Guest editorial: Current issues in composite-based and covariance-based structural equations modeling: what to do and when to do it

This special issue of the *European Journal of Marketing* was conceived to put a step forward in resolving two important, inter-related problems. First, casual observation of published papers that employ composite-based structural models reveal such a variation in quality that a reader would conclude that there is no common precept on how such analysis should be conducted and presented to the reader. This is unfortunate because such precepts do exist. Second, research methods oriented papers discussing the issues surrounding composite-based methods are also equally variable in quality and surprisingly vast in quantity. It is a very difficult task to process this information. But it is important. Structural equations modeling is still the primary method used for the analysis of primary data collected with multi-item measures. It is also relevant to anyone analyzing what some would refer to as "correlational data" from either primary or secondary sources. Further, the techniques may be useful in conducting meta-analysis.

The strategy employed to bring clarity to these issues is to have two groups of colleagues that have diametrically opposing views put forward and debate issues regarding partial least squares structural equations modeling. Partial least squares structural equations modeling (PLS SEM) is perhaps the most well-known and widely used form of composite-based structural modeling in the marketing literature. The advocates and critics of PLS SEM are passionate about the topic. As special issue editor, I have tried to take a neutral position and provide the environment for both sides to give voice to their positions. That goal has been accomplished. I strongly urge my colleagues interested in SEM to read and digest these very informative articles.

In the rest of this introductory article, I provide my executive summary of the included papers. Two of the papers received comments, and the original authors were invited to submit rejoinders.

Articles in the special issue

The first paper is a critical analysis of PLS SEM titled "Marketing or methodology? Exposing the fallacies of PLS with simple demonstrations". In this paper, Rönkkö *et al.* describe PLS SEM in a way that is accessible to the practicing researcher and provide direction on how researchers can use freely available data sets with PLS SEM software to see for themselves how the analysis performs under varying conditions. The paper attempts to dispel some beliefs that the authors believe are incorrect or not well substantiated. In particular, Rönkkö *et al.* argue that the PLS SEM indicator weights are, in a wide variety of circumstances, no improvement over unit weights. A system for testing weighted indicators versus unit weighted is proposed.

A commentary article on the above is titled "Comments on the article "Marketing or methodology? Exposing the fallacies of PLS with simple demonstrations" by Ke Hai Yuan.

European Journal of Marketing
Vol. 57 No. 6, 2023
pp. 1593-1596

0309-0566
DOI 10.1108/EJM-06-2023-986

In this comment, Yuan argues that assessing PLS SEM depends on the mode, PLS having two modes A and B. In much of the published literature, mode A is said to be preferred for reflective measures while mode B is preferred for formative measures. Yuan's point is that mode B estimates have desirable statistical properties that mode A estimates lack and should therefore be preferred. Reference is also made to a recently published article (Yuan and Deng 2021) that demonstrates how to transform mode A estimates into mode B estimates.

In their rejoinder, "Fractures in the edifice of PLS" Rönkkö *et al.* expand on their arguments. An important point made in the paper is the gateway decision that researchers should make, in Rönkkö *et al.*'s view, is whether to model their measures using composite or latent variables. A notable conclusion is that points made by the commentary seems to support many of the criticisms made in "Marketing or methodology? Exposing the fallacies of PLS with simple demonstrations". A final point to which readers should attend is the argument that GSCA may be a superior choice for modeling with composite variables than PLS SEM.

In "A comparative study of the predictive power of composite-based approaches to structural equations modeling" Cho *et al.* contrast generalized structured component analysis (GSCA) with PLS SEM in the context of prediction. The analysis and results are well captured in Tables 1 and 2 of the article. GSCA, it is argued, is at parity with, or superior to, PLS SEM in terms of model specification, model estimation, model evaluation and both observed and operative prediction. This would seem to narrow the use case for PLS SEM substantially. However, two points need to be acknowledged. First, the differences are not large, and PLS SEM will provide essentially equivalent analysis in many situations. Second, and more importantly, GSCA and PLS SEM are both composite-based approaches. Thus, the variables used in the path analysis are weighted composites rather than estimated latent variables measured with error. These differences can be important for estimation of model parameters and interpretation of the results.

In their article "Predictive Model Assessment and Selection in Composite-based Modeling Using PLS-SEM: Extensions and Guidelines for Using CVPAT" Sharma *et al.* expand a tool useful for assessing the predictive accuracy of PLS SEM in out of sample data. Here CVPAT refers to the cross-validated predictive ability test originally developed by Liengaard *et al.* (2021). Whereas the original CVPAT was constructed at the overall model level, the current adaptation allows assessment down to the variable level. The contribution is timely because, increasingly, PLS SEM is seen as a useful approach for identifying predictors and building predictive models. However, there are many existing alternatives for these tasks and the relative trade-offs are not well known. As a reviewer of this paper noted: "good theory implies prediction, but prediction does not imply good theory". Practicing researchers are cautioned to keep this distinction in mind.

