GEQ1000

Economics

(Social Science)

1.2 Causal Inference

Causation

Do changes in *one variable*, X, *cause changes in another variable*, Y?

Program: Reducing class size

If  is reduced to 

What happens to test scores?

Important: taxpayer dollars at stake!

Program evaluation

Policy Intervention = “Treatment”

“Treatment effect” = *effect* of *treatment* on *outcome* of interest

Program evaluation

If  is reduced to 

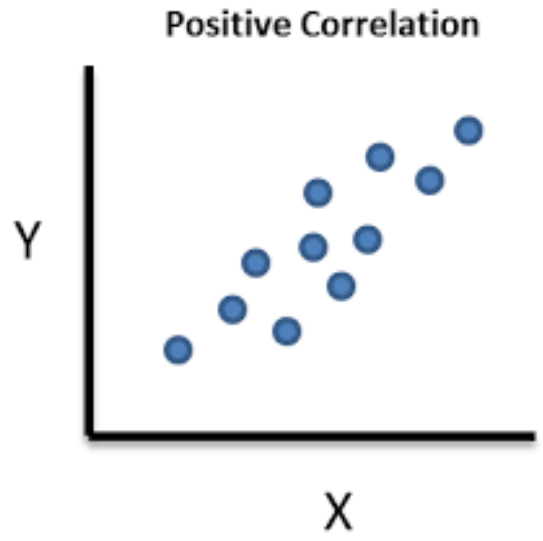
What happens to test scores?

Treatment variable (X) = class size

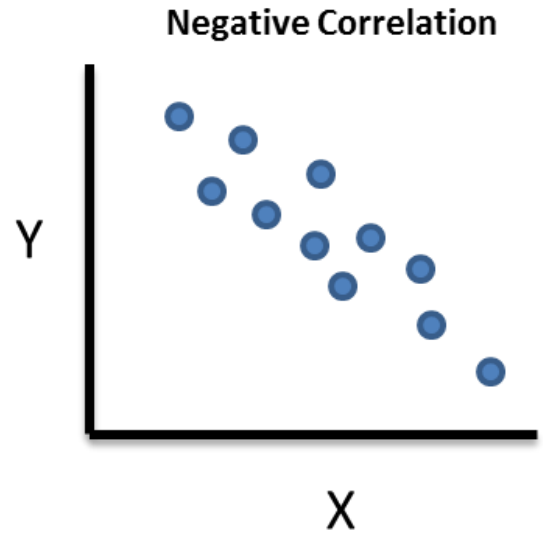
Outcome variable (Y) = students' test scores

Correlations in observational studies

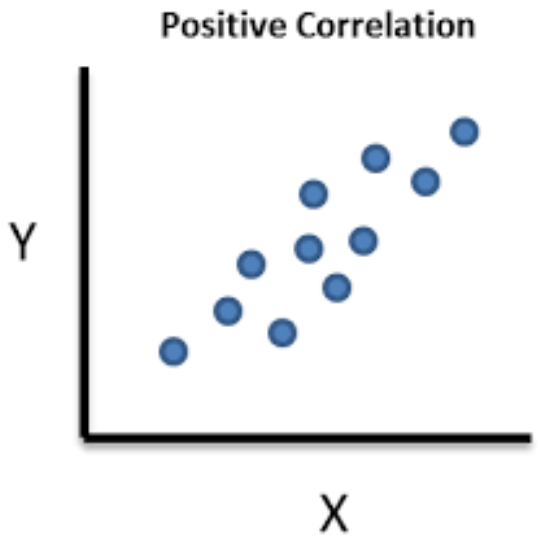
Positive correlation: larger class size goes together with higher scores



