A Method to Estimate Latent Variables in structural models

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Abstract

To estimate the latent scores in a structural model the LISREL model, composed of a set of measurement models and of a Path Analysis, is the most applied in empirical work. However the LISREL model presents a set of stringent assumptions that limits its applicability in empirical problems, as underlyed in recent papers (Joreskog 1981, p. 73, Vittadini 1999 a, 1999; Olsson , 1979 p.458; Jöreskog, 1993 Lovaglio 2003).
In particolar the LISREL model estimates the latent scores in a way that does not respect the separate measurement models composing it (Schneweiss, 1991)
To avoid the "hard" approach of LISREL, the Partial Least Squares methodology provides the estimate of structural parameters as linear weighting of its manifest indicators; the major drawbacks of this approach consist in arbitrariness of optimum criteria to achieve weights (not respecting the structural model) and finally that PLS latent scores are not estimated in a statistical model.
Vittadini e Lovaglio (2001) show that starting from the Path diagram and from the properties of the Partial Least Squares, the "exogenous latent variables" are obtained by means of a linear transformation of the observed variables, "whereas the endogenous variables are still considered as causes of the respective indicators"; the estimated scores respect all LV's properties hypotized in the specified structural models.
In this way the model uses all available information of the causal role of an LV in a coherent way with the measurement model and the structural model specified.
Regard to previous proposals, this methodology has several advantages: the parameters are estimated consistently with the supposed relations (in the model) between LV's-causes, LV's-indicators, causes-indicators, avoiding treating the causes as indicators and/or vice versa and the structural parameters of measurement models are simultaneously estimated with the matrix of weights to define LV.
The model proposed and its extended version with mixed manifest variables is a true causal model because the linear combination that defines (not exactly) the scores of LV are performed in a statistical model where the error matrix is interpretable as stochastic errors or as errors in equations.
Finally the proposed model will be applied in a psichometric application to estimate the caregiver stress (Relative Stress Scale Items) regarding a sample of old involved in a plan within of the Health service of public utility of Regione Lombardia.