Recent contributions to Structural Equation Modeling and Factor Analysis

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In this talk I will discuss two recent contributions to Structural Equation Modeling and Factor Analysis. First, I will present a new approach to estimate confidence interval for Cronbach's coefficient alpha and testing its sample value under the null hypothesis that the coefficient is higher than a given threshold. Then I will introduce a method for treating unobserved heterogeneity in latent growth curve modeling.

Reliability is commonly examined in order to assess the measurement quality of scales. To date, Cronbach's coefficient alpha is the most commonly used index for assessing the reliability of a scale. We recently presented an asymptotic distribution of the natural estimator of Cronbach's alpha coefficient and proposed a new confidence interval (CI) that does not require assumptions of equal variances and covariances, neither does it require the data to be approximated by a multivariate normal distribution. We also presented a test on the sample estimate of coefficient alpha for testing the null hypothesis that the coefficient is higher than 0.7 (or any other threshold). The proposed approach is compared to four popular methods commonly used to compute CIs for alpha using a Monte Carlo simulation study under a variety of sample size and number of items in a scale conditions. We compared results for each method in terms of the level of coverage and confidence interval length (CIL). The results of this simulation study indicated that the newly proposed interval estimate was the most accurate of the examined approaches, especially for small sample sizes.

Latent growth curve modeling is frequently used in social and behavioral science research to analyze complex developmental patterns of change over time. Although it is commonly assumed that individuals in an examined sample will exhibit similar growth trajectory patterns, there can be situations where typological differences in development and change are present. In such instances, it is important to treat the sample as stemming from unobserved heterogeneous populations. Unobserved heterogeneity is commonly analyzed using growth mixture models or group-based trajectory models. These methods are designed to identify clusters of individuals that follow a similar developmental trajectory on an outcome of interest. The methods utilize a combination of a latent growth curve model and a finite mixture model by assuming that the underlying population consists of a fixed but unknown number of groups or classes, each with distinct growth trajectories. Because group membership is not known and no observed variable is available to identify homogenous groups, group membership must in some manner be inferred from the data. We recently proposed a new approach to growth mixture modeling where the number of growth trajectories is determined directly from the data by algorithmically grouping or clustering individuals who follow the same estimated growth trajectory based on an evaluation of individual case residuals. The identified groups are assumed to represent latent longitudinal segments or strata in which variability is characterized by differences across individuals in the level (intercept) and shape (slope) of their trajectories and their corresponding individual case residuals. The illustrated approach algorithmically enables the data to determine both the number of groups and corresponding trajectories. The approach is illustrated using both empirical longitudinal and simulated data.

Main references

Katerina M. Marcoulides and Laura Trinchera (2019) *Detecting Unobserved Heterogeneity in Latent Growth Curve Models*, Structural Equation Modeling: A Multidisciplinary Journal, 26:3, 390-401.

Laura Trinchera, Nicholas Marie and George A. Marcoulides (2018) *A Distribution Free Interval Estimate for Coefficient Alpha*, Structural Equation Modeling: A Multidisciplinary Journal, 25:6, 876-887.

Short Bio

Laura Trinchera is Associate Professor of Statistics at NEOMA Business School, France. She holds a Master Degree in Business and Economics (2004) and a PhD in Statistics (2008) from the University of Naples « Federico II », Italy. Her research focuses on Multivariate Data Analysis with an emphasis on Structural Equation Modeling, Partial Least Squares (PLS) Methods and Clustering and Classification algorithms.

She is member of the International Society of Business and Industrial Statistics (ISBIS) and of the Société Français de Statistique (SFDS). She has been co-chair of the y-BIS (Young group of the International Society for Business and Industrial Statistics), and elected member of the Council Committee of the Young group of the SFDS. She is co-chair of the Component-based Methods for Predictive and Exploratory Path Modeling specialized team of the working group on Computational and Methodological Statistics in the European Research Consortium for Informatics and Mathematics (ERCIM).

She has been visiting researcher at University of California at Santa Barbara, University of Michigan at Ann Arbor, University of Hamburg, Charles University in Prague, HEC School of Management in Paris and external lecturer at ESSEC Business School, SciencesPo Paris, Sorbonne University at Abu Dhabi and Université Paris Descartes.