economic models of part-time and multiple jobholding and applies them to the military reserves. These models are used to specify estimating equations of reserve manpower supply at the local market level. The report also highlights the data needed for implementing the estimation procedure and identifies potential sources of data that are disaggregated to the local market area.

II. Review of Research on Reserve Manpower Supply

Previous attempts to estimate reserve accession models have been limited to the use of traditional econometric estimation techniques (Rostker, 1974; Kelly, 1979; McNaught, 1980; and McNaught, 1981). The econometric model is perhaps the most widely used technique for estimating military personnel supply. Typically, econometric manpower supply models attempt to estimate or predict the number of contracts signed by (or actual enlistments of) "high-quality" young males based upon variables deemed to employ related (in an aggregate sense) to the enlistment decision. Such models use standard econometric regression-based techniques and tend to employ either time-series, cross-sectional or pooled time-series/cross-sectional data. Table 1, which presents a summary of prominent econometric models developed for studying active duty young male enlistments, shows "supply" as a function of various predictors. In Table 1, supply is defined as "contracts signed by high-school diploma graduates," "accessions of mental grade I-IIIA high-school graduates," etc. To an econometric model builder, supply generally represents an expected value of "high-quality" contracts or accessions. Table 2 categorizes the explanatory variables used in these models under five distinct categories. Many of the models listed in Table 1 include one or more of the explanatory variables from several of these categories.

As indicated above, only four attempts have been made to model reserve supply econometrically. Rostker (1974) estimated a supply function for the Air Force Reserve. Kelly (1979) estimated the reserve supply function separately for NPS and for PS personnel. He measured reserve supply as the sum of Army National Guard, Army Reserve, Navy Reserve, Marine Corp Reserves, Air National Guard, and Air Force Reserve accessions. McNaught (1980) also examined supply

Summary of Active Duty Econometric Supply Models

Table 1

Study	Service	Dependent Variables	Explanatory Variables	Date	Estimation
Amey, Fechter, & Midlam (1976)	Army Navy	(HSDG I-II, HSDG III, total I-III, NHSDG I-III I-III contracts)/17-21 male QMAs	RMC/civilian income for 17-21 males, youth UNR, advertising $, recruiters/ QMAs, % black QMAs	CY 1970-74 annually by 9 census regions	Linear, log-linear by OLS and TSLS
Ash, Udis, & McNown (1983)	DoD, all Services	(Total contracts, total accessions, white accessions, nonwhite accessions)/18-19 year-old male population	Civ/mil pay (-1), youth unemployment rate (UNR), induction probability	1967II-76III semi-annually	Linear by TSLS
Brown (1983)	Army	(Total contracts, AFQT I-IIIA, 18-20 population, high-school diploma graduates (HSDG) contracts, HSDG I-IIIA)/HS graduates	RMC, VEAP/RMC, civilian wage (each in constant $), UNR,UNR-squared, (recruiters, DoD recruiters, national/local advertising)/18-20 population	1975IV-82III quarterly by state	Log-linear by OLS
Cotterman (1983)	All Services	HSDG I-IIA contracts/17-21 male population	RMC/civilian earnings, state, UNR-US UNR deviation, recruiters/17-21 male population	10/74-3/81 monthly by state	Log-linear by GLS
Cowin, O'Connor, Sage, & Johnson (1980)	Navy	(AFQT-I-IIIA, AFQT IIIB-IVA, HSDG, non-HSDG contracts)/17-21 male population, females, nonwhite school-eligible, nonwhite not school-eligible contracts	UNR, UNR (-6 mos), % employed, civilian wage, expected civilian wage, change in civilian wage, recruiters/17-21 male population tion % nonwhite, % military population	1975-2 to 1976-2 semi-annually by Navy recruiting area	Linear, log-linear by OLS
Dale, & Gilroy (1983)	All Services	(Total HSDG contracts, white & black HSDG contracts)/ 16-19 male population	RMC/civilian pay (+4), UNR, UNR (-2) (all for 16-19 males), GI bill/CPI, VEAP bonus	10/75-3/82 monthly	Linear by OLS and GLS

Table 1 (Continued)

Study	Service	Dependent Variables	Explanatory Variables	Date	Estimation
Daula & Smith (1984)	Army	HSDG I-IIIA contracts	High-quality goal, I-IIIA, non-HSDG enlistments, other Army enlistments, other DoD high-quality enlistments, military earnings (pay, bonuses, etc.)/ manufacturing production wages, UNR all-worked, QMA, percent minority in PMA, production recruiters, recruiter experience, local advertising experience, national advertising, impressions, percent 1980 Republican vote.	Monthly, Oct 1980-Jun 1983 by Army Recruiting district	Log-linear separately for supply/ demand constrained, censoring corrections
Dertouzos (1983)	Army	HSDG I-IIIA contracts	HSDG IIIB-lower contracts, UNR all workers 16 or older, manfufacturing production wages, 15-19 male population, recruiters, high-quality accession quota, low quality accession quota.	Monthly, FY 1980-81 by AFEES	Log-linear by two-stage least squares with quotas as instruments
DeVany & Saving (1977)	Air Force	(AFQT I-II contracts, AFQT III-VI contracts)/ 16-19 male population	Mil/civilian wage, employment rate, USAF recruiters/DoD recruiters, inductions/16-19 male population	6/69-6/76 monthly	Log-linear by TSLS
Donelan (1977)	Navy	Age 17-21 AFQT I-II accessions	UNR, % urban QMA, % rural QMA, % black QMA, recruiters (weighted)	FY 1975 annually by NRD	Linear-interaction, quadratic, logit, log-interaction, by
Fernandez (1979)	All Services	(Total HSDG, HSDG I-II, HSDG IIIA, HSDG IIIB, contracts)/17-21 male population	RMC/civilian earnings, lagged youth UNR, recruiters, minimum wage	7/1970-9/78 monthly	Linear, log-linear by OLS

