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Potential Outcomes

Day 1, Session 1

We want to know the causal effect of a project on its beneficiaries

Job training on earnings and employment

Class size on test scores

School leadership on teacher morale

Teacher qualifications on student outcomes

Potential outcomes - i

Consider an indicator for a potential beneficiary, Di

D tells us whether there is a project, or a "treatment"

The subscript i denotes a single individual who is either treated or not treated

Di = 1 means participation in a project (beneficiary)

Di = 0 means no participation in a project

Potential outcomes - ii

Consider an indicator for the outcome of a potential beneficiary, Yi

Y1i is the outcome after project participation

Y0i is the outcome without any project

Note that Y1 and Y0 denote *possibilities* for the *same person*, unit i !

Potential outcomes - iii

The effect of the project (treatment effect) on person i is the difference between the two potential outcomes

Treatment effect = Y1i - Y0i

This is the difference in potential outcomes for the *same person*

A person participates in a project, and then goes back in time and does not participate in the project

Potential outcomes - iv

But how can one person be both treated and untreated?

In the real world, person i experiences one of the potential outcomes, but not both

If Di = 1, the potential outcome of Yi becomes Y1i in fact and the potential outcome of Y0i is unobserved

If Di = 0, the potential outcome of Yi becomes Y0i in fact and the potential outcome of Y1i is unobserved

The fundamental problem of causal inference - i

This is the fundamental problem of causal inference:

We observe only one outcome, but we need both outcomes to describe the effect of the project

We refer to the outcome that didn't happen as the *counterfactual*, or what would have happened in the absence of the project

Researchers sometimes refer to impact evaluation as a "missing data problem", because we are missing two pieces of information about what happens with or without the treatment