Discovering interaction in Structural Equation Models through a diagnostic plot

Porzio, Giovanni Camillo
University of Cassino, Department of Economics
Via S. Angelo, localitá Folcara, Cassino (FR) I- 03043, Italy
E-mail: porzio@eco.unicas.it

Vitale, Maria Prosperina
University of Salerno, Department of Economics and Statistics
Via Ponte Don Melillo, Fisciano I-84084, Italy
E-mail: mvitale@unisa.it

Abstract

Structural Equation Models are increasingly applied in many research areas in order to analyze causal relationships between theoretical latent concepts. Within these models, linear linkages between variables are generally assumed. Nevertheless, this assumption may not adequately describe the complexity and richness of social phenomena. For this reason, models including interaction effects between latent variables have been developed, with a large literature on methods for their estimation (see e.g.: Schumacker and Marcoulides, 2005). However, few efforts have been devoted to the development of adequate diagnostic tools.

Aim of this work is to introduce thus a graphical device, the latent joint effect plot, that allows users to evaluate the presence of interaction effects between latent variables. The plot is in line with the graphical diagnostic methods used in the framework of multiple linear regression (Cook and Weisberg, 1999). In particular, it belongs to the framework of the conditional plot, and mimics the joint effect plot introduced in path analysis by Porzio and Vitale (2007). However, plots for diagnostics in multiple regression are based on the visualization of observed variables. Here, given that we are dealing with latent variables, factor scores are plotted. It is worth noting that, in spite of the well known factor score indeterminacy issue (Grice, 2001), the plot seems to be effective, as shown by a proper simulation study (Porzio and Vitale, 2011). By varying sample size, reliability, and interaction effect size, we evaluate how the choice of a different factor score estimation method affects the plot efficacy. The study shows that the proposed plot has some efficacy beyond the factor score estimation method one may select. On the other hand, the same study suggests that the factor scores estimated according to the Krijnen proposal (Krijnen et al., 1996) should be generally preferred over the others.

REFERENCES

Cook, R.D., Weisberg, S. (1999). Applied Regression Including Computing and Graphics. New York: John Wiley and Sons.

Grice, J.W. (2001). Computing and evaluating factor scores. Psychological Methods 6: 430-450.

Krijnen, W.P., Wansbeek, T.J., Ten Berge J.M.F. (1996). Best linear predictors for factor scores. Communications in Statistics: Theory and Methods 25: 3013-3025.

Porzio, G.C., Vitale, M.P. (2007). Exploring nonlinearities in path models. Quality and Quantity 41: 937-954.

Porzio, G.C., Vitale, M.P. (2011). Plotting factor scores to detect interactions in Structural Equation Models. Manuscript submitted for publication.

Schumacker, R.E., Marcoulides, G.A. (eds) (2005). Interaction and Nonlinear Effects in Structural Equation Modeling, edited by Mahwah, NJ: Lawrence Erlbaum Associates.