Table 1 (Continued)

Study	Service	Dependent Variables	Explanatory Variables	Date	Estimation
Goldberg (1982)	All Services	Total HSDG, HSDG I-IIIA, HSDG I-II contracts	RMC/civilian pay, UNR (youth job program $, countercyclical job program $, blacks)/17-21 male population, total 17-21 male population, Navy, Army, USAF, USMC recruiters	FY 1976-80 annually by recruiting district	Log-linear by OLS
Goldberg & Greenston (1983)	All Services	HSDG I-IIIA contracts, HSDG IIIB contract	RMC/civilian earnings, change in UNR, avg UNR, 17-21 male population, % black male, % urban population of 17-21 males, Navy, Army, USAF, USMC rcruiters	FY 1976-82 annually by recruiting district	Log-linear by OLS
Greenston & Toikka (1978)	Navy	HSDG I-III, HSDG IV, NHSDG I-II, NHSDG III, NHSDG IV contracts	Male youth UNR (-2), military pay (-2)/real 18-21 male civilian pya (-1), 17-21 male population, quota/total contracts	1970III-77IV quarterly	Log-linear by OLS
Grissmer (1977)	DoD, all Services	(HSDG I-II, HSDG III, NHSDG I-III, total I-III, black, HSDG I-III, nonblack HSDG I-III, total HSDG, total NHSDG, black HSDG, Black NHSDG contracts)QMAs	Mil/civilian wage, youth UNR, recruiter/QMAs, male HSDGS/ male college enrollments, military residents/population, bonus, advertising $	CY 1972-73 annually and CY 1971-73 monthly by state	Linear, log-linear, by stepwise LS
Grissmer, Amey, Arms, Huck, Imperial, Koenig, Moore, Sica, & Szymanski (1974)	DoD, All Services	(Total age 17-18, total age 19-21, AFQT I-II, AFQT I-III, total HSDG, total NHSDG, black NHSDG contacts	Mil/civilian wage, youth UNR, recruiters/QMAs, male HSDG/male college enrollments, military residents/population bonus, advertising $	CY 1972-73 annually and CY 1971-73 monthly by state	Linear, log-linear, by stepwise LS
Hanssens & Levien (1983)	Navy	Leads, delayed entry pool (DEP), direct shipment contracts/17-21 male population	(Civilian earnings, UNR, % black, % urban, % HS seniors, YATS propensity, recruiters, recruiting $, advertising $, direct shipment goal, DEP (-1)/17-21 male population	1/76-12/78 monthly by NRD, pooled cross-section (CS), time series (TS)	Log-linear by OLS

Table 1 (Continued)

Study	Service	Dependent Variables	Explanatory Variables	Date	Estimation
Huck & Allen (1978)	DoD, All Services	Total HSDG, I-IIIA, white HSDG I-IIIA, nonwhite HSDG I-IIIA contracts	Civilian mfg pay, UNR, recruiters, QMAs (17-21 male HSDG I-IIIA, not in college)	CY 1975 by state	Log-linear, Cobb-Dougals by Gauss-Marquandt LS
Jehn & Shughart (1976)	Navy	(Total contracts, HSDG I-IIIA contracts)/17-21 male population	UNR, per capita income, % black, % urban, median years of education, % mfg workers, % net migration (1960-70), recruiters, male enlistment quota	CY 1973 and CY 1975 annually by NRD	Logit, log-interaction by OLS
Morey (1980)	Navy	Total HSDG, HSDG I-IIIA contracts, leads	RMC/civilian pay, UNR youth UNR, % urban, DEP, YATS propensity, recruiters, minority and overall recruiting $, advertising $, HS seniors, % black	1/1976-12/78 monthly by recruiting district	Linear, log-linear by OLS and TSLS
Morey & McCann (1980)	Navy	(Total contracts, HSDG contracts, leads)/labor force	(Unemployment population, leads, advertising $, recruiters, HS seniors, dependent variable (-1)/labor force	CY 1976/77 monthly by NRD, pooled CS-TS	Log-linear interaction by seemingly unrelated regression
Siegel & Borack (1981)	Navy	Total HSDG contracts/HSDG male population	Civilian/basic military pay, (UNR recruiters (weighted), HSDG accession goal)/HSDG male population, YATS employment prospects, YATS propensity	FY 1977-79 annually by NRD, pooled CS-Ts	Log-linear interaction by seemingly unrelated regression
Van Doren (1981)	Navy	(Total HSDG, HSDG I-II contracts)/17-21 male population	18-year-old male earnings/RMC, UNR, 17-21 male population, recruiters/17-21 male population	FY 1976-80 annually	Linear, log-linear, logistics by OLS

Table 2

Summary of Econometric Variables

Variable Category	Examples
External Economic	Civilian earnings Unemployment rate Employment prospects Youth job programs Per capita income
Demographic	Percent black Percent nonwhite Percent urban High school seniors College enrollments Percent military residents Median years of education Net migration
Military Compensation	Regular military compensation Recruiting and promotion expenditure National, local advertising expenditure Other DoD recruiters
Recruitment Effort	Number of recruiters (weighted) Recruiting and promotion expenditure National, local advertising expenditure Other DoD recruiters
Goals (Demand)	Direct shipment goal Contract goal HSDG accession goal Size of delayed entry pool (DEP)
Other (Non-AVF)	Number of inductions

functions for all selected reserve components. These models have used variables such as wages on the primary job, reserve wages, population, age of enlistees, regional indicators of unemployment, primary hours, and urban/rural location. These three studies arrived at very different conclusions regarding the relative effectiveness of the determinants of supply, particulary the effectiveness of reserve pay. A good discussion of the limitations, weakness, deficiencies, and inconsistencies of these efforts is found in McNaught's (July 1981) work on reserve supply.

