The Fox School of Business

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Department of Statistics

Temple University

ANNOUNCES A
COLLOQUIUM

Dr. Peter H. Westfall

James and Marguerite Niver Professor of ISQS
Paul Whitfield Horn Professor of Statistics
Texas Tech University

will speak on

Reliability-Constrained Latent Structure Models

Time: 3:30 – 4:30 PM
Date: Friday, October 2, 2009
Place: Alter Hall 231

Abstract

What would you think if another researcher said your theory was wrong, and proposed another theory diametrically opposed to yours, saying yours was wrong and his or hers was right? The resolution, it seems is simple: test each of your theories on the available data. One theory should clearly be shown superior, right? Wrong, if the theory hinges on latent structure models.

Latent structure models (aka "LISREL" models) are ubiquitous in the social sciences. Commonly, a covariance structure, typically diagonal or nearly diagonal, is assumed for the error covariance matrix of a latent structure model. In turn, this assumed error covariance structure determines the reliability of a manifest score (defined as squared correlation between the manifest score, which is most commonly a simple summate, and the latent variable). Such reliabilities are important for researchers, as small values might preclude publication. The assumed error correlation structure also determines correlations between latent variables; these correlations are important for researchers because they measure the strength of evidence for their primary research hypotheses, and are also a determinant of publishability of the research.

This paper shows that the assumed error covariance matrix structure cannot be empirically tested, and argues further that there is usually no scientific basis for assuming that it is precisely diagonal. Thus, alternative, equally well fitting, and equally scientifically plausible models are available to the modeler. Rather than presuppose an untestable, unverifiable correlation structure, we propose instead that the modeler presuppose the reliability of a manifest score of interest; the error covariance structure and correlations between latent variables are then determined from this putative reliability. Statistically, the resulting model cannot be distinguished from the "usual" model, in which the modeler presupposes a diagonal error correlation structure.

In the single factor model, the reliability of any manifest score can be set by the modeler to any value between 0 and 1, with all values equally supported by the data. This reliability value then determines an error covariance structure that is statistically indistinguishable from the usual model with diagonal covariance structure. With multiple factors, reliabilities can also be set in advance, which then determine not only the error covariance structure, but also correlations between factors; these correlations can be as high as 1.0 and as low as the correlations between manifest scores, with all values equally supported by the data.

These results call into question the utility of latent variable structural equation models to correct for measurement error, as well their supposed "confirmatory" nature; further, the results call into question the utility of latent modeling in general, and argue for greater use of manifest modeling. On a more positive note, if researchers must use latent models, the methods described in this talk provide them with a tool to incorporate known reliability information into their models.

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