Topics in Applied Econometrics

Randomized experiments

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How to tackle an empirical project

1. What causal effects are we interested in?
2. What ideal experiment would capture this effect?
3. What is our identification strategy?
4. What is our mode of statistical inference?

Consequences of randomization

- Imagine treatment and control groups with no compliance issues
- Units are *truly* randomly assigned to treatment
- What happens to the expected outcomes?

$$\mathbb{E}(Y_{1i} \mid D_i = 1) = \mathbb{E}(Y_{1i} \mid D_i = 0)$$

- But the potential outcome under treatment for the treated is not counterfactual!
- Therefore the ATE is simply

$$ATE = \mathbb{E}(Y_i \mid D_i = 1) - \mathbb{E}(Y_i \mid D_i = 0)$$

- Both terms are measurable, thus the ATE is identified

Randomized controlled trials (RCTs)

- Experimental designs to test the effect of a well-defined treatment
- Originated in medicine
- *Idea:* "the only thing different across similar units in treatment/control is chance"
- Under perfect randomization, potential outcomes are independent of treatment status

$$(Y_{1i}, Y_{0i} \perp\!\!\!\perp D_i = Z_i)$$

RCTs with imperfect compliance

- Randomizing assignment is relatively simple
- However, ensuring random treatment status is much harder
- *Example:* Dallas Buyers Club (trailer)
  - HIV/AIDS treatment drug is under FDA testing
  - The central question: is the drug effective?
  - Patients are randomly given the drug and placebo
  - However, compliance is less than perfect...

RCTs with imperfect compliance (cont'd)

- Under perfect randomization, potential outcomes are independent of treatment assignment

$$(Y_{1i}, Y_{0i} \perp\!\!\!\perp Z_i)$$

- We can identify ITT

$$ITT = \mathbb{E}(Y_i \,|\, Z_i = 1) - \mathbb{E}(Y_i \,|\, Z_i = 0)$$

- But is ITT enough? Not in the case of HIV/AIDS treatment

RCTs in social sciences

- “Gold standard” of impact assessment
- However, rare in practice
  - Possibility of implementation
  - Moral issues
  - Social cost
  - Financial cost
  - Randomized design from day 0
- Organizations driving the experimental movement
  - J-PAL, Gates Foundation, IMF, World Bank

In the absence RCTs

- More often than not, you will not be able to run your own experiment
- Designs providing “as-good-as-random” assignment
  - Natural experiments
  - Quasi-experiments
- However, we must be careful with the underlying assumptions
  - *Example:* earthquakes are random, effects may not be
- We can learn from nonexperimental settings too
- But: always think of the ideal experiment