Annals of Economic and Social Measurement, 2/3, 1973

NBER COMPUTER RESEARCH CENTER NOTES

The NBER Computer Research Center for Economics and Management Science has been engaged, since its formation in 1971, in developing new software systems for quantitative social science research. Prototype systems for exploratory data analysis, mathematical programming, and econometrics are now in various stages of design and implementation. Informal summaries of research in progress, as well as abstracts of specific Research Reports, are a regular feature in the Annals. Following are a progress report on one of the econometrics projects, estimation of equation systems, and abstracts of two recent Research Reports.

Estimation of Equation Systems (April 1971)

The initial focus of our work in estimation of equation systems is to design and program interrelated software modules that will enable a researcher to use and compare the more important estimation techniques, specifically simultaneous system estimators. The availability of such a facility is a prelude to experimentation with, and systematic comparison of, the estimators. Very little is now known about the small-sample properties of these estimators; the projected software modules will provide, for the first time, a means of amassing the experimental evidence required to compare the estimators properly.

The estimation techniques to be included are:

(1) Double k-class
   (a) Two stage least squares (2SLS)
   (b) Limited information maximum likelihood (LIML)
   (c) Unbiased to order K (UOK)
   (d) General double k-class ($k_1 k_2$)
(2) Three stage least squares (3SLS), including the Brundy-Jorgensen instrumental variable techniques

In each case estimators are being developed to handle both linear and nonlinear equations.

The basic modules for all the k-class and 3SLS estimators were originally designed based on a study by Ruble [1968]. The design was then revised in the light of new computational techniques which were brought to our attention by the Center's numerical analysts, Viriginia Klema and Donald Rose. These techniques promise to afford greater computational accuracy in the presence of ill-conditioned data matrices which are often encountered in econometric work. Programming of the basic modules should commence shortly.

The Brundy-Jorgensen limited and full information instrumental variable estimators are currently being adapted for our purposes. For each of the preceding estimators, a corresponding iterative technique is being employed to handle nonlinear equations.

A generalized full information maximum likelihood (FIML) routine is now being designed. Heavy emphasis is being given to the FIML technique for nonlinear equations being developed by Chow [1972] for this purpose. The routine

will be specialized to accept a diagonal covariance matrix of the disturbance terms among the equations. This procedure promises computational advantages with minimum sacrifice of efficiency in real-life situations; it also deals with diagonal second-order Markov schemes in the disturbance terms.

David Belsley and Swarnjit Arora (University of Wisconsin at Milwaukee) now coordinate this project. J. Phillip Cooper (University of Chicago) and Gregory Chow (Princeton University) initiated the project in the first three months of 1972 and continue to serve as consultants.

David A. Belsley
Boston College
National Bureau of Economic Research

References

Chow, G. C. [1972], "On the Computation of Full-Information Maximum Likelihood Estimates for Non-Linear Equation Systems," Econometric Research Program Research Memorandum No. 142, Princeton University.

Ruble, W. L. [1968], "Improving the Computation of Simultaneous Stochastic Linear Equations Estimates", Agricultural Economics Report No. 116, Michigan State University.

Abstracts of Research Reports

Working papers of researchers at the NBER Computer Research Center are published under the general title NBER-CRC Research Reports and are abstracted here. The full text of the reports are available in limited quantity, at $1.00 per copy, from the NBER Computer Research Center, 575 Technology Square, Cambridge, Massachusetts 02139 (Attention: Support Staff).

Belsley, David A. (Boston College and NBER Computer Research Center), **"The Applicability of the Kalman Filter in the Determination of Systematic Parameter Variation"**, NBER-CRC Research Report W0011 (March 1973), 8 pp.

The basic optimality theorem for the Kalman filter is stated and generalized to account for a conditional mean varying systematically with respect to additional variates z. The relevance of the resulting "state" estimator is discussed in the context of determining systematic parameter variation in a linear regression model. The Kalman filter is seen to have essentially the same drawbacks as the moving-window technique which I discussed in an earlier report [NBER-CRC Research Report W0005, abstract in last issue of *Annals*].

Sarris, Alexander H., **"Multiattributed Utility Theory: A Survey of Some Recent Developments"**, NBER-CRC Research Report W0012 (March 1973), 30 pp.

This report surveys some recent methods for simplifying the assessment of multiattributed utilities. First, aggregation of attributes is examined. Under reasonable assumptions, theorems are stated which can reduce the dimension of the space over which the cardinal utility must be assessed. Second, additivity is examined in detail. The assumptions made here are stronger, the theorems stated

are correspondingly deeper, and the simplification arising from additivity can be considerable. Finally, the problem of evaluating infinite time streams of money is examined. It is impossible to find a comprehensive cardinal utility, but approximate utilities can be constructed based on ideas of multiattributed utility theory.