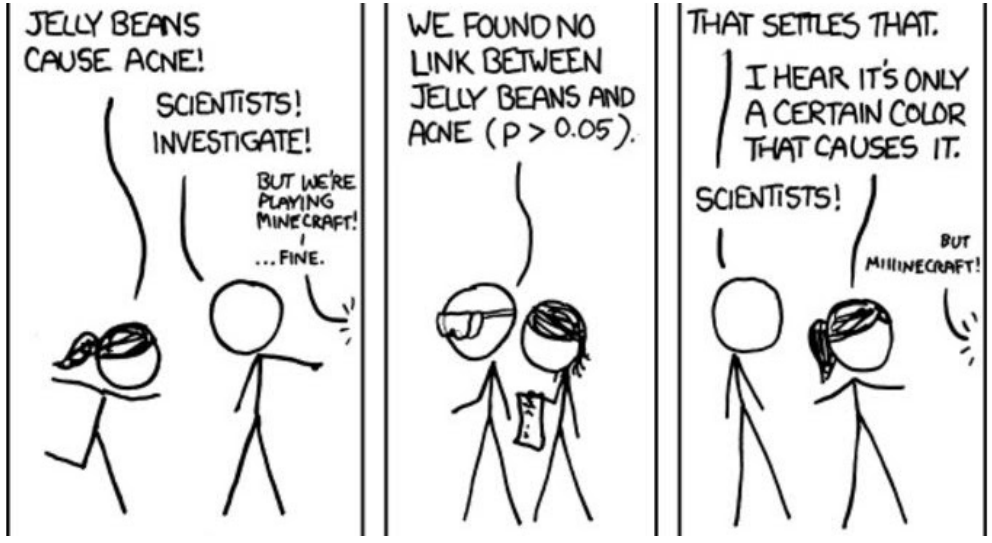
STA 235H - Randomized Controlled Trials I

Fall 2022

McCombs School of Business, UT Austin

Continuing our path of Causal Inference



Randomized Controlled Trials:

- Assumptions: The power of randomization
- Design: What should we consider?
- Limitations: Gold Standard?

The Magic of Randomization

The Fundamental Problem of Causal Inference

- Remember that we can only see one potential outcome
  - E.g. if Z is binary, either $Y(0)$ OR $Y(1)$

