WORKSHOP

Partial Least Squares Structural Equation Modeling (PLS-SEM): Advanced Topics

March 11, 2025, Babeș-Bolyai University

1 Instructor

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2 Course objectives

This online course introduces participants to advanced topics of partial least squares structural equation modeling (PLS-SEM) using the SmartPLS 4 software. PLS is a composite-based approach to SEM. Compared to other SEM techniques, PLS-SEM allows researchers to estimate very complex models with many constructs and indicators. Furthermore, the method allows estimating reflectively and formatively specified constructs and generally offer much flexibility in terms of data requirements.

The course starts with a brief recap of the more basic and advanced model evaluation criteria. The remainder of the course covers very useful tools for advanced results illustration—the importance-performance map analysis, the necessary condition analysis (NCA), and its fusion in the combined NCA. Next, the course will cover higher-order constructs, before concluding with a brief overview of heterogeneity assessment in PLS-SEM.

3 Learning outcomes

This workshop is designed to participants with advanced results reporting and modeling options in PLS-SEM. More specifically, participants will comprehend the following topics:

- Short recap on the fundamentals of PLS-SEM model evaluation,
- Importance performance map analysis (IPMA),
- Necessary condition analysis (NCA),
- Combined NCA,
- Higher-order constructs, and
- Outlook on heterogeneity assessment in PLS-SEM.

This course has been designed for PhD students and faculty who are interested in learning how to use the PLS-SEM method in their own research applications. The course builds on the contents covered in the Foundations course. Participants should have been exposed to PLS-SEM and the SmartPLS software.

4 Teaching and learning methods

- The course is based on the PLS-SEM textbooks:
  - Hair, J. F., Hult, G. T. M., Ringle, C. M., and Sarstedt, M. (2022). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. 3rd edition. Thousand Oaks, CA: Sage.

- Hair, J. F., Sarstedt, M., Ringle, C. M., and Gudergan, S. P. (2024). *Advanced Issues in Partial Least Squares Structural Equation Modeling (PLS-SEM)*. 2nd edition. Thousand Oaks, CA: Sage.

- Presentations: The session will cover theory and its application.
- Computer exercises using the latest SmartPLS 4 version: Specifically, theoretical explanations underlying the software procedures and practical exercises where participants will apply their learning to real-world examples provided by the instructors.

5 Registration and practical issues

- The course will be conducted on site (room tba).
- Software: Computer exercises use the latest SmartPLS 4 version. Course participants will receive a 90-days fully functional version of the software SmartPLS 4.

6 Teaching resources

Comprehensive lecture slides will be provided to all participants

Books:

Hair, J. F., Hult, G. T. M., Ringle, C. M., and Sarstedt, M. (2022). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. 3rd edition. Thousand Oaks, CA: Sage.

Hair, J. F., Sarstedt, M., Ringle, C. M., and Gudergan, S. P. (2024). *Advanced Issues in Partial Least Squares Structural Equation Modeling (PLS-SEM)*. 2nd edition. Thousand Oaks: Sage.

Journal Articles (selection):

Becker, J.-M., Cheah, J. H., Gholamzade, R., Ringle, C. M., & Sarstedt, M. (2023). PLS-SEM's most wanted guidance. *International Journal of Contemporary Hospitality Management*, *35*(1), 321-346.

Becker, J.-M., K. Klein, and M. Wetzels (2012). Formative hierarchical latent variable models in PLS-SEM: Recommendations and guidelines, *Long Range Planning*, *45*(5/6), 359-394.

Hauff, S., Richter, N., Sarstedt, M., & Ringle, C. M. (2024). Importance and performance in PLS-SEM and NCA: Introducing the combined importance-performance map analysis (cIPMA). *Journal of Retailing and Consumer Services*, *78*, 103723.

Klesel, M., Schuberth, F., Niehaves, B., & Henseler, J. (2022). Multigroup analysis in information systems research using PLS-PM: A systematic investigation of approaches. *ACM SIGMIS Database: the DATABASE for Advances in Information Systems*, 53(3), 26-48.

Matthews, L. (2018). Applying multi-group analysis in PLS-SEM: A step-by-step process. In H. Latan & R. Noonan (Eds.), *Partial least squares structural equation modeling: Basic concepts, methodological issues and applications*. New York: Springer.

Richter, N., Hauff, S., Ringle, C. M., Sarstedt, Kolev, A., & Schubring, S. (2023). How to apply necessary condition analysis in PLS-SEM. In H. Latan, J. F. Hair, & R. Noonan (Eds.), Partial Least Squares Path Modeling: Basic Concepts, Methodological Issues, and Applications (2nd ed.). Cham, Switzerland: Springer.

Richter, N. F., Schubring, S., Hauff, S., Ringle C. M., & Sarstedt, M. (2020). When predictors of outcomes are necessary: Guidelines for the combined use of PLS-SEM and NCA. *Industrial Management & Data Systems*, *120*(12), 2243-2267.

Sarstedt, M., J. Henseler, and C. M. Ringle (2011). Multi-group analysis in partial least squares (PLS) path modeling: Alternative methods and empirical results. *Advances in International Marketing*, 22, 195-218.

Sarstedt, M., J. F. Hair, J.-H. Cheah, J.-M. Becker, and C.M. Ringle (2019). How to specify, estimate, and validate higher-order constructs in PLS-SEM. *Australasian Marketing Journal*, *27*(3), 197-211.

Sarstedt, M., Radomir, L., Moisescu, O. I., & Ringle, C. M. (2022). Latent class analysis in PLS-SEM: A review and recommendations for future applications. *Journal of Business Research*, *138*, 398-407.

Sarstedt, M., Richter, N. F., Hauff, C., & Ringle, C. M. (2024). Combined Importance-performance Map Analysis (cIPMA) in Partial Least Squares Structural Equation Modeling (PLS-SEM): A SmartPLS 4 Tutorial. *Journal of Marketing Analytics*, Advance online publication.

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2018). Treating unobserved heterogeneity in PLS-SEM: A multi-method approach. In H. Latan & R. Noonan (Eds.), *Partial Least Squares Structural Equation Modeling: Basic Concepts, Methodological Issues and Applications*. New York: Springer.

7 Schedule

Tuesday, March 11, 2025

Time	Topic
09:00 – 10:30	Short recap on the fundamentals of PLS-SEM model evaluation Importance-performance map analysis (IPMA)
10:30 – 11:00	Break
11:00 – 12:30	Necessary condition analysis (NCA) and the combined IPMA (cIPMA)
12:30 – 13:30	Lunch break
13:30 – 15:00	Higher-order constructs
15:00 – 15:30	Break
15:30 – 17:00	Higher-order constructs (cont.) Outlook on heterogeneity assessment in PLS-SEM

8 Instructor's short bio

Marko Sarstedt is a chaired professor of marketing at the Ludwig-Maximilians-University Munich (Germany) and an adjunct research professor at Babeș-Bolyai-University Cluj-Napoca (Romania). His main research interest is the advancement of research methods to further the understanding of consumer behavior. His research has been published in *Nature Human Behaviour, Journal of Marketing Research, Journal of the Academy of Marketing Science, Multivariate Behavioral Research, Organizational Research Methods, MIS Quarterly, Psychometrika*, *Structural Equation Modeling: A Multidisciplinary Journal*, and *British Journal of Mathematical and Statistical Psychology*, among others. Marko's research has been cited over 250,000 times according to Google Scholar and he has repeatedly named member of Clarivate Analytics' Highly Cited Researchers List, which includes the "world's most impactful scientific researchers."