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OF MILITARY MANPOWER

BY CHARLES C. HOLT AND RICHARD S. TOIKKA

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2100 M Street, N.W.  
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  This annual summary report describes the work of the Urban Institute in developing a simulation capability for predicting the impact of economic and demographic factors on the Navy's recruiting success. Some of the work was carried out jointly with researchers from Wharton Econometric Forecasting Association.		

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## I. OVERVIEW

The first year of work attempted to pull together three strands of research that previously had been studied in isolation at different institutions: military recruitment, disaggregated labor market dynamics, and macroeconomic stability. The Urban Institute supplied its demographic labor market model which includes young men; the Wharton Economic Forecasting Association (WEFA) group supplied its macroeconomic model; the Urban Institute picked up and elaborated previous research on recruitment functions; and the WEFA group developed a new labor market model. This report is on the Urban Institute's part of this joint effort.

The Institute's labor market model of some 180 odd econometric equations was extended to incorporate the prediction of job vacancies, a very important variable, the study of which has been seriously neglected because of data problems. The model was reestimated with more recent data and some resulting problems addressed.

The dynamic interaction of two econometric models of quite different structures raised problems that were solved of non-matching variables at the interface, different time periods, and partial overlap of structure--the macroeconomic model already contained a rudimentary labor market sector.

The recruiting relations which ultimately will tie into the labor market model, concentrate on examining how the level of youth unemployment and the size of the recruitment quota will affect the quality of the recruits as measured by test scores.

The year has been one of base building. The macro and the labor market are interfaced so that the impact of monetary and fiscal policy and of world shocks on the economy and on the labor market can be studied. The work on

recruitment has indicated the need for better data and further analysis before tying the whole system together.

Although the RASST and WEFA models were designed with other problems in mind, using other sources of support, we have found that they could be successfully merged. However, the recruitment relations are relatively undeveloped and various extensions of the original model are needed to improve their relevance to the recruiting issues.



## II. TESTING AND FURTHER DEVELOPMENT OF RASST

In order to interface the Urban Institute monthly labor market model (RASST) with the Wharton quarterly model, it was necessary to add an equation which made job vacancies endogenous (i.e., determined within the model). In the original version of RASST (for a description see Ralph E. Smith, "A Simulation Model of the Demographic Composition of Employment, Unemployment, and Labor Force Participation," in R. G. Ehrenberg, ed., Research in Labor Economics, Vol. I, JAI Press, 1977), the total number of jobs (employment plus job vacancies) was an exogenous (i.e., determined outside the model) variable. A vacancy determination equation was added to the RASST model so that job vacancies were determined by monthly Gross National Product and unfilled orders.<sup>1</sup> This extension of the RASST model is described in Section 2 of Richard S. Toikka, William J. Scanlon, and Charles C. Holt, "Extensions of a Model of the Demographic Labor Market," in R. G. Ehrenberg, ed., Research in Labor Economics, Vol. 1, JAI Press, 1977.

In addition to modifying the model to include a vacancy determination equation, the model was also reestimated using recent data through December, 1975. In the testing of the reestimated model, dynamic instability appeared on certain tests where it had not appeared in the tests of the earlier version. It was discovered that one possible source of the instability was the lack of an upper bound on the predicted values of the transition probabilities in the RASST model. When the aggregate unemployment rate was very low, some of the predicted transition probabilities exceeded unity. We are still not certain that this is the source of the instability problem and are performing further tests.

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1. These are variables which the Wharton model will supply.

### III. INTERFACING THE LABOR MARKET AND MACROECONOMIC MODELS

The merging of the Urban Institute's RASST model with the Wharton's WEFA model involved four distinct steps.

