Graphical Models for Causal Inference with Observational Data

Felix Elwert
University of Wisconsin-Madison
elwert@wisc.edu

Princeton University
May 20-21, 2013

What to Expect

- An introduction to <u>direct acyclic graphs </u>(DAGs) for causal inference from *observational* data
  - A rigorous, largely graphical approach to causal inference
- Understand what variables you should control
- Understand what variables you shouldn't control
- Solid graphical intuition for identification via adjustment (e.g., regression, matching), instrumental variables, and mediation analysis
- Focus mostly on *problems*, less on solutions
- Building dependable intuition, little formal math
- Laying the groundwork for adventures in a fast evolving field.

Procedure

- Lectures interspersed with exercises
- Day 1: central concepts and machinery
- Day 2: making the link to estimation techniques and advanced topics.
- We'll handle the schedule flexibly to prioritize your interests. Ask questions whenever you want.

Schedule

(Exercises interspersed throughout)

1. Brief review of counterfactual causality

2. DAGs: The Essentials

3. Testable implications of a model

4. Graphical identification criteria

5. Endogenous selection bias

6. Comments on adjustment-based estimation

7. DAGs for instrumental variables

8. Causal mediation analysis

One of the two— you choose

Selected Readings

(Written relatively accessibly)

- Brito, Carlos. 2010. " Instrumental Sets." Pp. 295-309 in *Heuristics, Probability and Causality: A Tribute to Judea Pearl*, R. Dechter, H. Geffner, J. Halpern (eds.). *London:* College Publications.

- Elwert, Felix. 2013. "Graphical Causal Models." In *Handbook of Causal Analysis for Social Research*, S. Morgan (ed.). Dodrecht: Springer.

- Elwert, Felix, and Christopher Winship. *Forthcoming.* "Endogenous Selection Bias." *Working Paper.* Unversity of Wisconsin–Madison.

- Pearl, Judea. 1995. "Causal Diagrams for Empirical Research." *Biometrika* 82(4):669-710.

- Pearl, Judea. [2000] 2009. *Causality: Models, Reasoning, and Inference, 2nd Edition*. Cambridge: Cambridge University Press.

- Pearl, Judea. 2012. "Interpretable Conditions for Identifying Direct and Indirect Effects." Technical Report (R-389). UCLA Cognitive Systems Laboratory.