Causal Analysis

Impact Evaluation and Causal Machine Learning with Applications in R

Chapter 1: About Causality

Why Causal Questions Matter

From early on, we are confronted with questions of cause and effect:

- Should I study for my statistics exam, or will I pass anyway?

Important causal questions also arise in society, politics, business, and economics:

- Will more education increase income?
- Does a discount increase sales?
- Does harsher punishment reduce crime?
- Do mothers work more if childcare is free?
- Does free education foster equality of opportunity?

$\Rightarrow$ Reasoning about causal effects is fundamental to human decision-making (whether to act or not) and central to social science research.

Data-Based Causal Analysis

- Significant methodological progress in causal analysis over recent decades.
- Integration with AI (machine/deep learning), driven by digitization and data availability.
- Widely applied to evaluate interventions and policies in:
  - Public administrations (e.g., social programs),
  - International institutions (e.g., development aid),
  - Companies (e.g., pricing and marketing strategies),
  - Healthcare providers (e.g., medical treatments),...
- At the center of interest are causal effects of specific interventions:
  - Examples: job training, surgical techniques, advertising campaigns.
  - Outcomes of interest: employment, health, sales.
  - Causal analysis based on comparison of outcomes with and without the intervention.