Design of Experimental and Observational Studies and the Analysis of Causal Effects. An Introduction.

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Topic: This course is different from other courses on design and analysis of experimental and quasi-experimental data in at least two respects. *First,* it is based on the concepts of individual and average causal effects: All designs and models for the analysis are developed for the purpose to learn about individual and/or average causal effects. *Second,* it uses structural equation modelling with latent variables, instead of analysis of variance techniques and the General Linear Model. As will be shown, this will enable us to learn not only about means and average effects, but also about individual causal effects.

In a way, this course may be considered a synthesis of different traditions in methodology: Rubin's approach to causality, the Campbellian tradition of quasi-experimentation and internal validity, and structural equation modeling, especially latent state-trait modeling, latent change modeling and latent growth curve modeling. A slight generalization of Rubin's approach provides the conceptual foundation: individual and average causal effects. The Campbellian tradition gives the inspiration to generate new designs to argue against alternative explanations of the purported causal inference. Structural equation modeling, especially *latent state-trait models* provide a realistic formulation of the hypothesis that there is no trait change in an untreated control condition. *Latent change models* teach us how to include latent state and latent trait change variables as latent variables in structural equation models in such a way that they can depend on other variables explaining the inter-individual differences in the individual causal effects of the treatment. Note that explaining inter-individual differences in intra-individual change has also been the main purpose of latent growth curve models. Hence, they can be included in the list of the traditions of methodology on which this course is built.

Contents

Theoretical Background

1. Basic Concepts: Individual and Average Causal Effects
2. Bias of the Difference between two Expectations

Analysis of Average Causal Effects

3. Randomized Groups, Single Post-test Occasion

Analysis of Conditional and Average Causal Effects

4. Conditionally Randomized Groups, Covariates and a Single Post-test Occasion
5. Latent Covariates

Analysis of Individual and Average Causal Effects

6. A Single Group, two Pre-test and two Post-test Occasions
7. Two Groups, two Pre-test and two Post-test Occasions
8. Extensions

Method: The course consists of a two-day lecture in which the theory, data examples, and input files, are presented, and the output is discussed. Students also receive exercises they have to present and discuss in a two-day follow-up seminar some weeks later.

Target group: Advanced BA students and students in a doctoral program

References

Steyer, R., Gabler, S., von Davier, A., Nachtigall, C. & Buhl, T. (2000a) Causal regression models I: individual and average causal effects. *Methods of Psychological Research-Online*, *5*, 2, 39-71. (http://www.mpr-online.de)

Steyer, R., Gabler, S., von Davier, A. & Nachtigall, C. (2000b) Causal regression models II: unconfoundedness and causal unbiasedness. *Methods of Psychological Research-Online*, *5*, 3, 55-86. (http://www.mpr-online.de)

Steyer, R., Nachtigall, C., Wüthrich-Martone, O. & Kraus, K. (2002). Causal regression models III: covariates, conditional and unconditional average causal effects. *Methods of Psychological Research*-Online, *7*, 1, 41-68. (http://www.mpr-online.de)

Steyer, R., Flory, F., Klein, A., Partchev, I., Yousfi, S., Müller, M. & Kröhne, U. (2004). Testing Average Effects in Regression Models with Interactions. Paper submitted.

Steyer, R. (2005). Analyzing Individual and Average Causal Effects via Structural Equation Models. *Methodology: European Journal of Research Methods* in the *Behavioural and Social Sciences*, *1*, 39-54.

Related References

Gelman, A. Meng, X-L. (2004). *Applied Bayesian Modeling and Causal Inference from Incomplete-Data Perspectives*. New York: Wiley.

Rosenbaum, P. R. (2002). *Observational Studies*. (2nd Edition). New York: Springer.

Requirements for credits

Active participation, one home writing assignment, one mid-term test, one final test.