Negative correlation: smaller class size goes together with higher scores



Correlation does not equal causation



$\neq$

$X \rightarrow Y$

Correlation between X and Y: 3 explanations

Causation

$$X \longrightarrow Y$$

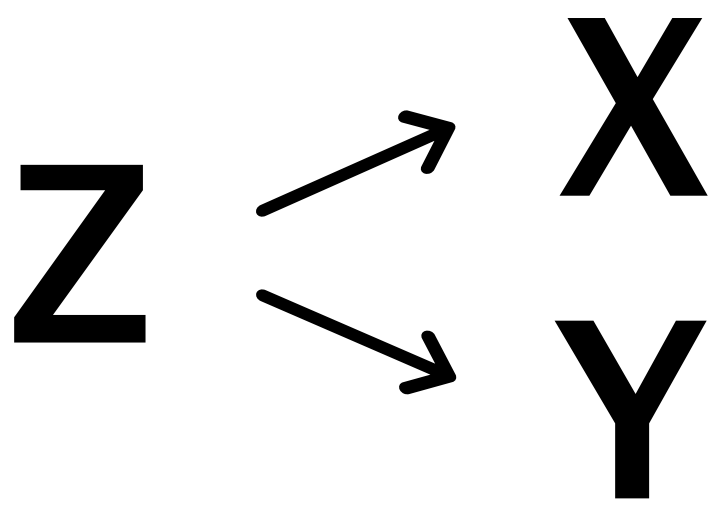
Correlation between X and Y: 3 explanations