Building on previous studies, McNaught (July 1981) formulated the following model of reserve supply for the selected reserve forces:

$$R = f(W, C, S, H, U, P, I, T, X),$$

where

R is reserve participation,
W is the reserve wage,
C is the civilian primary wage,
S is the civilian secondary wage,
H is hours worked on the primary job,
U is the unemployment rate,
P is the population of eligible enlistees,
I is the available information about reserve enlistment opportunities,
T is the travel cost, and
X is a set of regional dummies.

However, McNaught's estimates of the model are of limited usefulness. He used 51 observations, one for each state, no measures of information about reserve opportunities, no measure of travel cost, and no measure of goal. Two specifications of a NPS model were utilized: one included the ambiguous measure of percent reservists in a state's population as a measure of recruiter effort, the other contained no measure of recruiter effort.

McNaught's study did not yield good estimates of reserve supply. As

indicated in his report, the results of the analysis were too weak to be useful for policymaking. McNaught's study was hampered by four serious problems. The first problem was the level of aggregation used. McNaught used state-level data in a one period cross-sectional model. As he indicated in his conclusion, future reserve models should be disaggregated below the state level, and are best conducted at the level of individual reserve units. The second serious problem was the lack of measures capturing interest in the military. No survey data, for example, were utilized to develop measures of market potential based on interest. The third major problem was the absence of any variables capturing the interaction between the various reserve components and/or active duty personnel systems. That is, no measures of competition were used in the accession model. Finally, no meaningful method of accounting was used to include the effects of demand (goals) on accessions.

In summary, previous efforts to model reserve supply have yielded inconsistent results, which have not been useful for guiding reserve policy. In particular, the responsiveness of accessions to pay variables, both civilian and military, have been found to be near zero. Several improvements are necessary in order to develop useful reserve supply models:

a. Reserve goals must be integrated into the model;

b. Improved measures of the military eligible population must be developed;

c. Improved measures of recruitment effort must be developed;

d. Measures of intra- and inter-service competition for reservists must be developed and incorporated into the models;

e. Data must be disaggregated to the recruiting district, reserve center, or unit level;

f. Reserve propensity/attitudinal measures must be incorporated; and

g. The active regular versus reserve decision process must be modeled.

III. Economic Analysis of Reserve Participation

The underlying theoretical framework for analyzing the reserve participation decision--as distinct from the decision to join the regular components--must be based on economic models of individual choice to work part-time and to hold a second job. We first focus on modeling part-time labor force participation.

A. Analysis of part-time work

Since 1954 the number of voluntary part-time workers in the labor force has tripled. In May 1977, 22 percent of all nonagricultural employees were working part time, which compares to only 15 percent in May 1954 (Deutermann and Brown, 1978). Although part-time work is becoming increasingly common, little attention has been paid to this phenomenom. While part-time workers come from virtually every segment of the workforce, the literature tends to focus on part-time work by married women. This stream of research finds major differences between wives who work part-time and wives who work full time. Wives working part-week tend to have either lower market earnings potential, higher income spouses, more schooling, or more and younger children than their full-week counterparts.

One major implication of models of part-time work for the reserves is that husbands and wives do not make labor supply decisions in isolation. Changes in part-time labor market conditions can affect a spouse's choice of a full-time job. Suppose that a husband works full-time and his wife works part-time. If conditions in the secondary labor market improve, e.g., higher wages or more available hours, then joint maximization by the couple implies that the husband may choose a job with a lower probability of overtime. This logic is particularly important for military reserve labor markets, since

changes in the wife's employment situation may affect both the husband's primary job and his secondary reserve job.

Military reserve labor markets are particularly sensitive to changes in a spouse's job situation, because a large percentage of reservists are between the ages of 18 and 35, the period when families are formed. Family formation is associated with intermittent labor force participation by wives. Joint maximization by the couple implies that the decision to enlist (or reenlist) in the military reserve is influenced by the wife's current and expected employment status. The above analysis also applies to women who are potential enlistees. In 1982, women comprised 9.8 percent of total reserve personnel and 17.5 percent of non-prior service accessions (Brinkerhoff & Grissmer, 1984). Under present regulations, women (even those with children) may enlist in the reserves or National Guard only if: (a) their husbands have not also enlisted and, (b) they sign an agreement indicating that, if activated, they will enter active duty irrespective of their family situation. Since the primary responsibility for child care rests with wives, we assume it is unlikely for married women with children under 6 to participate in the reserves. To understand adequately the reservist's decision to enlist or reenlist, it is therefore critical to consider primary and secondary employment opportunities for both husband and wife.

