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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. Notes on research in progress, as well as abstracts of working papers, are a regular feature in the Annals. Following are abstracts of five recent working papers. The complete papers are available at cost from the NBER Computer Research Center, 575 Technology Square, Cambridge, Massachusetts 02139 (Attention: Support Staff).*

Arora, Swarnjit S., "**Migration Flows and Their Determinants: A Comparative Study of Internal Migration in Italy and the U.S.A.**", NBER Working Paper 26 (January 1974), 19 pp.

This paper has two goals: first, to describe a theoretical model which derives relationships among migration decisions explicitly from utility maximization under uncertainty; and second, to examine why nations vary in their internal migration. To explain variation in internal migration, we hypothesize that the degree of monetization and industrialization of an economy is inversely related to the family cohesiveness; hence, a given percentage increase in relative income will have higher migratory effect in a relatively more monetized economy. The availability of higher initial information and better transportation systems in these economies strongly complement this effect. These hypotheses are confirmed by estimates based on the U.S. and Italian data.

Engle, Robert F., "**Interpreting Spectral Analyses in Terms of Time-Domain Models**", NBER Working Paper 37 (April 1974), 23 pp.

This paper derives relationships between frequency-domain and standard time-domain distributed-lag and autoregressive moving-average models. These relations are well known in the literature but are presented here in a pedagogic form in order to facilitate interpretation of spectral and cross-spectral analyses. In addition, the paper employs the conventions and discusses the estimation procedures used in TROLL. Some aspects of these estimation procedures are new and have not been discussed in the literature.

Holland, Paul W., and Samuel Leinhardt, "**The Statistical Analysis of Local Structure in Social Networks**", NBER Working Paper 44 (June 1974), 41 pp.

We introduce the concept of a triad census of a digraph and show how it can be used to enumerate various types of subgraph configurations. We give the basic probabilities needed for computing means and variances for a triad census under the U|MAN distribution for digraphs. These concepts are combined to provide a way of testing propositions about social structure using sociometric data. An application to 408 sociograms is given.

Sarris, Alexander H., "**A General Algorithm for Simultaneous Estimation of Constant and Randomly-Varying Parameters in Linear Relations**", NBER Working Paper 38 (April 1974), 20 pp.

A recursive algorithm for estimating linear models with both constant and time-varying parameters is derived by maximization of a likelihood function:

Recursive formulas are also derived for derivatives of the likelihood function; the derivatives are needed for numerical evaluation of some parameters. Smoothing formulas are also derived. The estimation algorithm is compared with others for similar classes of models.

Welsch, Roy E., "Graphics for Data Analysis", NBER Working Paper 43 (June 1974), 27 pp.

In recent years, graphics has become an essential part of modern data analysis. It is particularly useful for interactive data analysis. This paper describes a system called CLOUDS which is designed to make available on inexpensive storage tube terminals a wide range of graphic tools related to data analysis, economics, and management science. The system can be accessed nationwide by nonprofit organizations via the National Bureau of Economic Research computer network.