Reverse Causation

$$Y \longrightarrow X$$

Correlation between X and Y: 3 explanations

Confounder Z



Regression can help, but only so much

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \epsilon$$

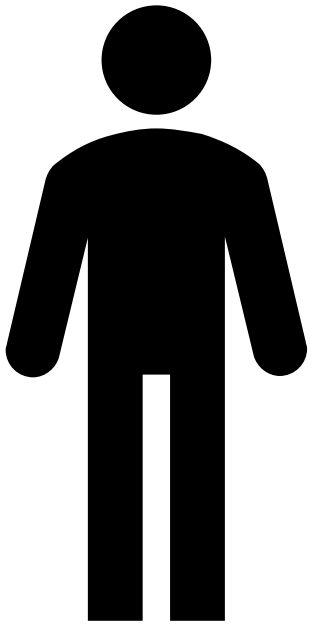
Outcome variable

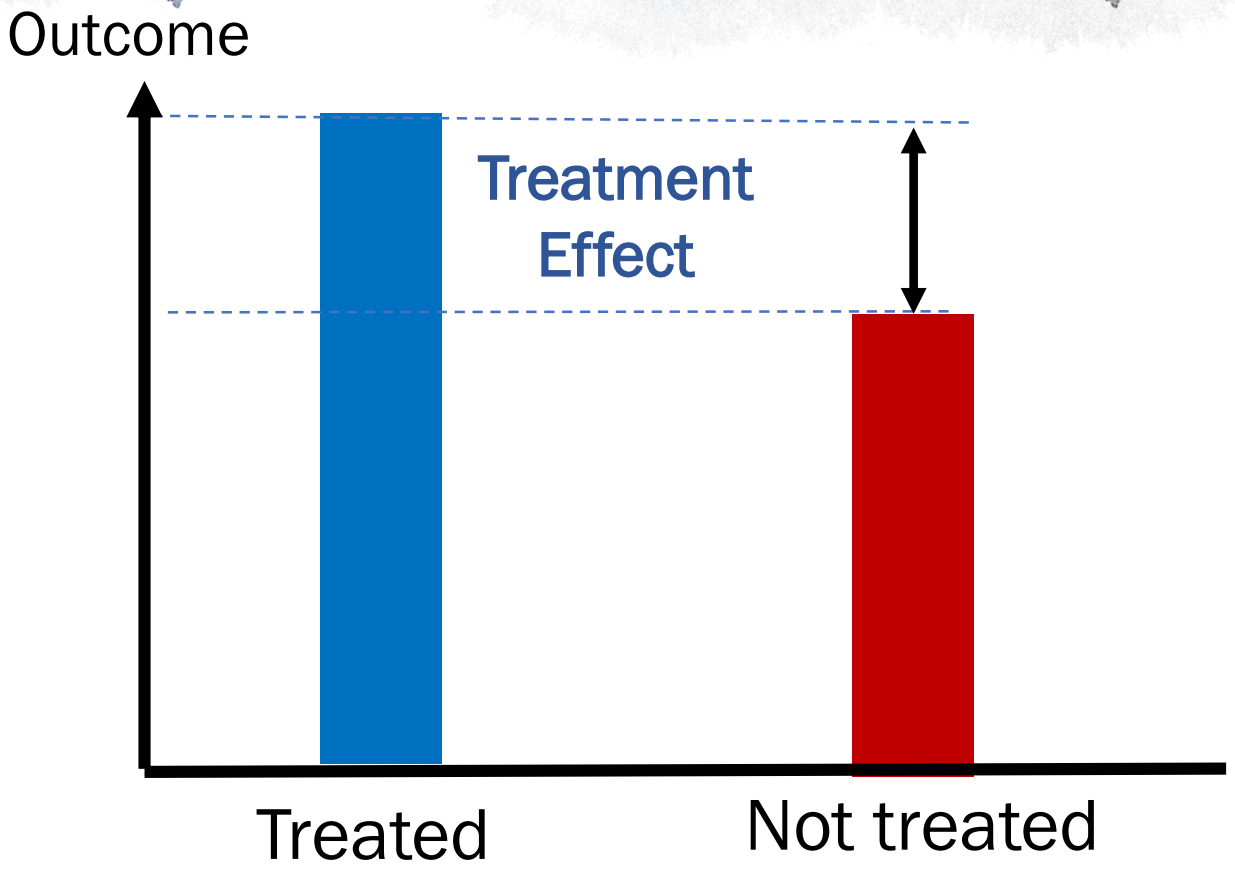
Treatment variable

Confounders

The Fundamental Problem

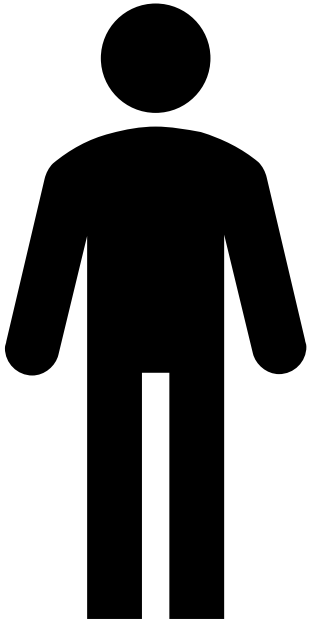
Observe the same person in both situations