B. Analysis of Multiple Job Holding

Multiple job holding is not a rare phenomenon in the United States. In May 1980 approximately 4.8 million persons held more than one job; of this group, 3.2 million persons chose to work more than 40 hours per week. The proportion of employed men who are multiple job holders dropped from 7 percent in 1970 to 5.8 percent in 1980, while the multiple jobholding rate for

employed women jumped from 2.2 percent in 1970 to 3.8 percent in 1980. In the same period, the overall multiple job holding rate dropped from 5.2 percent to 4.9 percent. The average workweek for multiple job holders was 51 hours. Married men were more likely than single men to extend their workweek. For both men and women, multiple job holding rates peak between the ages of 25 and 44. These demographic notes are important, since they highlight a declining propensity, at least for men, to take multiple jobs. Since the military reserves are staffed predominantly by males, these demographic trends raise the possibility that the reserves may be confronted with manpower shortages in future years.

The economic theory of moonlighting can be developed with the aid of the standard work-leisure choice model (see Shisko and Rostker, 1976). Figure 1 depicts an individual's set of equal-utility indifference curves (I_0, I_1,...) and wage lines (W_0, W_1,...). The slopes of the indifference curves depend on the individual's relative preferences for leisure and income, while the slopes of the wage lines depend on the individual's wage rate in market work. In the case shown, the worker maximizes utility at point E_1 where the wage line is tangent to the highest indifference curve, I_1. At this equilibrium point the worker desires to work 55 hours (per week, say). But suppose that his primary job offers only 40 hours. The individual will then be in a less preferred position along indifference curve I_0. This worker is said to be "underemployed" on his current job.

The worker's minimum (or reservation) wage necessary to induce him to moonlight is W_1, which is derived from the slope of I_0 at point E_0. As long as the moonlighting wage exceeds W_1, the probability that the individual will accept a second job is positive. While the <u>probability</u> is positively correlated with the secondary job wage, the number of <u>moonlighting hours</u>

worked may decline as the second job wage increases due to an income effect. However, the worker would be unlikely to quit his second job altogether as the second job wage increases, since this would return him to his previous inferior position at E_o. While previous studies have concentrated on explaining the magnitude of hours worked on the second job, the focus in this study is on the <u>likelihood</u> that an individual will accept or keep a second job.

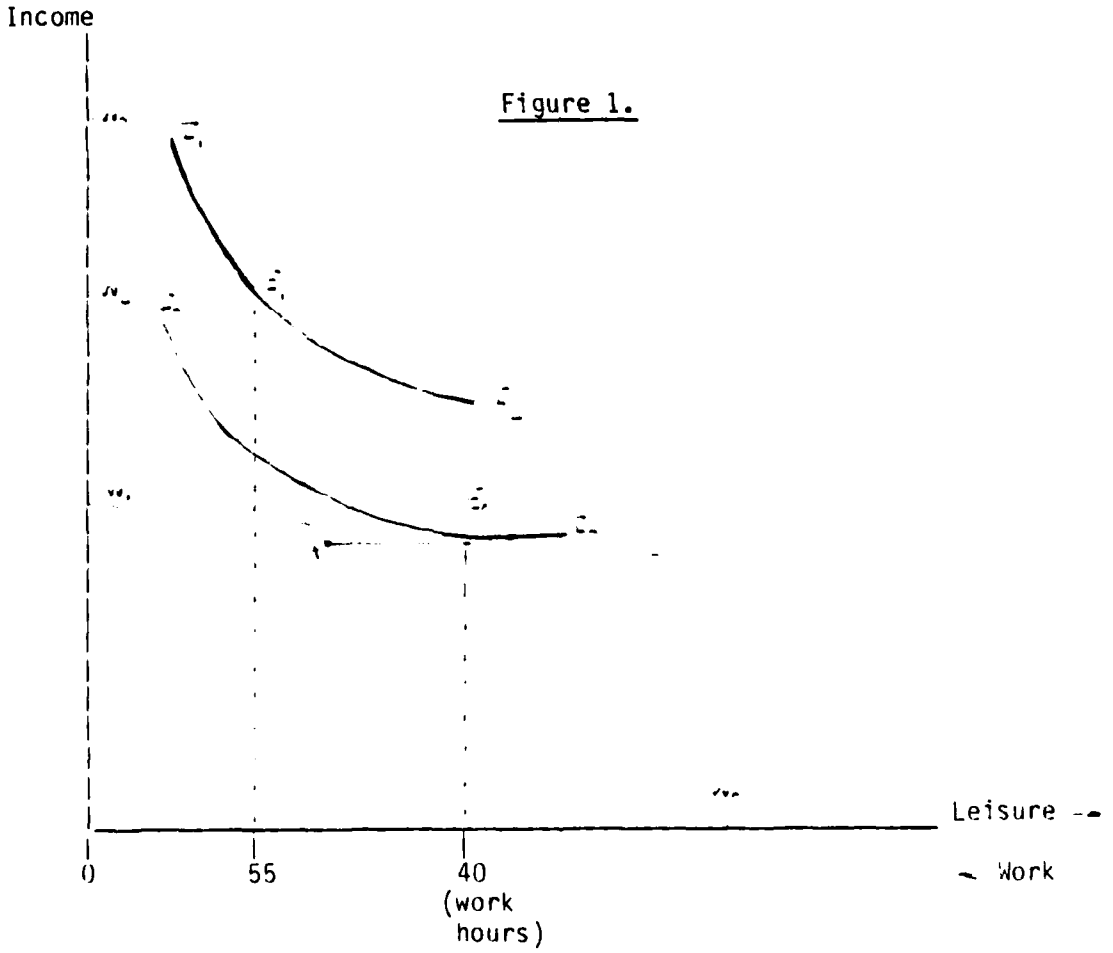

Figure 1.

