Causal Inference

Mixtape Session

MIXTAPE SESSIONS

Roadmap

SUTVA

- Potential outcomes model places a limit on what we can measure: the "stable unit-treatment value assumption" . Horrible acronym.
  1. **S**: **s**table
  2. **U**: across all **u**nits, or the population
  3. **TV**: **t**reatment-value ("treatment effect", "causal effect")
  4. **A**: **a**ssumption

- As this is a bit of a pregnant concept, let's go slow

SUTVA: Unit-level assignment only

- Most people, if they know of SUTVA, tend to associate with one of its elements not its core definition
- It's core definition is actually the switching equation:

$$Y_{i,t} = D_{i,t}Y^1_{i,t} + (1 - D_{i,t})Y^0_{i,t}$$

- Notice now the i and t subscripts; think of what that means
- A particular unit i and some contemporaneous time t is assigned potential outcome based on *its* contemporanous treatment assignment for the same i unit at the same t time
- **Not** someone else's (spillovers), and not some future assignment (anticipation)

SUTVA: (1) Homogenous dose

- SUTVA requires each unit receive the same treatment dosage; this is what it means by "stable"
- If we are estimating the effect of vents on covid symptoms, we assume everyone is getting the same kinds of vents more or less.
- Easy to imagine violations if hospital quality, staffing or even the vents themselves vary across treatment group
- Be careful what we are and are not defining as *the treatment*

SUTVA: (2) No spillovers to other units

- What if putting someone on a ventilator causes someone else to be more or less likely to develop severe covid symptoms?
- Have to think hard about externalities, particularly with transmissible diseases
- SUTVA means that you don't have a problem like this.
- If there are no externalities from treatment, then δ_i is stable for each i unit regardless of whether someone else receives the treatment too, but herd immunity must be considered when it comes to cures

SUTVA: (3) Partial equilibrium only

Easier to imagine this with a different example.

- Let's say we estimate a causal effect of early childhood intervention in Texas

- Now President Biden wants to roll it out for the whole United States – will it have the same effect as we found?

- Scaling up a policy can be challenging to predict if there are rising costs of production

- What if expansion requires hiring lower quality teachers just to make classes?

- That's a general equilibrium effect; we only estimated a partial equilibrium effect (external versus internal validity)