

CAUSAL MEDIATION ANALYSIS

Third-term Workshop, Academic Year 2021- 2022

Dates:

30 May 2022 (9:30-12:00 - 13:30-16:00), Seminar Room 2, Badia Fiesolana

31 May 2022 (9:30-12:00 - 13:30-16:00), Seminar Room 2, Badia Fiesolana

Instructor: Peter Fallesen, SPS Visiting Fellow / Stockholm University

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Workshop worth: 10 credits

Course Description:

Establishing a causal relationship often leave researcher wanting to further inquire about the underlying processes and mechanisms through which that relationship operates. Frequently, such questions are investigated by introducing mediating variables into a model and then estimating that model through regression analysis and analyzing the changes in coefficients. However, doing so only allow for a causal interpretation of the size of the mediation under strict assumptions, and interpretations and techniques are contingent on the statistical model being used. Being unaware of these necessary conditions may introduce endogeneity issues and lead to biased and erroneous interpretations of mediation effects.

The course will aim to elucidate under what conditions mediation analysis yields valid conclusions, and how recent advances may help remedy shortcomings in the classical approaches and introduce techniques for multiple and time-varying mediators. Further the course aims to make clear what are issues of identification and what are issues pertaining to estimation. The course will also include practical exercises in Stata/R. At the end of the course, participants will have received the tools to

consider whether and under what assumptions mediation is plausibly identified, and how to go about estimating the effect of mediation using an array of estimation techniques.

Prerequisites

This course builds on ordinary least square (OLS) regression and nonlinear models (logit/probit). Participants should be familiar with basic statistical concepts such as sample mean and sample variance and their properties. Participants should possess basic knowledge of regression analysis. Basic skills in Stata/R are also required.

Objectives

- *Understand under which assumptions causal mediation effects are identified
- *Understand the different types of mediation effects and classical and modern techniques for identification
- *Hands-on experience with implementing classical and modern techniques for causal mediation analysis.

Workshop structure

The two-day workshop will alternate between lectures and lab sessions. Stata/R required.

COURSE PROGRAM

Day 1:

Defining effects in the presence of causal mediation
Classical approaches to mediation analysis
Pitfalls and problems in classical approaches
Issues regarding nonlinear models

Day 2:

Longitudinal data
Time-varying mediators
Approaches to address endogeneity issues
Alternative usage and approaches

READINGS

Overview

- Jung, Sun Jae. 2021. "Introduction to Mediation Analysis and Examples of Its Application to Real-World Data." *Journal of Preventive Medicine & Public Health* 166. doi: 10.3961/jpmp.21.069
- Lange, Theis, Kim Wadt Hansen, Rikke Sørensen, and Søren Galatius. 2017. "Applied Mediation Analyses: A Review and Tutorial." *Epidemiology and Health* 39. doi: 10.4178/EPIH.E2017035.
- VanderWeele, Tyler J. 2016. "Mediation Analysis: A Practitioner's Guide." *Annual Review of Public Health* 37:17–32. doi: 10.1146/annurev-publhealth-032315-021402.
- VanderWeele, Tyler J. 2009. "Mediation and Mechanism." *European Journal of Epidemiology* 24(5):217–24. doi: 10.1007/S10654-009-9331-1/FIGURES/2.

Techniques

- Breen, Richard, Kristian Bernt Karlson, and Anders Holm. 2013. "Total, Direct, and Indirect Effects in Logit and Probit Models." *Sociological Methods and Research* 42(2):164–91. doi: 10.1177/0049124113494572.
- Dawid, Philip, Macartan Humphreys, and Monica Musio. 2022. "Bounding Causes of Effects With Mediators." *Sociological Methods and Research*. doi: 10.1177/00491241211036161.
- Vanderweele, Tyler J. 2013. "A Three-Way Decomposition of a Total Effect into Direct, Indirect, and Interactive Effects." *Epidemiology* 24(2):224–32. doi: 10.1097/EDE.0b013e318281a64e.
- Vanderweele, Tyler, and Stijn Vansteelandt. 2013. "Mediation Analysis with Multiple Mediators." *Epidemiologic Methods* 2(1):95–115. doi: 10.1515/em-2012-0010.
- Wodtke, Geoffrey T. 2020. "Regression-Based Adjustment for Time-Varying Confounders." *Sociological Methods and Research* 49(4):906–46. doi: 10.1177/0049124118769087.

Empirical examples

Aitken, Zoe, Julie Anne Simpson, Lyle Gurrin, Rebecca Bentley, and Anne Marie Kavanagh. 2018.

“Do Material, Psychosocial and Behavioural Factors Mediate the Relationship between Disability Acquisition and Mental Health? A Sequential Causal Mediation Analysis.”

International Journal of Epidemiology 47(3):829–40. doi: 10.1093/ije/dyx277.

Levy, Brian L., Ann Owens, and Robert J. Sampson. 2019. “The Varying Effects of Neighborhood

Disadvantage on College Graduation: Moderating and Mediating Mechanisms.” *Sociology of*

Education 92(3):269–92. doi: 10.1177/0038040719850146.

Mencarini, Letizia, and Daniele Vignoli. 2018. “Employed Women and Marital Union Stability: It

Helps When Men Help.” *Journal of Family Issues* 39(5):1348–73. doi:

10.1177/0192513X17710283.

Wodtke, Geoffrey T., and Matthew Parbst. 2017. “Neighborhoods, Schools, and Academic

Achievement: A Formal Mediation Analysis of Contextual Effects on Reading and

Mathematics Abilities.” *Demography* 54(5):1653–76. doi: 10.1007/s13524-017-0603-1.

Wodtke, Geoffrey T., Ugur Yildirim, David J. Harding, and Felix Elwert. 2020. “Are Neighborhood

Effects Explained by Differences in School Quality?” *Institute for Research on Labor and*

Employment Working Paper No. 102-20 (102).

Suggested readings

Hernán, Miguel A., and James M. Robins. 2019. “Causal Inference: What If.”

VanderWeele, Tyler. 2015. *Explanation in Causal Inference: Methods for Mediation and*

Interaction.