In practice, the moolighting reservation wage must exceed W_1 due to the additional job-related costs of a second job. For example, one major additional job-related cost is the transportation cost. The effect of these job-related costs is shown in Figure 1 by a parallel shift of wage line W_0 to W_2. This shift, equal to horizontal distance E_0 A, indicates that the additional job-related costs are fixed, once the second job has been taken. The new reservation wage line becomes E_0 A W_2, which exceeds the old reservation wage, W_1. Thus, commuting costs on the second job tend to increase the moonlighting reservation wage and reduce the probability that an individual chooses to moonlight.

Transportation cost is important not only in theory but also in practice. Travel distance to a reserve center has been identified in several surveys of U.S. Army reservists as an important factor affecting reserve participation. USAREC studies indicate that approximately 85 percent of USAR members live within 35 miles of their reserve center. Thus, distance and transportation cost will be an important factor that must be accounted for when examining reserve market potential.

The moonlighting model also identifies the following factors that can influence the moonlighting decision: (1) hours worked on the primary job; (2) the primary wage; (3) the secondary wage; and (4) nonlabor income. Under most circumstances, an increase in the first factor, work hours on the primary job, will reduce the probability of moonlighting.

The separate effects of changes in the primary job wage and changes in the secondary job wage on the moonlighting decision is more difficult to predict. In theory, an increase in the primary wage can result in either an increase or a decrease in the minimum acceptable second-job wage rate. This result can be narrowed, however, if we assume that an individual is able to work as many hours

as he desires on his primary job. In this case, the wage must rise to induce this individual to work an extra hour. Thus, as the primary wage increases, the individual's reservation wage for accepting a second job increases so that the probability of moonlighting tends to decline.

Changes in secondary wages are subject to different qualifications. In general, increases in secondary wages could result in an increase or a decrease in secondary hours worked. When the secondary wage is greater than the primary wage, an increase in the secondary wage generates the usual set of income and substitution effects. The existence of an hours constraint on the primary job will alter this analysis. Second jobs may be accepted when the secondary wage is less than the primary wage. As the secondary wage increases and approaches the primary wage, the individual will unambiguously choose to work more moonlighting hours (Shisko & Rostker, 1976).

This result must be modified when applied to the military reserves, because the reserve employment contract is an all-or-nothing contract. At the reserve wage all reservists work a fixed number of hours. Individuals who are considering enlisting in the reserves may work more or less hours than they desire, given the reserve wage. As a result some individuals who are able to find a civilian secondary job that offers the reserve wage, but with flexible hours, will take the civilian job rather than enlist in the reserves. If, however, the reserve wage increases, individuals already in the reserve have no incentive to switch jobs, but would like to adjust their hours; since reserve hours are fixed, however, adjustments in hours are impossible. Because of the all-or-nothing nature of reserve labor contracts, these individuals will be off their labor supply schedules; the increase in the reserve wage improves their lot, even though the inability to adjust hours acts as a binding constraint. Since an increase in reserve wages attracts additional enlistees, we can conclude

that an increase in the reserve wage raises the number of individuals desiring to supply labor as well as the total number of hours supplied.

Another important variable is nonlabor income. Assuming that leisure is a normal good, when nonlabor income increases, an income effect results in an individual supplying fewer hours to the labor market. This result also depends on an individual's being able to work a desired number of hours given the primary and secondary wage rates. If the individual's desired hours are greater than his actual hours, then hours of work probably will not be adjusted downward. When desired hours are equal to actual hours, however, the nonlabor income increase could cause the individual to reduce his hours. But if the individual is working more hours than he desires, then even a small increase in nonlabor income could substantially reduce the individual's probability of enlisting or reenlisting in the reserves. Due to the all-or-nothing nature of the reserve labor contract, it is likely that some individuals in this market are constrained by the reserve's fixed workhours. Estimated nonlabor income elasticities will, therefore, be a weighted combination of the elasticities of the two constrained groups plus the one unconstrained group.

Shishko and Rostker (1976) also include family size in their regression specifications claiming that it serves as a proxy for family consumption. Age is also included as a demographic control variable. They find that family size is positively related to moonlighting hours, and conclude that both family size and age are proxies for "unmet family needs." As spouses' ages increase, their additional experience translates into additional productivity and higher wages. Since a larger percentage of the family's consumption goals can then be achieved from primary job income, moonlighting hours can be

reduced.

Family structure may also influence moonlighting behavior in other important ways. In our section on part-time work, we noted that two other variables may be important--the spouse's employment and the number of children under six. All other things equal, when a spouse enters the labor market, the potential reservist perceives a higher family income and an increase in his household productivity. Consequently, he is less likely to take a second job.

Since young children require more care than older children, the number of children under age six may also be an important variable. If both parents are working, young children may place considerable constraints on moonlighting hours. While young children could affect the decision to enlist or reenlist in the reserves, the effect could be either negative or positive. If young children lead to further specialization in the marriage, female reservists will be less likely to enlist (or reenlist), while male reservists will be more likely to enlist (or reenlist). On the other hand, other families may decide to reduce moonlighting by both partners in order to spend more time with their children. Since the average moonlighting job in May 1980 extended the work week by 13 hours, these parents may decide to substitute into the military reserve, a secondary job which extends the workweek by only 4 hours (augmented by two weeks of summer duty). Potential enlistees who reduce their desired moonlighting hours from 4 hours to 2 hours per week will be <u>less</u> likely to enlist; potential enlistees who reduce their desired moonlighting hours from 13 hours to 4 hours per week will be <u>more</u> likely to enlist. Without more information on the composition of these two groups, the net effect cannot be predicted. While the net effect of young children cannot be determined by theory, it is potentially important and should be addressed in

and should be addressed in any empirical analysis.

