

# **A framework for causal analysis**

## **Applied Microeconomics**

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# Does hospital treatment improve health?

- A "yes" Might seem obvious
- But: Infectious diseases, maltreatment / overtreatment might be worse than no treatment... (fancy health insurance that makes doctor rich + uncritical mind...)
- NHIS one of the most important studies at the intersection of health / social sciences in the U.S.
- Two questions might help us...

# Data: 2005 U.S. National Health Interview Survey

- Whether the respondent was a patient in a hospital overnight in the past 12 months (0 = No, 1 = Yes)
- The respondent's general health status (1 = Poor, 2 = Fair, 3 = Good, 4 = Very Good, 5 = Excellent)

## Cross-tabulated NHIS data

| Hospitalised | Sample Size | Mean Health Status | Std. Error |
|--------------|-------------|--------------------|------------|
| Yes          | 7,774       | 3.21               | 0.014      |
| No           | 90,049      | 3.93               | 0.003      |

# Defining Potential Outcomes

- Let  $\omega \in \Omega$  denote all relevant characteristics of an agent.
- There are no restrictions on  $\omega$  – heterogeneity can be of any kind.
- Let  $s \in \mathcal{S}$  denote the (treatment, policy) state. Focus on  $\mathcal{S} = 0, 1$  for now.
- The potential outcomes of agent  $\omega$  are denoted by:

$$Y(0; \omega), Y(1; \omega)$$

# Treatment Effects

The individual-level treatment effect is defined as:

$$Y(1; \omega) - Y(0; \omega)$$

This is also known as the individual-level causal effect or the Marshallian c.p. effect.

# The Evaluation Problem

At any point in time, for any given individual  $\omega$ , we observe either  $Y(0; \omega)$  or  $Y(1; \omega)$ . That is, we observe somebody with characteristics  $\omega$  either in state  $s = 0$  or in state  $s = 1$ .

There is no way to construct the unobserved quantity without further assumptions.

# Brief group discussion: OLS & PO

OLS assumptions:

- $Y = \alpha + \beta \cdot S + \epsilon$
- $E[\epsilon|S] = 0$
- Regularity conditions

How does this relate to the potential outcome framework?

Don't discuss potential violation of the assumptions!

# Assignment Mechanisms

Let  $\tau \in \mathbb{T}$  be an assignment rule mapping types to treatments:  $\tau : \omega \rightarrow \mathcal{S}$ .

## **Group discussion: Assignment mechanisms**

1. Describe the most plausible (in your view) assignment mechanism which generated the NHIS data.
2. Try to think in a very abstract way: What are typical assignment mechanisms out there?