First, the RASST labor market model which can be related to Navy recruitment functions emphasizes monthly turnover dynamics of people flowing into and out of the labor force, unemployment, and jobs. However, most macroeconomic variables are sufficiently sluggish that a quarterly time period suffices for the WEFA model. Hence, when the two models interact, it is necessary to interpolate quarterly data to obtain monthly observations and aggregate monthly data into quarters. The interpolation method chosen utilizes an implicit polynomial, but since the system is linear with respect to the data points, a simple weighted average calculation is easily performed.

Second, the labor market model originally was driven by the vacancies which in turn were obtained from the total number of jobs and the employment level; neither variable was found in the WEFA model. It was necessary to develop a relation for predicting labor market vacancies from the level of production and the backlog of unfilled orders. Not only did the vacancy relation which was discussed above meet the technical need, but by connecting the two sets of variables it also avoided treating an unfilled vacancy as exactly parallel to a job that was filled.

The third step implements the interactions between the two models either by running WEFA for a number of periods and then letting its time path drive the labor market model, or alternatively, deleting the labor sector from WEFA, substituting RASST, and solving both models iteratively. Providing for interactions between the models raised the issues of how their dynamics would mesh and also how to deal with the fact that the model structures partially overlapped--two different views of the labor market were involved.

The fourth step involves testing the merged system to see how well it works and which of the two form of interactions yields the most accurate predictions of historical data.

The first three steps are complete and the fourth is currently being carried out by WEFA.

#### IV. RESEARCH ON RECRUIT QUALITY

During the first year of its contract with ONR, The Urban Institute has been investigating the effect of military pay and job opportunities in the civilian labor market on the number and quality of navy recruits. The qualitative dimension of the supply of enlistees is being stressed in this research. Recruit quality is important in a number of ways to the Navy. The type of recruit selected affects not only performance in the service, but also the attrition rate. Recent research has indicated that education level and test scores are negatively correlated with the likelihood of a new recruit leaving the service prior to completion of his first term. This kind of attrition may be a less efficient way of identifying suitable young men for Naval service than setting recruitment standards high initially.

However, while it is desirable for the Navy to set high standards in recruiting, the supply of high quality recruits is limited. The research under way at the Urban Institute is directed at determining precisely what is the available supply of recruits in various test score categories.

It is fairly well established that there is a relation between job opportunities in the civilian economy and the number of young men who wish to enlist in the service. When job opportunities fall off as in the recent recession, the number of applicants for military service increases. This increase in number of potential recruits allows the military services to be more selective in recruiting.

Past research on enlistment supply usually has focused on clarifying the relation between the number of applicants for military service and hypothesized determinants such as military and civilian pay levels, civilian



unemployment, and draft pressure. For example, see Fechter (1970), Kim et al. (1971), Fisher (1969). However, the qualitative dimension of recruit supply is also important, but has received less attention in prior research. Presumably, if the Navy or any other service were willing to lower recruitment standards sufficiently, they would be able to meet recruitment quotas, at least in the short-run. There is evidence that recruitment standards do respond to changes in the supply of applicants and military recruitment quotas. However, this question has not been studied extensively in a framework which considers the effects of inter-service competition for recruits. One study of Air Force enlistments has focused on analyzing how average recruit quality responds to recruit supply and quotas (Cook and White, 1970), but by and large the quality dimension of recruit supply has been ignored in research on the other services. In some studies, the focus has been on the supply of high quality recruits, and the supply of lower quality recruits has been ignored.

Under the first year of the Urban Institute's ONR contract, exploratory research was carried out on the impact of military and civilian pay, and unemployment on the quality of Navy recruits. Toikka extended earlier work by Cook and White on the quality of Air Force volunteers to derive a relation between the distribution of recruits by quality and determinants of the supply of applicants (pay, unemployment, etc.) (Toikka, 1977). Preliminary data analysis using quarterly data on enlistees by AFQT test score indicates some empirical support for the hypothesis that recruit quality is directly correlated with the supply of applicants and negatively correlated with the Navy's demand for accessions.

