Lecture 1 - Potential Outcomes and Directed Acylic Graphs

Paul Goldsmith-Pinkham

October 7, 2023

Not every economics research paper is estimating a causal quantity. But, the implication or takeaway of papers is (almost) always a causal one. Causality lies at the heart of every exercise. [1]

Goal for today's class: Enumerate tools used to discuss causal questions Emphasize a *multimodal* approach Set terminology/definitions for future discussions

[1] "We do not have knowledge of a thing until we have grasped its why, that is to say, its cause." – Aristotle

In his later books, [2]

[2] Arthur Lewbel. The identification zoo: Meanings of identification in econometrics. *Journal of Economic Literature*, 57(4):835–903, 2019

- The true underpinnings of causality are nearly philosphical in nature
  - If Aristotle didn't settle the question, neither will researchers in the 21t century
- I will avoid many of the discussions, but my biases will show up in one or two settings
- Key point: economics research is messy, and a careful discussion of causality entails two dimensions:
  1. A good framework to articulate your assumptions
  2. Readers that understand the framework

Medical example

- Two variables:
  - $Y \in \{0, 1\}$: whether a person will get Covid-19
  - $D \in \{0, 1\}$: whether a person gets a vaccine
- Our question: does D causally affect Y?
- *Ignore the question of data for now* – this is purely a question of what is knowable.
- "The fundamental problem of causal inference" (Holland 1986) is that for a given individual, we can only observe one world – either they get the vaccine, or they do not

References

[1] Arthur Lewbel. The identification zoo: Meanings of identification in econometrics. *Journal of Economic Literature*, 57(4):835–903, 2019.