Finally, the variables discussed above are not independent of each other. Neoclassical models of the labor market always relate the number of hours worked in the primary market to the primary wage and the secondary wage as long as the person is not hours-constrained on the primary job. Even if the person is hours-constrained, the choice of primary job may be affected by opportunities in the secondary labor market. For example, surely some prospective (and existing) elementary school teachers would choose another occupation if the wage rate available on summer vacation jobs fell substantially. Moreover, changes in the primary and secondary wage rates may not be independent. If the person invests in general skills, which raise his productivity on both primary and secondary jobs, then changes in primary and secondary wages will be positively correlated. On the other hand, if the individual invests in skills which are specific to the secondary sector, then changes in secondary and primary wages will be uncorrelated. If the investment in secondary skill comes at the expense of maintaining primary skills, then changes in primary and secondary wages will be negatively correlated. This analysis suggests that empirical estimates of the secondary labor market must be interpreted carefully, since many of the determinants of second job participation are simultaneously determined.

IV. Estimating Market Potential of a Local Market Area

How does moonlighting theory assist us in understanding local reserve labor markets? First of all, if data were available on the economic and labor force characteristics of individuals comprising a given reserve recruiting area (county, zipcode, or recruiting district, for example), that area's reserve manpower potential could be calculated. The potential could be measured either as counts of individuals who are "underemployed" and, therefore, likely candidates for second job holding, or in terms of the area's overall probability for second job holding ("high," "average," "low," "poor").

A second approach would be to employ data on the average values for the same characteristics to determine an area's reserve potential on average. Note that in both cases these values should be weighted by some measure of attitudes toward the military. Knowledge of economic and demographic correlates of civilian moonlighting is only a first step toward estimating military reserve manpower supply. While economic factors derived from the moonlighting model might predict a high level of civilian underemployment in a given local area, this may or may not translate into high reserve market potential, since those interested in civilian moonlighting may not share a similar interest in the military. Only some fraction of the civilian underemployment count in an area will be candidates for the reserves.

Where will the necessary data be obtained? One important source of data are the various surveys that have been conducted of reservists. From these surveys we can obtain an economic and demographic profile of current members, including their age, civilian occupation, civilian wage, education, marital status, family size, and travel distance to the reserve center. Currently available reserve surveys include: (a) the 1979 Rand Reserve Force Survey;

(b) the 1980-81 survey by USAREC (Klopp, Sept. 1982); (c) the Reserve Component Attitude Study (RCAS) conducted annually from 1978 to 1982; (d) Reserve Personnel Files; (e) National Longitudinal Survey of Labor Force Behavior (NLS); and (f) Youth Attitude Tracking Study (YATS). The RCAS profiles reserve enlistment propensities for both NPS and PS and for both males and females. To obtain a propensity measure for a specific market, responses from two different years can be pooled. DMDC's current reserve data files can also be used to construct a profile of first term enlistees and their individual characteristics.

Another data source is the National Longitudinal Survey of Youth Labor Market Experience (NLS), which sampled 12,686 young men and women (ages 14-21) in 1979. The NLS oversampled persons in the military, including those in the Reserves and Guard. Follow-up surveys were conducted in 1980, 1981, 1982, and 1983. The NLS also includes some area-specific variables taken from the City and County Data Book. These data should be useful in aligning reserve activities with local labor market characteristics and in estimating NPS market potential. The Youth Attitude Tracking Study (YATS) is another source of information on military attitudes and enlistment propensities of individuals in the age groups that constitute the primary source of NPS supply. The 1984 YATS includes male and female reserve propensities.

A. Estimating Civilian Labor Market Characteristics

The second method of determining market potential is to examine civilian multiple job holding and part-time job patterns in a local labor market. This can be done by analyzing variations in this type of work participation across local labor markets. Reserve participation can then be correlated with local labor market characteristics observed to influence multiple job holding.

Since the reserves must recruit and fill units in individual market areas, the latter method will assist in predicting accession rates and "unit success" rates at various locations.

The first step in estimating reserve market potential within a specific labor market is to estimate the market potential for part-time employment and multiple job holding. Such estimates will provide a measure of current civilian "underemployment" in a given market area.

An equation to estimate multiple jobholding can be specified as follows:

$$M = f(WP, WS, HP, D, X) \qquad [1]$$

where

M = measure of extent of moonlighting
WP = wage in primary employment
WS = wage in secondary employment
HP = hours in primary employment
D = distance to primary job
X = vector of individual characteristics (e.g., sex, age, race, marital status, etc.)

The dependent variable can be measured in one of two ways: (a) the number of hours the respondent worked in the secondary job; or (b) a qualitative variable which equals 1 if the individual holds a second job, and equals zero otherwise. The latter method is preferred since the purpose will be to estimate the overall moonlighting potential of a given area, not the actual number of hours offered by individuals to the market. Using the qualitative choice variable would mean that the moonlighting supply equation would be estimated by the logit or probit technique. The coefficient of each independent variable would indicate the impact of that factor on the probability that the individual chooses to moonlight.

The previous literature on moonlighting (cited above in Section III) has analyzed the effect of numerous economic variables on the number of hours worked in the secondary job by individuals, not on the probability of moonlighting. Variables that have been used include: the wages and hours worked on the primary job, the wages in the secondary job, and non-labor income. Prior studies have relied on the usual work-leisure choice framework and on the assumption that hours worked can be varied continuously. One reason a worker may choose to moonlight, however, is the presence of an upper-bound constraint on the number of hours available on the primary job. Similarly, there is no reason to expect that the hours available on the secondary job will be any more or less likely to be continuously variable than hours on the primary job. That is, the number of hours available on the second job also may be constrained. Hence, analyses that focus on the hours worked on the second job may be analyzing a choice variable in a constrained region. If so, the estimated effect of the explanatory variables will be understated when compared to situations where hours worked are, in fact, continuously variable.