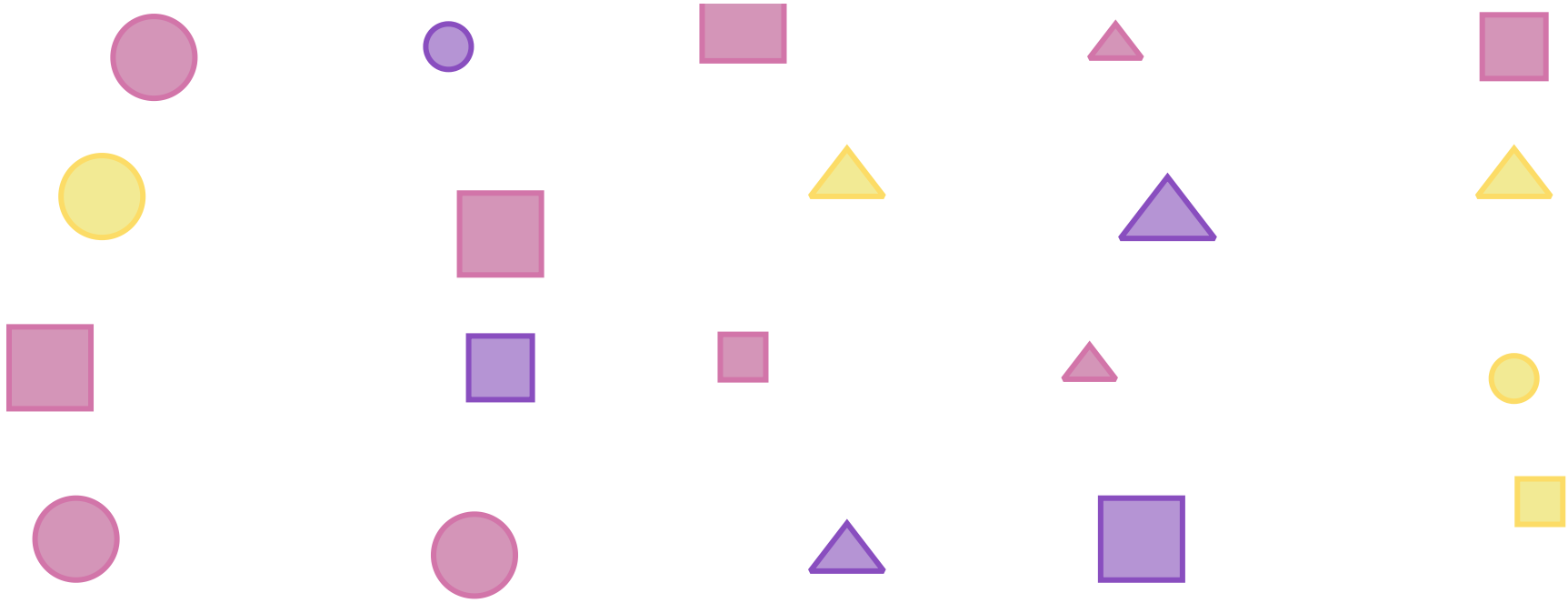
Fundamental Problem of Causal Inference

- Need for the ignorability assumption

$$Y(z) \perp\!\!\!\perp Z \quad \forall\, z \in Z$$

- Most times, the ignorability assumption doesn't hold

The problem with self-selection



Play

The power of randomization

- One way to make sure the ignorability assumption holds is to do it by design:

Randomize the assignment of Z

i.e. Some units will randomly be chosen to be in the treatment group and others to be in the control group.

What does randomization buy us?

The power of randomization

- One way to make sure the ignorability assumption holds is to do it by design:

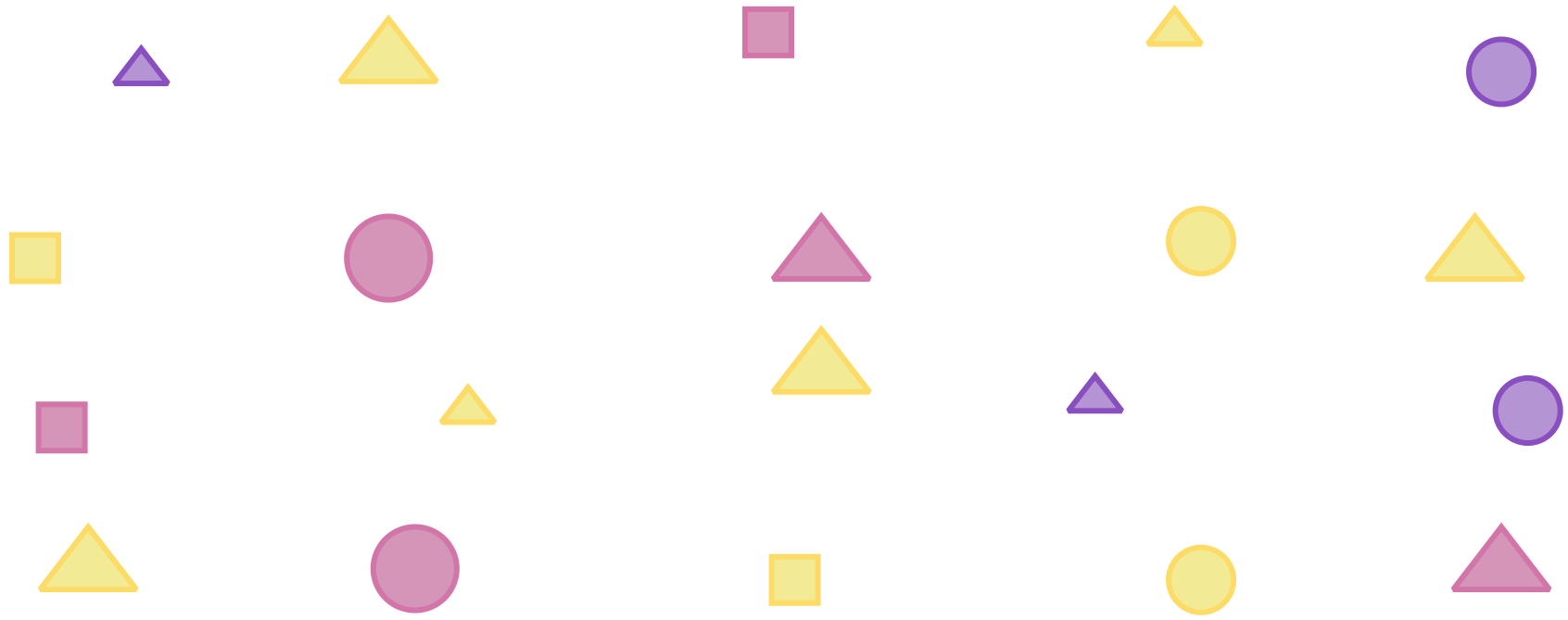
Randomize the assignment of Z

i.e. Some units will randomly be chosen to be in the treatment group and others to be in the control group.

