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#### 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. Following are abstracts of 17 recent working papers. The complete texts are available at \$1.00 per copy from the respective authors at: NBER Computer Research Center, 575 Technology Square, Cambridge, Massachusetts 02139.*

Amemiya, Takeshi, **The Maximum Likelihood and the Nonlinear Three-Stage Least Squares Estimator in the General Nonlinear Simultaneous Equation Model**, NBER Working Paper 90 (June 1975).

The consistency and the asymptotic normality of the maximum likelihood estimator in the general nonlinear simultaneous equation model are proved. It is shown that the proof depends on the assumption of normality, as is not the case in the linear simultaneous equation model. It is proved that the maximum likelihood estimator is asymptotically more efficient than the nonlinear three-stage least squares estimator if the specification is correct. However, the latter has the advantage of being consistent even when the normality assumption is removed. Hausman's instrumental-variable interpretation of the maximum likelihood estimator is extended to the general nonlinear simultaneous equation model.

Dharmadhikari, V. K., **The Decision-State Method: Convergence Proof, Special Applications, and Computational Experience**, NBER Working Paper 94 (July 1975).

The decision-state method is a new method for obtaining exact optimal solutions for a class of discrete-variable nonlinear resource-allocation problems. This method works in the state space and the decision space. It generates and retains only a fraction of the points in the state space at which the state functions are discontinuous; it thus overcomes to some extent the curse of dimensionality. It carries the cumulative decision-strings associated with these points, and thus avoids the back-tracking entailed by the conventional dynamic programming method for recovering the optimal decisions. The method is adapted for solving problems with special structures (e.g., block-angular or split-block-angular constraints). The performance of a computer implementation of the method is reported for many resource-allocation problems and is compared with that of the MMDP algorithm.

———, **Finding a Dual-Feasible Solution to an LP with  $m$  Equalities in  $(1/m)$  Dual Iterations**, NBER Working Paper 100 (August 1975).

Lemke's dual-simplex method of linear programming is usually considered inferior to the primal simplex method for any general linear programming problems. One reason is the difficulty of finding a starting dual-feasible basis. In this paper, a new starting technique is presented, which finds a dual-feasible basis in a single dual-simplex pivot for LP's with no equality constraints, and in  $(1 + m_2)$

pivots for LP's with  $m_3$  equality constraints irrespective of the number of inequality constraints. The technique is illustrated on a small problem. The performance, in terms of the number of pivots to optimality, of the dual-simplex with the new starting technique on 100 medium-sized problems is reported and compared with that of the primal simplex. Efficient implementation of the new starting technique is discussed.

Kirsch, John, **The TROLL Econometric System: Availability and Capabilities**, Special Report of the NBER Computer Research Center (September 1975, no charge).

Scholars may use the TROLL econometric system on the NBER's computer facility via a national telecommunication network. The capabilities of the system are outlined. An annotated bibliography of TROLL documentation directs interested readers to sources of detailed information about each capability. Cities in the network are listed.

Lavey, W. G., **Autoregressive Spectrum Estimation Technique Applied to Quarterly Consumer Durables Expenditure Data**, NBER Working Paper 91 (June 1975).

Classical spectral techniques can provide sharp insights into the cyclical patterns in a time series of economic data. Various problems in the application of classical spectral techniques, such as the choices of smoothing routine and bandwidth and the appearance of end-effects, inhibit the usefulness of spectral analysis. Alternatively, an autoregressive spectral technique does not share these problems, but does present the difficulty of the choice of the order of the autoregression. This paper applies classical and autoregressive spectral techniques to quarterly consumer durables expenditure data, discusses three approaches to the choice of the order of the autoregression, and compares the results of the different spectral techniques. Autoregressive spectral analysis provides a superior representation for this time series.

Maddala, G. S., and F. D. Nelson, **Specification Errors in Limited Dependent Variable Models**, NBER Working Paper 96 (July 1975).

A preliminary investigation of two specification-error problems in truncated dependent variable models is reported. It is shown that heteroscedasticity in a tobit model results in biased estimates when the model is misspecified. This differs from the OLS model where estimates are still consistent though inefficient. The second problem examined is aggregation. An appropriate nonlinear least squares regression model is derived for situations when the microlevel model fits a tobit framework but only aggregate data are available.

Marsten, Roy, **The Use of the Boxstep Method in Discrete Optimization**, NBER Working Paper 86 (May 1975).

The Boxstep method is used to maximize Lagrangean functions in the context of a branch-and-bound algorithm for the general discrete optimization problem. Results are presented for three applications: facility location, multi-item production scheduling, and single machine scheduling. The performance of the Boxstep method is contrasted with that of the subgradient optimization method.

Shiller, R. S., **Alternative Prior Representations of "Smoothness" for Distributed Lag Estimation**, NBER Working Paper 89 (June 1975).

In some applications of the distributed lag model, theory requires that all lag coefficients have a positive sign. A distributed lag estimator which provides estimated coefficients with positive sign is developed here which is analogous to an earlier distributed lag estimator derived from "smoothness priors" which did not assume that all estimated coefficients be positive. The earlier estimator with unconstrained signs was a posterior mode of the coefficients based on a spherically normal "smoothness prior" in the  $d + 1$  order differences of the coefficients. The newer estimator with constrained sign is a posterior mode of the logs of the coefficients. The meaning of both categories of prior is discussed, and they are compared to prior parameterizations of the lag curve. Both varieties of "smoothness prior", in contrast to the parameterizations, allow the coefficients to assume any "smooth" shape subject to the sign constraint. The sign-constrained estimator has the additional advantage that it easily forms asymptotes. Moreover, the sign-constrained estimator is easily implemented. The estimate can be obtained by an iterative procedure involving regressions with dummy observations similar to those used to find the unconstrained sign estimator. An illustrative example of the application of both estimators is given.

———, **Rational Expectations and the Dynamic Structure of Macroeconomic Models: A Critical Review**, NBER Working Paper 93 (June 1975).

A recent literature on rational expectations in macroeconomic theory is surveyed with the objective of distilling useful suggestions for econometric methodology. The paper is not concerned with the empirical questions with which these models have been associated, but rather with the value and usefulness of the concept of rational expectations. The paper begins with a brief discussion of the theory of martingales as it has been applied to macroeconomic theory. Then, the general linear rational expectations model (of which most models discussed in the literature are, in terms of their structure, special cases) is developed and its properties, advantages and drawbacks discussed. The paper concludes with a discussion of the possibilities for estimation and application of such linear models.

#### ANNOUNCEMENTS

Under the joint sponsorship of the National Bureau of Economic Research, ILPES (Latin American Institute for Economic and Social Planning) and the Ministerio de Planificación y Política Económica of Panama, a Latin American Computer Workshop on Short-Term Macroeconomic Policy in Latin America was held October 31–November 2, 1975 on the Isla Contadora, Panama. The conference was organized under the supervision of Professor M. Ishaq Nadiri, Senior Research Staff, National Bureau of Economic Research; and Professor

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