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STRUCTURAL EQUATION MODELING WITH ORDINAL VARIABLES

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The statistical models used in structural equation modeling are described. The estimation theory for these models is reviewed for the case when all variables are continuous. Estimation theory for the case when all observed variables are ordinal is developed. This involves fitting the structural equation model to a matrix of polychoric correlations by weighted least squares. The weight matrix is a consistent estimate of the inverse of the asymptotic covariance matrix of the polychoric correlations. The asymptotic covariance matrix of the estimated polychoric correlations is derived for the case when the thresholds are estimated from the univariate marginals and the polychoric correlations are estimated from the bivariate marginals for given thresholds. Computational aspects are also discussed.

1. Introduction. Structural equation models have proven useful in solving many substantive research problems in the social and behavioral sciences. Such models have been used in the study of macroeconomic policy formation, intergenerational occupational mobility, racial discrimination in employment, housing and earnings, studies of antecedents and consequences of drug use, scholastic achievement, evaluation of social action programs, voting behavior, studies of genetic and cultural effects, factors in cognitive test performance, consumer behavior, and many other phenomena.

Methodologically, the models have many names, including simultaneous equation systems, linear causal analysis, confirmatory factor analysis, path analysis, structural equation models, recursive and non-recursive models for cross-sectional and longitudinal data, and covariance structure models.

The basic ideas and methods of structural equation models are explained in Bollen (1989). Bibliographies on the theory and applications of structural equation models are found in Jöreskog and Sörbom (1989) and Austin and

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