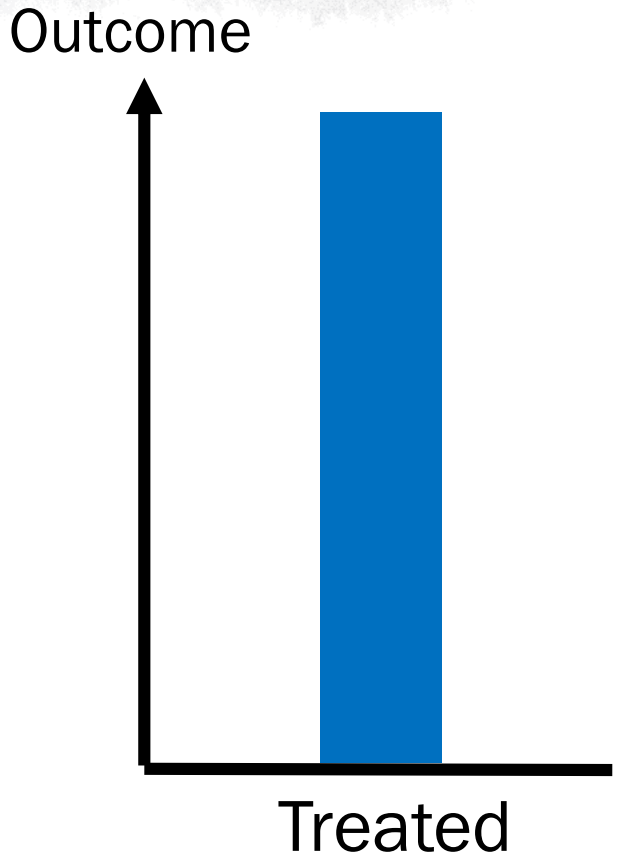




The Fundamental Problem

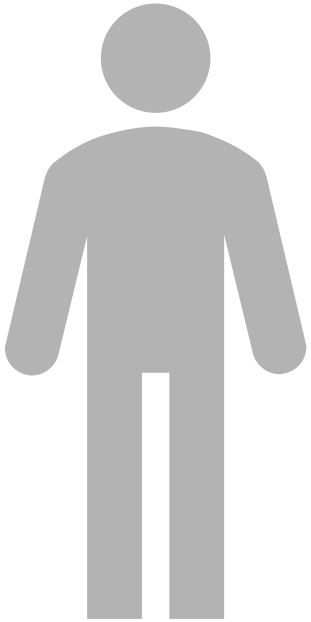
But we can only observe the person being treated

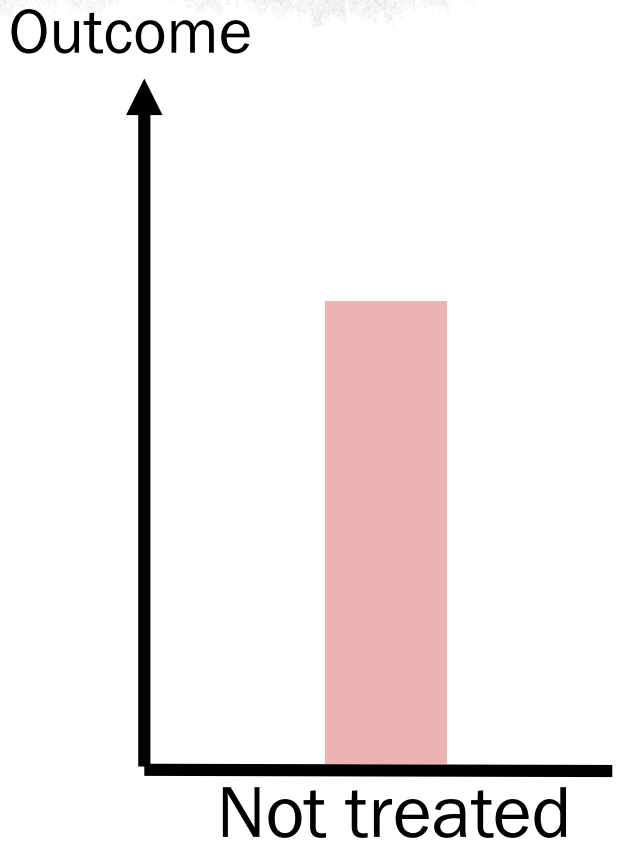




The Fundamental Problem

We do not observe the **counterfactual**





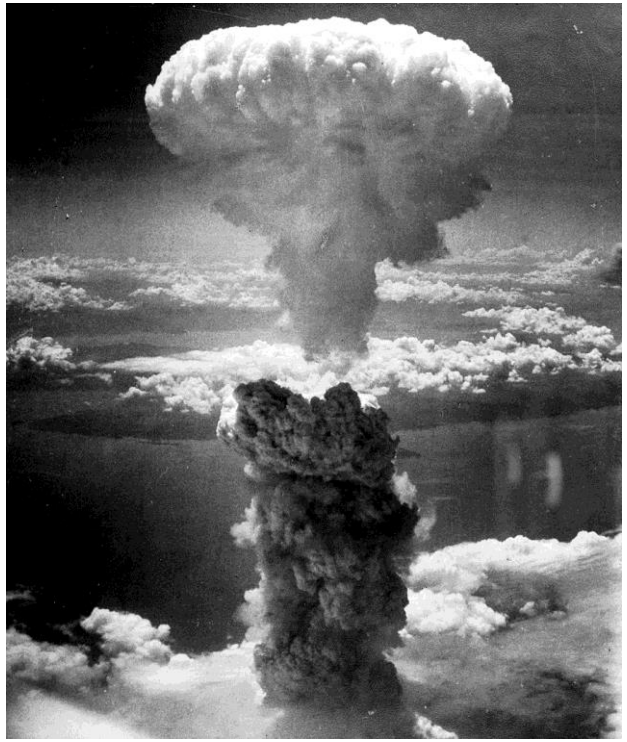
Find substitutes for the Counterfactual

Since we cannot observe the counterfactual, we need to find *substitutes* for it.