In the article "Assessing the Overall Fit of Composite Models Estimated by Partial Least Squares Path Modeling," Schuberth, Rademaker and Henseler propose assessing model fit based on indices well known to those who fit models in covariance-based structural equations models. These include root mean square residual (RMR), standardized RMR, goodness of fit index and normed fit index. They argue that many of the existing arguments against assessing fit by way of distance are not valid. Still, the mission of the PLS SEM algorithm is to generate high levels of explained variance by weighting indicators based on their correlations with indicators of other variables. In view of this, it remains to be seen whether distance based fit indices can add any value over and above R^2 for the individual exogenous constructs as tools for evaluating the resulting model. Empirical research is needed in this area.

Cadogan and Lee in their article "A Miracle of Measurement or Accidental Constructivism? How PLS Subverts the Realist Search for Truth" argue that PLS SEM is a close fit for those using a constructivist philosophy and a poor fit for those operating from a realist philosophy. They point out that PLS SEM results are indeterminant in the sense that the results always depend on other constructs in the model. This indeterminancy implies that researcher decisions are in part responsible for the results. This situation would make PLS SEM unsuitable for making the confirmatory hypothesis testing and strong inferences that are the goal of realist research agendas. Two comments were received on this paper.

In "The Proxy of Dorian Gray: Scientific Realism, Construct Validation, and the Way Forward", Rigdon takes issue with Cadogan and Lee's view of realism and constructivism. Rigdon casts the entire enterprise of structural modeling as an anti-realist pursuit driven by empiricism. Thus, Rigdon sees covariance-based structural equations modeling and composite-based structural equations modeling as fruit from the same orchard. Although in a different manner, Henseler and Schuberth, in their article "Partial Least Squares as a Tool for Scientific Inquiry: A Comment on Cadogan and Lee", arrive at a similar conclusion as Rigdon. Henseler and Schuberth conclude that the perspective taken in Cadogan and Lee is actually instrumentalism and is thus, in Rigdon's terms, "anti-realist". Rigdon writes that:

> Honestly, instead of embracing one kind of method and demonizing others, it would probably be more productive to be familiar with all kinds, so as to have the widest choice to deal with complications of any particular research situation.

Henseler and Schuberth's similar view is that "Researchers should select a statistical model that best describes their theory".

In an invited rejoinder titled "Scientific Realism, the Necessity of Causal Contact in Measurement, and Emergent Variables" Cadogan and Lee view the arguments proffered by the two commentary articles with skepticism. Lest the reader become swamped by the language of the philosophy of science, the key question goes to the very nature of measurement itself. The scientific realist approach described by Cadogan and Lee ascribes causal significance to measures, whereas the proxy approach described by Rigdon apparently attaches no special significance to a measure save for its consistency with the conceptual variable. Henseler and Schuberth's apparent view is that measures created through the PLSc composite estimation procedure (Dijkstra and Henseler, 2015) can be interpreted in the same terms as latent construct measure estimates obtained through covariance-based structural models using maximum likelihood estimation. Cadogan and Lee question this approach on both philosophical and practical grounds. This is an important discussion.

In the postscript article "Composite-based and Covariance-based Structural Equations Modeling: Moving Forward by Changing the Dialogue", the special section editor summarizes the discussion pointing to areas of new agreement and areas where future research and development appear promising. The postscript outlines several important considerations in structural modeling with hopes of changing the discussion in a more promising direction. Finally, and most importantly, the postscript outlines recommendations for authors, reviewers and editors regarding the use, analysis and reporting of statistics involving both covariance-based and composite-based structural equations models.

Kevin Voss

Department of Marketing, Oklahoma State University, Stillwater, Oklahoma, USA

References

Dijkstra, T.K. and Henseler, J. (2015), "Consistent partial least squares path modeling", *MIS Quarterly*, Vol. 39 No. 2, pp. 297-316.

Liengaard, B.D., Sharma, P.N., Hult, G.T.M., Jensen, M.B., Sarstedt, M., Hair, J.F. and Ringle, C.M. (2021), "Prediction: coveted, yet forsaken? Introducing a cross-validated predictive ability test in partial least squares path modeling", *Decision Sciences*, Vol. 52 No. 2, pp. 362-392.

About the authors

Kevin Voss is a Don and Cathey Humphreys Chair and Spears Professor of Marketing in the Spears School of Business at Oklahoma State University in Stillwater, Oklahoma. The author wishes to thank the publishers and editor-in-chief for their support and patience during the process of assembling this special issue.