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Working Paper Series

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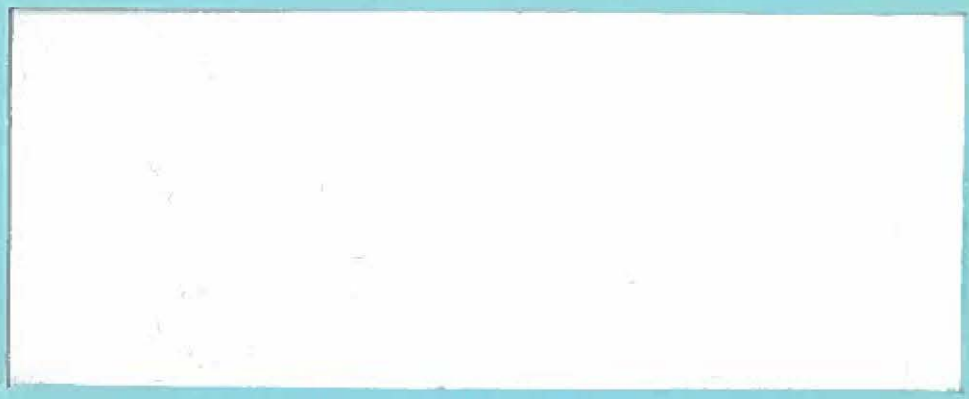

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BUDGET ALLOCATION AND ENLISTMENT PREDICTION MODELS OF RICHARD C. MOREY*: A BRIEF REVIEW

Dan C. Boger and Kneale T. Marshall**

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* Budget Allocation and Enlistment Prediction Models for the Navy's Recruiting Command; Richard C. Morey, Principal Investigator; May 1979 and October 1979; The center of Applied Business Research, Graduate School of Business, Duke University, Durham, N.C.

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The subject reports were prepared to summarize work performed for the Office of Naval Research and the Naval Recruiting Command under a contract to measure the impact of recruiters and advertising on new Navy enlistment contracts. The reports describe a model of recruiting efforts which may be used to predict the number of new contracts given particular levels of recruiting inputs, such as advertising, recruiters, etc., as well as to determine minimal budget requirements for a desired level of new contracts. The May report provides a description of the entire model and its components along with the results of fitting the model to a preliminary data set. The October report provides results of fitting the model to a more complete data set. The principal investigator of these reports, R. C. Morey, was contacted by the reviewers in an attempt to clarify parts of the reports. Several of the points discussed below were raised with Morey, who generally agreed with the reviewers' positions.

Briefly stated, the model is composed both of a three-equation system which relates various explanatory variables to enlistment contracts and a Koyck distributed lag system which is used to estimate the lagged effects of several of the explanatory variables. The model itself is apparently a very reasonable approach to the problem but the two reports are lacking in clarity. The reports are overly terse and do not describe the methods of fitting together the model components or the estimation techniques employed on the various model components. The most serious of these problems are discussed below.

On page 16 of the May report, the pooling technique utilized is valid only in certain restricted circumstances. The implicit assumption of this technique is that interdistrict differences occur only in the intercept term

of the estimated equation and not in any of the slope parameters. The sample utilized is certainly large enough so that this assumption could have been tested in several ways using Chow tests. On page 19 of the May report, the Koyck lag structure for advertising is presented. It should be noted that equation (3) is inconsistent with both equation (2) and the equation used in the model. Also, the Koyck estimation is not included. Conversations with the principal investigator revealed that the model was apparently consistent, properly specified and correctly estimated, but that the report was misleading.

In the October report on page 10, re-estimated values are reported for several of the model parameters. Unfortunately, new values have not been reported for the parameters designated as $p_{i,\ j,\ 2}$. This does not permit the model to be verified using some of the partial equilibrium results derived over the years by the Recruiting Command. All re-estimated values should be included in this report.

All predicted values in the final versions of the model were reported as point estimates. The principal investigator should use the estimated standard errors from previous stages of the model to compute confidence intervals for the predictions. This is especially important when using the model in the budget requirements mode. The overall value of the model to users will be greatly enhanced if the users know what budget level will enable them to meet enlistment goals with, say, a probability of .95, given the model's assumptions. The principal investigator has reported that such confidence intervals are currently being calculated.

On page 7 of the October report, the principal investigator states that predicted values for 1978 contracts were obtained through use of 1976 and 1977 data for advertising, recruiters and enlistments together with 1978

demographic data. In practice, such demographic data are available only after the fact, so that a true test of predictive ability of the model would require use of solely 1976 and 1977 data in order to predict 1978 contracts. After the reports were written, the principal investigator did use this approach to measure the predictive ability of the model. He obtained a prediction error for total contracts of only four percent. This is a much more reasonable error than .2 percent but it also indicates that the model may still be used to obtain high quality predictions, at least in the short term.

Any potential user should realize that the model has been estimated using a large cross section and a short time series of observations. Since the estimated parameter values of the model reflect only this short time series, it is highly probable that the true parameter values will change over time. Hence, the model should periodically be re-estimated as more time series data become available. In this way, the model may be continually adapted to potentially changing circumstances. Finally, the estimates produced by this model, as with all predictive models, must be utilized in conjunction with a keen knowledge of the actual processes being modelled and tempered with professional judgment.

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