Microeconometrics Module

Lecture 1: Potential Outcomes

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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?

An example
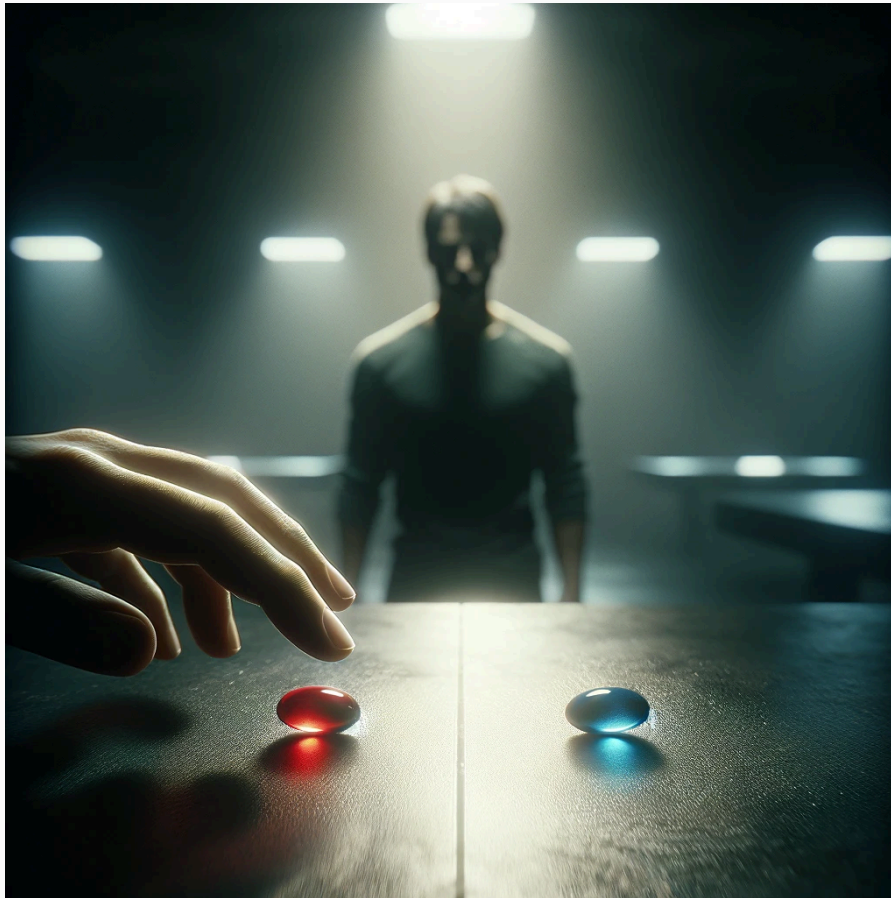
Red pill or blue pill

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 heatlh 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 $Y_i(0)$
- **SUTVA** Assumption
  - 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