This entails making *identification assumptions*, because they allow us to potentially identify the treatment effect.

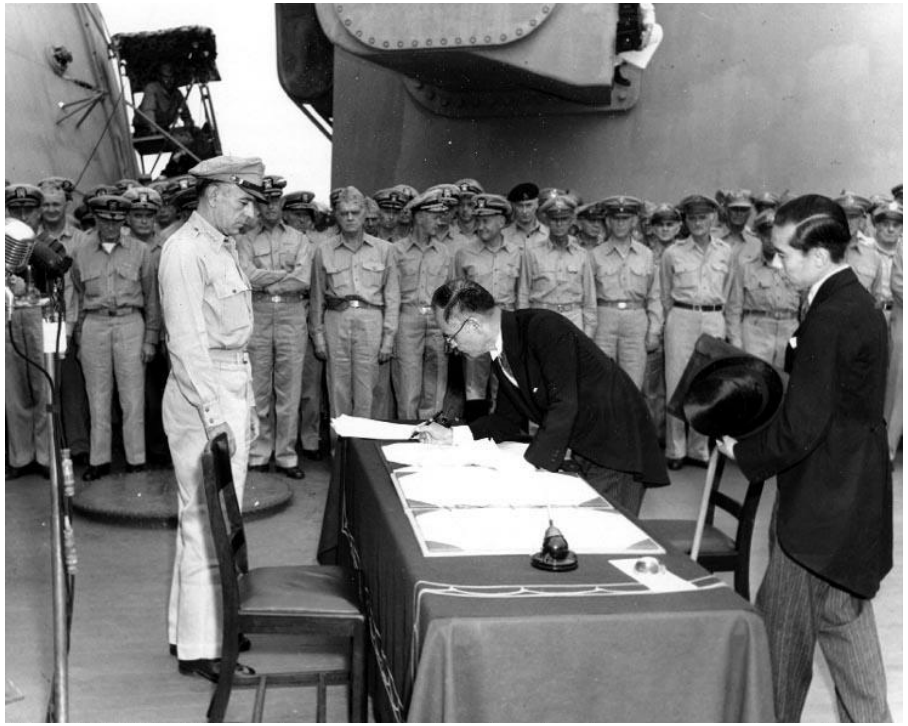
Counterfactuals in Qualitative Studies

If



didn't happen,

would



have happened?

Experiments for inanimate subjects

Wash with Brand X

Brand X

Brand Y

Wash with Brand Y

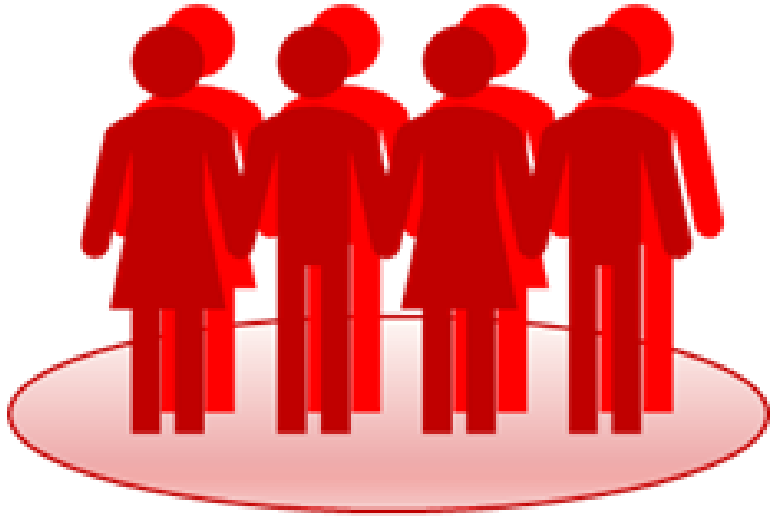
Even “identical twins” are not truly identical

Photo by Richard Reid

Groups as a solution to the problem

Treated

Not Treated



Next up:
Randomized Trials