Second, moonlighting hours worked may not be spread evenly throughout a given time period, say a year, as implicitly assumed in prior studies. Instead, the opportunity to moonlight may be constrained by seasonal fluctuations in hours available and employment on the primary job. Thus, the opportunity to moonlight may occur either regularly or irregularly, but on a seasonal rather than a continuous basis. Work situations where this is likely to be true are seasonal industries, such as construction and farming, and seasonal occupations, such as teaching. In these cases, too, secondary work hours are constrained by the time available in the non-primary work period.

These considerations suggest that estimating moonlighting work hours may

conceal the true nature of the moonlighting decision--whether to moonlight or not--which will be affected by the hours available as well as the usual variables described in prior studies. When the moonlighting decision is analyzed as an all-or-nothing choice, worker's industry and occupation, as well as the usual factors, will be important determinants of moonlighting.

These considerations also suggest that another useful empirical technique will be to estimate the determinants of various categories of job choice. For example, some moonlighters hold a full-time primary job, while others work only part-time on their primary job. That is, some so-called "moonlighters" are simply people holding two part-time jobs. This distinction may be important from the standpoint of estimating reserve manpower supply, since the characteristics of moonlighters who hold a part-time primary job may differ significantly from those who hold full-time primary jobs. Two important factors explaining differences between these two groups will be occupation and industry.

From an empirical standpoint this approach generates three classifications to be explained rather than merely two: (a) moonlighters with full-time primary jobs; (b) moonlighters with full-time primary jobs; and (c) non-moonlighters. Empirically, the technique used to analyze multiple job choice by individuals is the multinomial logit technique. This procedure analyzes the determinants of why people fall into the three categories, and predicts the probability that any individual will fall in a given category, holding constant other personal and labor force characteristics (Maddala, 1984).

A final consideration is that the decision to moonlight is as likely to be a joint family supply decision as an individual decision. Factors affecting family income, such as changes in the spouse's wage rate or hours worked, may also affect the decision by the family head to moonlight. Thus, the

specification of the moonlighting estimating equation must include factors reflecting family size and marital status as well as industrial and occupational status.

Data on civilian moonlighting are available from at least two sources. One source is the Panel Study of Income Dynamics (PSID) survey conducted by the University of Michigan. This is an annual survey of approximately 5,000 families (18,000 individuals) which has been conducted since 1968. The survey asks questions concerning the hours worked on the respondent's primary and secondary job, along with numerous other questions on labor force status, socioeconomic characteristics of the family, and distance and travel time to work.

The moonlighting logit equation would be estimated using individual observations aggregated by geographical units. Because the PSID data are drawn from a nationwide sample, the number of observations in a given county may not be sufficient to estimate each county's moonlighting potential. However, the analysis will identify those factors that affect part-time job choice, and can be used to estimate the number of individuals in a county or market area likely to be in the secondary market. These individuals can be considered "underemployed" on their primary jobs. Clearly, the most successful reserve recruiting areas will be those that share the same characteristics--socioeconomic, demographic, and attitudinal--with labor markets generating numerous multiple jobholders (i.e., labor markets where "underemployment" levels are high).

A second, and perhaps better, source of multiple jobholding data is the May survey of the Current Population Surveys conducted by the Census Bureau. The CPS includes about 57,000 households and provides detailed information on personal characterisitics of the population as well as hourly wage rates,

primary job hours, veteran status, and multiple jobholding. A sufficient number of observations are available for a certain number of SMSAs. This data source may not yield enough observations by county, at least for the smaller counties, to identify each county's moonlighting supply potential. However, a sufficient number of observations for counties can be obtained by pooling the observations from the survey in several consecutive years.

B. Econometric Estimation of NPS Market Potential/Supply

To estimate market potential the theories of part-time employment and multiple jobholding must be integrated into a logical framework. For example, a manpower supply model similar to the following could be specified:

$$A_i/MA_i = A(WC_j^{-}, WM_s^{+}, H_j^{-}, O_j, U_j^{+}, C_i^{-}, P_i^{+}, R_i^{+}, D_i, L_i^{+}, G^{+}) \quad [2]$$

where

A_i = high quality NPS reserve accessions in market area i

MA_i = high quality military available population in market area i

WC_j = full-time civilian wage in labor market j, in which market area i is located

WM_s = relative military compensation for reservists state s

H_j = average full-time weekly hours worked in labor market j

O_j = occupational/industrial employment distribution in labor market j

U_j = unemployment rate in labor market j

C_i = interservice competition in i

R_i = recruiter resources in i

P_i = military propensity in i

D_i = geographic characteristics of market i (e.g., distance, range, gradient, travel cost)

L_i = cost of living, especially housing, in area i

G = recruiting goals

The expected signs of the relationships are indicated above each variable, where these can be predicted in advance on the basis of theory or prior research. The data necessary to estimate this model are listed in Table 3, along with some potential data sources.

This model will yield forecasts of market potential for any specific market area, including those in which no reserve center currently exists. The estimated NPS market potential can be compared with the current level of authorizations to determine whether the area is one of excess market potential. If excess potential exists, then the area could probably absorb additional authorizations or support; if not, the market is probably saturated.