What does randomization buy us?

No (systematic) selection on observables OR unobservables

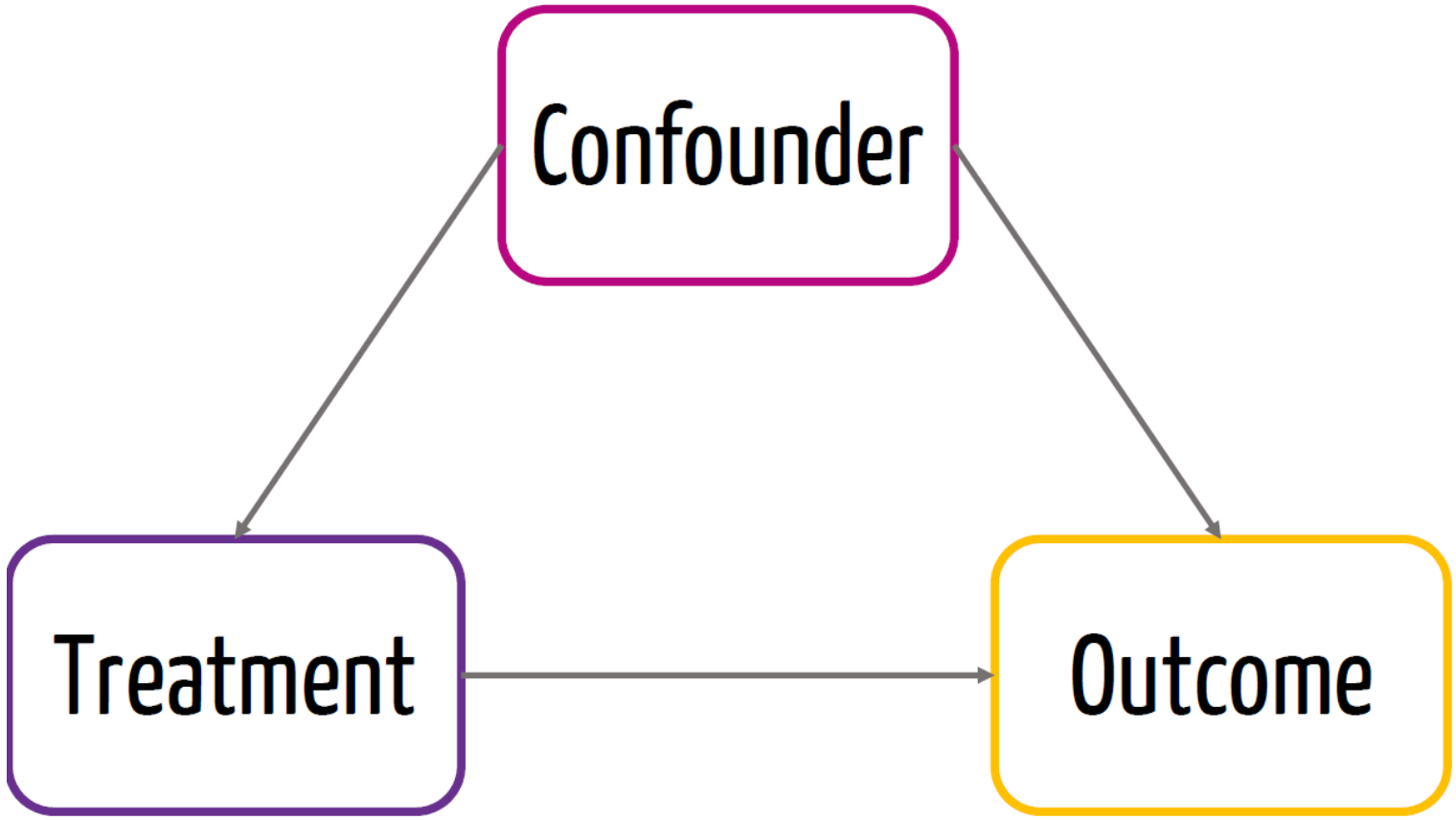
Randomization of z



Play

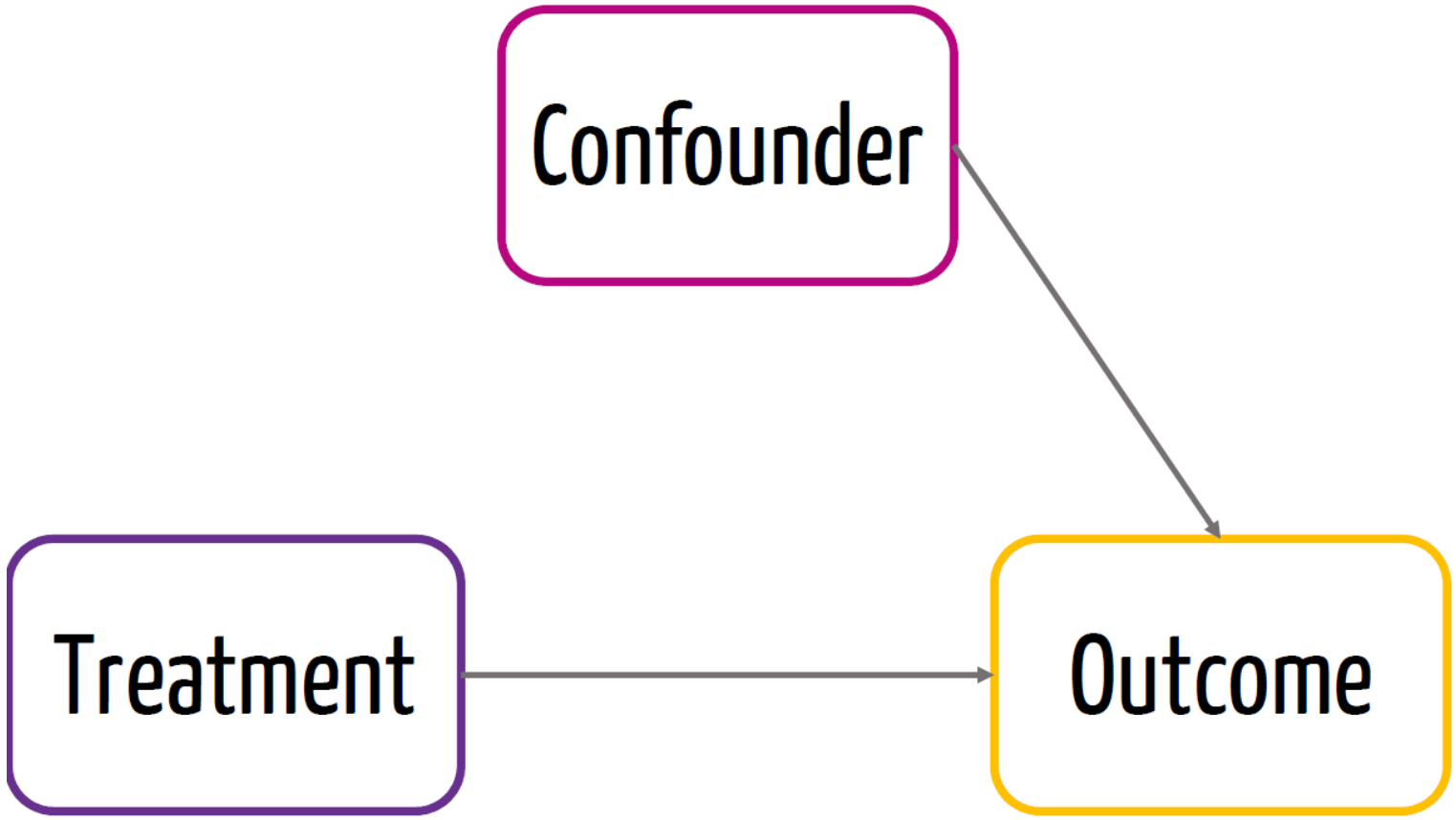
Non-Experimental Causal Graph

- Confounder is a variable that affects both the treatment AND the outcome



Experimental Causal Graph

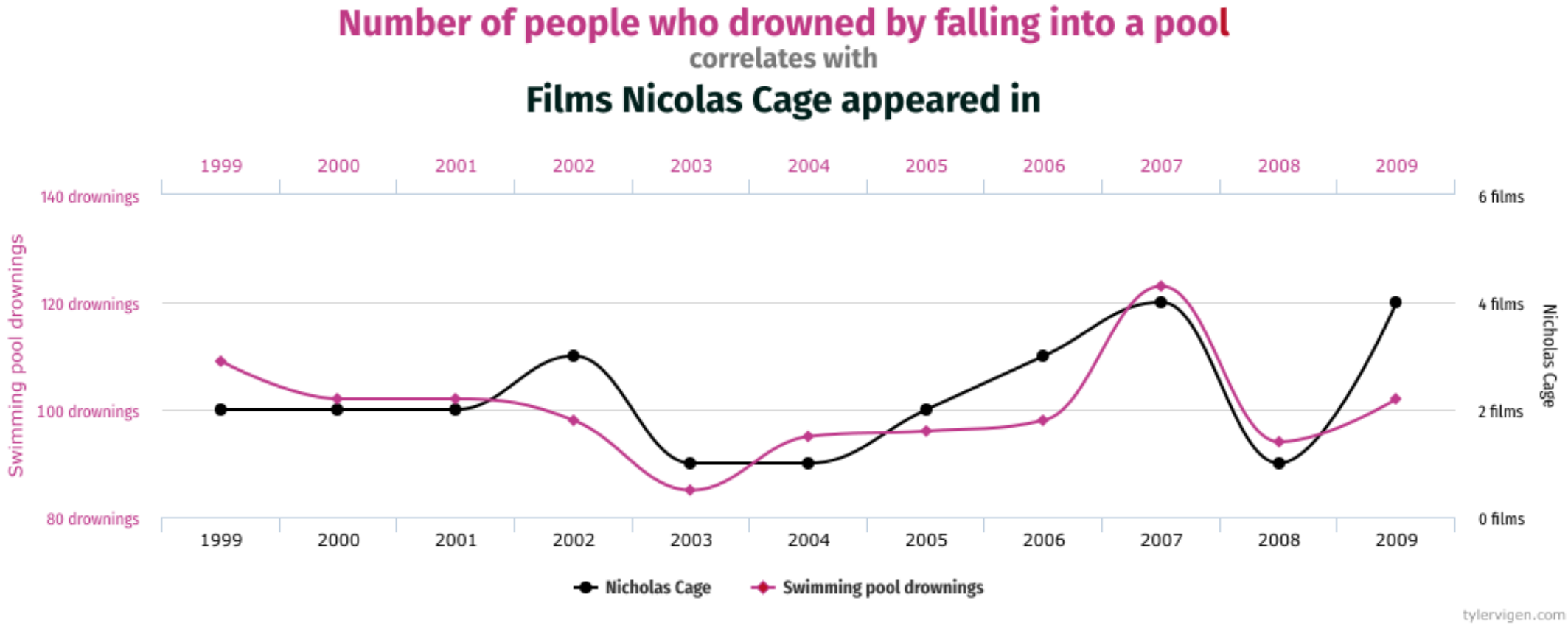
- Due to randomization, we know that the treatment is not affected* by a confounder



If I randomize treatment allocation...

Can the treatment be potentially correlated with a confounder?

Just by chance!



Definition: Identification Strategy

According to Keele (2015):

"A research design intended to solve the identification problem"

"Consists of an assumption or set of assumptions that will identify the causal effect of interest"

RCTs: The Gold Standard

The New York Times

Nobel Economics Prize Goes to Pioneers in Reducing Poverty

Three professors, Abhijit Banerjee and Esther Duflo, both of M.I.T., and Michael Kremer of Harvard, were honored.