However, there is a strong correlation in the quarterly data (1958-1975) between unemployment and draft inductions (prior to 1973) so that it



is difficult to separate the effects of these two variables. In addition, the standard errors of the coefficients on the other variables are large partly due to colinearity among the explanatory variables. For that reason, we feel that another data set is needed to establish the quantitative importance of the determinants of Navy enlistees. The data which seem most promising for this purpose are monthly data beginning in 1970 from which draft motivated enlistees have been removed. The number of enlistees with lottery numbers below a critical level was reduced by an estimate of draft motivated enlistments from the sample. This corrected series has been used in analyzing the supply of enlistments in a study prepared for the Defense Manpower Commission (Amey et al., 1970).

In the second year of our contract we will analyze this monthly series and test its sensitivity. The data are disaggregated by service, education, test score, and race (for the Army) and thus give a more complete picture of the quality of recruits than do the quarterly data disaggregated only by test score and service. We feel, in particular, that the inclusion of education as a variable is important in light of recent findings that high school graduates are less likely to attrite than high school dropouts (Lockman et al., 1975).

V. CONCLUSIONS AND FUTURE RESEARCH PLANS

→ The research under the first year's funding has been largely the development of simulation capabilities which, when completed, will allow *etc* us to make statements about the effect of economic and demographic factors on the Navy's recruiting situation. *The authors do not yet have* We have no strong conclusions yet regarding the determinants of recruit quality but expect to reach some in the second year of the contract.

In the next year of our contract we propose to do further research using monthly data on recruits by education, race, test score, and service. We will examine the effects of interservice competition on the distribution of recruits by quality. These recruit quality equations will be incorporated into the RASST model and simulations of Navy recruitment under various conditions will be carried out. A user of the system will be able to feed in assumptions about civilian unemployment, military and civilian pay, the presence or absence of a draft, the presence or absence of a war, total military accessions by service, and population of recruitment age population and get out the distribution of Navy recruits by education and test score. The model will have the capability to perform simulations under a variety of assumptions about economic conditions and military accession requirements. Projections of Navy recruits to 1985 under existing recruitment standards will be made. Then we will determine how recruitment standards would have to change to eliminate any shortfall. We will also discuss the trade-off between raising pay and lowering recruitment standards as competing methods of eliminating recruitment shortfalls.

→ The present version of the RASST model predicts several variables affecting the military age labor market. However, it does not include

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(cont. p. 9)  
money wages in the private economy. Since military recruiting, attrition and reenlistments are influenced by the relation between military and civilian wages, it would be an important improvement in terms of military recruitment simulations for the RASST model to add wages. A

Demographic wage data pose a problem since only annual observations are available from the CPS and by race only since 1967. However, the relative wages for demographic groups change slowly so monthly interpolations of annual wage changes can be used for exploratory analyses. BLS has unpublished tabulations of the CPS May survey of usual weekly earnings for highly disaggregated groups. These will be aggregated to the level needed for the RASST model.

Another data problem is the lack of any disaggregated demand variables such as demographic vacancies. The earlier version of the RASST model has successfully used aggregate vacancies with disaggregated labor supply variables.

The theory of wage determination in a segmented labor market has received little attention. Brechling did early research (Brechling, 1973) and Baily and Tobin recent research (Baily and Tobin, 1977) in this area. Previous research at the Urban Institute on wage changes in compartmentalized labor markets will serve as a relevant starting point. Demographic wage changes should be influenced by the structure of relative wages and by the ratio of vacancies to unemployment.

The allocation of the labor supply between employment, unemployment and out-of-the-labor-force is determined by the transition probabilities between those states. These transitions are influenced by availability as well as real and relative wages.

The work will proceed in two steps. First, we will estimate changes in the wages of the demographic groups as functions of labor market tightness and relative wages. This will add sixteen behavioral equations to the model. Second, we will test for wage effects in the transition probability functions of the military eligible populations. This may require reestimating some of the transition probability functions of the model.



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