It will also be possible to examine "fill rates" for similar reserve units. An estimating equation similar to equation [3] could be developed to explain reserve unit "success," where success is defined as fill rates exceeding some predetermined percent, such as 95 percent. Units exceeding this level would be classified as successful and assigned a value of unity, while those below 95 percent fill would be classified as unsuccessful and assigned a value of zero. The same set of explanatory variables as in equation [3] can then be used and the equation estimated with the logit technique. This technique estimates the probability that a unit will be successful (i.e., achieve a specified fill rate) based on the economic and demographic characteristics of the market. Market potential can be estimated separately for several broad types of reserve units (medical, engineering, transportation, armor, etc.).

Table 3

Data Available to Estimate Local Area Market Supply

VARIABLE	UNIT OF OBSERVATION	DATA SOURCE
A: Accessions	-Zipcode; Market area -Reserve Center -Rctg BDE	-Army Data
WC: Civilian Wages and H: Civilian Hours	-Counties (all)-to date -Counties (350)-1980 only -SMSAs (71)-1980 only -SMSAs (71)-to date	-Census Bureau, "County Business Patterns" -Census, "Public Use Microdata Sample" -BLS, "Area Wage Surveys"
O: Occupation/ Industl. Distribution	-Zipcode-1980 only	-1980 Census, Summary Tape Files (SFT 1-4)
U: Unemployment rate	-Counties-to date	-BLS, "Unemployment in States & Local Areas"
C: Interservice Competition	-Market Areas	-Army Data -DMDC data files
P: Mil. Propensity	-Nationwide -Regions	-YATS -RCAS -NLS Youth Cohort -Reserve Surveys
D: Geographic Characs. of Market	-Market areas	-Army Data -1980 "Public Use Microdata Sample"
R: Recruiter Resources	-Market areas	-Army Data
L: Cost of Living	-Cities/SMSAs	-BLS, "Family Budgets"

C. Assessing the Importance of Civilian Occupational Mix

Another complementary approach for analyzing market potential would involve matching the skill requirements with the type of planned or existing reserve units in a given local market area. Reserve units with certain occupational specialties should be matched with areas in which the civilian occupational distribution would support those specialties. Conversely, a reserve unit with certain specialties should not be located in areas with a small pool of civilians in that specialty since the chances of success of that unit may be lessened.

The first approach would determine whether a reserve unit's "success" (ability to maintain high fill rates) is correlated with the occupational mix in a local area. While this is a researchable issue, it would seem that this correlation will, in general, differ across reserve units as well as across reserve components. For example, in the USAR the importance of occupational matching will tend to be greater for units with a disproportionate share of technical ratings, and lower for combat units. Similarly, since the Naval Reserve relies on a more skilled labor force, the importance of occupational matching will be greater for the USNR than for the USAR.

There are two techniques for estimating the relationship between the civilian occupational mix and reserve manpower supply. The first approach would be to regress unit success ("fill") rates on the civilian occupational distribution at the local market level. The second would be to regress accessions by military occupational specialty against civilian occupational codes by area. The latter equation could be estimated at a more aggregated level since the only purpose would be to establish whether a relationship

exists between civilian occupation and reserve manpower supply potential.

Once the importance of civilian occupations has been established, a technique for utilizing the information might be simply to count the number of individuals in a given local market area in the specific civilian occupation. The numbers would have to be adjusted, however, for several factors: (a) military propensity; (b) age; (c) competition from other reserve components; and (d) propensity to moonlight or work part time.

It bears repeating that the first step is to determine whether, in fact, occupational distribution is important for assessing manpower potential at the local level. The reserves are similar in some ways to the active components in relying to some extent on recent male high school graduates and younger workers who may not yet have established a clear-cut occupational designation. Furthermore, it should be established to what extent the reserves rely on training to fill an MOS and to what extent they rely on recruiting civilians who are already trained. The entire issue may be more important for older, and possibly prior service individuals, than for younger, NPS recruits. We now turn our attention to a consideration of PS market potential.

V. Estimating Prior Service Market Potential/Supply

Because about one-half of reserve accessions have prior service, it will be important to also develop a model that estimates potential PS accessions for local market areas. This source of supply clearly affects unit success and recruiter allocation. The PS model can be based on a count of the number of prior service individuals who live in a given area and have left active service within a specified number of years. This measure should include only those individuals who are not currently serving in the reserves and who were eligible for re-enlistment. Second, many of the variables discussed in relation to estimating NPS market potential can be utilized to estimate local area PS market potential. These results can be used to estimate the average number of PS personnel in a market area necessary to support a given unit or reserve center authorization.

This estimation of PS market potential will require data on the current residence of recent veterans to obtain an estimate of the stock of veterans in a given location. These data are available from DMDC. The number of veterans can be aggregated by member zipcode to obtain a count of veterans for a reserve market area. More important is an examination of the Veterans Attitude Tracking Study-Wave I, 1983 and the 1984 YATS survey. These surveys identify the propensity of veterans to enlist in the reserve components, and each respondent's zipcode is included in the file. This file will provide a measure of the propensity of veterans to enlist in the reserves for an area, which affects the market potential and unit success probabilities in that area.

IV. Summary

This report has assessed the feasibility of modeling reserve manpower availability at the local market level. Alternative approaches and empirical techniques for evaluating reserve manpower supply at the local market level have been presented. If the factors affecting supply can be identified, empirical techniques can be developed to build models that forecast future supply and predict success rates for maintaining fully staffed units at alternative locations. These models should assist manpower planners in determining the optimum location of reserve units and in establishing reserve recruiter zones and recruiting goals for each zone.

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