Abhijit Banerjee and Esther Duflo, both of M.I.T., and Michael Kremer of Harvard University won the Nobel Memorial Prize in Economic Sciences. Jonathan Nackstrand/Agence France-Presse — Getty Images

The Nobel went to economists who changed how we help the poor. But some critics oppose their big idea.

Randomized controlled trials and the debate over them, explained.

By Kelsey Piper | Dec 11, 2019, 9:00am EST

SHARE

The Laureates of The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel (L-R) Michael Kremer, Esther Duflo and Abhijit Banerjee pose after their Nobel Lectures at Stockholms University in Stockholm, Sweden, on December 8, 2019. | Photo by CHRISTINE OLSSON/TT News Agency/AFP via Getty Images

How to analyze RCTs?

How to analyze RCTs?

Easy! (Statistically speaking)

How to analyze RCTs?

Easy! (Statistically speaking)

1) Check for balance

How to analyze RCTs?

Easy! (Statistically speaking)

1) Check for balance

2) Calculate difference in sample means between treatment and control group

Let's see an example

Are Emily and Greg More Employable Than Lakisha and Jamal?

- Actual field experiment conducted in Boston and Chicago.
- Send out resumes with randomly assigned names:
  - Female- and male-sounding names.
  - White- and African American-sounding names
- Measure whether applicant was called back

Let's go to R

Next class

- Finish with randomized controlled trials:
    - How do we assign treatment randomly in practice?
    - Stratification
    - Limitations of RCTs.
- Selection on observables
- The wonderful world of matching!

References

- Angrist, J. and S. Pischke. (2015). "Mastering Metrics". *Chapter 1.*
- Heiss, A. (2020). "Program Evaluation for Public Policy". *Class 7: Randomization and Matching, Course at BYU*
- Imbens, G. and D. Rubin. (2015). "Causal Inference for Statistics, Social, and Biomedical Sciences: An Introduction". *Chapter 1*