

Microeconometrics Module

Lecture 1: Potential Outcomes

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[Course Link](#)

Introduction

- We are interested in causality
 - Does vaccine prevents polio, Covid-19, malaria?
 - Does schooling increases earning potential of individuals?
 - Is dense urban development conducive for economic growth?
 - Why female labor force participation increased in the 20th century?
- **Objective** of today's lecture
 - Learn about potential outcomes: notation and intuition
- **Why?**
 - Fundamental block to talk about causality

An example

- **Question:** Does health insurance access improves health outcomes
- **Notation:**
 - Y - called *outcome* - denotes health of individual
 - D - called *treatment* - denotes whether individual has health insurance or not
- Transformation of our question:
 - D has an effect on Y ?
- Why this question is hard?

Potential Outcomes

- We do not observe both worlds simultaneously
- But thinking about them helps to understand causality
- **Potential Outcomes**
 - different states that can occur for a unit
- in our example *unit* is *individual*
- different states
 - individual's health without health insurance
 - individual's health with health insurance

Potential Outcomes: Notation

- Neyman-Rubin Causal model
- n individuals
- index i
- Two potential outcomes for each individual
 - health when have health insurance: $Y_i(D_i = 1)$ or $Y_i(1)$
 - health when don't have health insurance: $Y_i(D_i = 0)$ or $Y_i(0)$
- Causal effect for i

$$\tau_i = Y_i(1) - Y_i(0)$$

- τ_i is not observed. Why?
- **SUTVA**
 - Stable unit treatment value assignment
 - fancy name to say there are no spillover effects
 - individual i 's outcome is not affected by treatment of other units

Potential outcomes and actual outcome

For individual i we observe Y_i

- Two potential outcomes for the same individual: $Y_i(0)$, $Y_i(1)$
- We can write

$$Y_i = (1 - D_i)Y_i(0) + D_iY_i(1)$$

where $D_i \in \{0, 1\}$

| i | $Y_i(1)$ | $Y_i(0)$ | D_i | Y_i |
|----------|----------|----------|----------|----------|
| 1 | 0 | 1 | 1 | 0 |
| 2 | 0 | 0 | 1 | 0 |
| 3 | 1 | 0 | 0 | 0 |
| \vdots | \vdots | \vdots | \vdots | \vdots |
| n | 0 | 1 | 0 | 1 |

Reiterating the objective

- We want to estimate the causal effect of treatment D
- Life would be easy if observe both potential outcomes
- But, life is not easy
- Essentially, our whole objective will be to construct that missing potential outcome
 - counterfactual
- Essence of this module: construction of counterfactuals

- Some basic primer on terminology
- Identification meaning

Questions?