

**POLI 30 D: Political Inquiry**  
**Professor Umberto Mignozzetti**

Lecture 20 | Do's and dont's in Political  
Methodology  
(Based on BdM and Fowler's book, Zack  
Binney, and others)

## Before we start

### Announcements:

- ▶ Quizzes and Participation: On Canvas.
- ▶ GitHub page:  
<https://github.com/umbertomig/POLI30Dpublic>
- ▶ Piazza forum: Not sure what the link is. Ask your TA!
- ▶ Note to self: Turn on the mic!

## Before we start

**Recap:** We learned:

- ▶ The definitions of theory, scientific theory, and hypotheses.
- ▶ Data, datasets, variables, and how to compute descriptive stats.
- ▶ Causal effect, treatments, outcomes, and randomization.
- ▶ Strengths and weaknesses of observational and experimental studies.
- ▶ Probability, the law of large numbers, central limit theorem, and their use in hypothesis testing.

**Great job!**

- ▶ Do you have any questions about these contents?

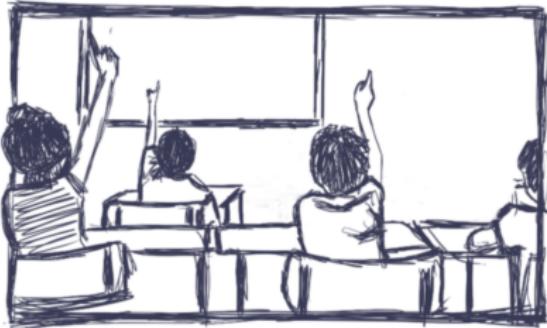
## Plan for Today

- Hypothesis Testing
- Denominators
- Regression to the mean
- Behavior Adaptation
- Reporting Bias and P-Hacking
- Dangers of Uncritical Analyses

# Do Small Classes Improve Math Scores?

# Do Small Classes Improve Math Scores?

TREATMENT: SMALL CLASS



CONTROL: REGULAR-SIZE CLASS



(Based on Mosteller. 1995. "The Tennessee Study of Class Size in the Early School Grades," *Future of Children* 5 (2): 113–27.)

## Do Small Classes Improve Math Scores?

- ▶ The data come from a randomized experiment conducted in Tennessee:
  - ▶ Students were randomly assigned to attend either a small class or a regular-size class
- ▶ To estimate the average causal effect, what estimator can we use?

# 0. Get Ready for the Analysis

- ▶ Load the data and create any variables needed

```
## load and look at the data
star <- read.csv("https://raw.githubusercontent.com/umbertomig/POLI30Dpublic/master/stars.csv")

## create treatment variable
star$small <- # stores return values as new variable
  ifelse(star$classtype=="small", # logical test
         1, # return value if true
         0) # return value if false
```

# 0. Get Ready for the Analysis

- ▶ Look at the data

```
## make sure the variable was created correctly
head(star) # shows first observations
##   classtype reading math graduated small
## 1    small     578   610        1      1
## 2  regular     612   612        1      0
## 3  regular     583   606        1      0
## 4    small     661   648        1      1
## 5    small     614   636        1      1
## 6  regular     610   603        0      0
```

- ▶ The treatment variable is?
- ▶ The outcome variable is?
- ▶ What is the outcome's unit of measurement?

# 1. What Is the Estimated Average Treatment Effect?

- ▶ Fit a linear model so that the estimated slope coefficient is equivalent to the difference-in-means estimator.
- ▶ In this case, the fitted line is:  $\widehat{math} = \widehat{\beta}_0 + \widehat{\beta}_1 small$
- ▶ R code?

```
mod <- lm(math ~ small, data = star) # fits linear model
mod # shows the contents of the object
##
## Call:
## lm(formula = math ~ small, data = star)
##
## Coefficients:
## (Intercept)      small
##           628.84        5.99
```

## 1. What Is the Estimated Average Treatment Effect?

- ▶  $\hat{\beta}_1 = 5.99$
- ▶ Direction, size, and unit of measurement of the effect?
  - ▶ An increase of about 6 (or 5.99) points

# 1. What Is the Estimated Average Treatment Effect?

## CONCLUSION STATEMENT

Assuming that [the treatment and control groups are comparable] (a reasonable assumption because ...), we estimate that [the treatment] [increases/decreases] [the outcome] by [size and unit of measurement of the effect], on average.

## 1. What Is the Estimated Average Treatment Effect?

- ▶ Assuming that students who attended a small class were comparable to students who attended a regular-size class (a reasonable assumption because the data come from a randomized experiment), we estimate that attending a small class increases math test scores by about 6 points, on average.

## 2. Is the Effect Statistically Significant?

- ▶ Is the average treatment effect statistically distinguishable from zero at the population level?
  1. Specify null and alternative hypotheses
- ▶  $H_0: \beta_1 = 0$  (attending a small class has no average causal effect on math test scores at the population level)
- ▶  $H_1: \beta_1 \neq 0$  (attending a small class either increases or decreases math test scores at the population level)

## 2. Is the Effect Statistically Significant?

- R computes the coefficient and the p-value by running **summary()**:

```
summary(mod)
##
## Call:
## lm(formula = math ~ small, data = star)
##
## Residuals:
##     Min      1Q  Median      3Q     Max 
## -119.827 -27.585  -0.827   26.163  145.163 
## 
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)    
## (Intercept) 628.837    1.476  426.09 < 2e-16 ***
## small        5.990     2.178    2.75  0.00604 ** 
## ---        
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 
## 
## Residual standard error: 38.74 on 1272 degrees of freedom
## Multiple R-squared:  0.005911, Adjusted R-squared:  0.00513 
## F-statistic: 7.564 on 1 and 1272 DF,  p-value: 0.006039
```

## 2. Is the Effect Statistically Significant?

- ▶ Is the effect statistically significant at the 5% level?

```
summary(mod)
##
## Call:
## lm(formula = math ~ small, data = star)
##
## Residuals:
##       Min     1Q   Median     3Q    Max
## -119.827 -27.585  -0.827  26.163 145.163
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 628.837     1.476 426.09 < 2e-16 ***
## small        5.990      2.178    2.75  0.00604 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 38.74 on 1272 degrees of freedom
## Multiple R-squared:  0.005911, Adjusted R-squared:  0.00513
## F-statistic: 7.564 on 1 and 1272 DF, p-value: 0.006039
```

How not to be fooled with data?

# Denominators

# Denominators

NYT reported 28k COVID cases this week (Mar 13). Is that bad?

- ▶ Is our denominator San Diego county?
- ▶ Or is our denominator the entire country?

▶ This one is my favorite!



ZODIAC MOTHERFUCKER @ZODIAC\_MF · Oct 16  
WHATS THE CONNECTION?



7

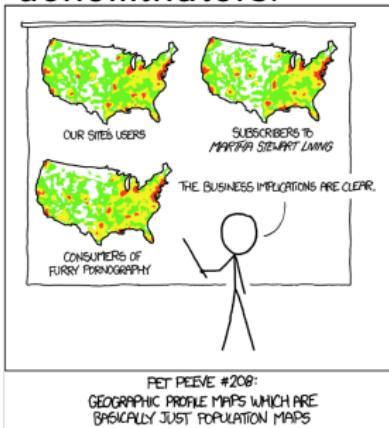
48

522

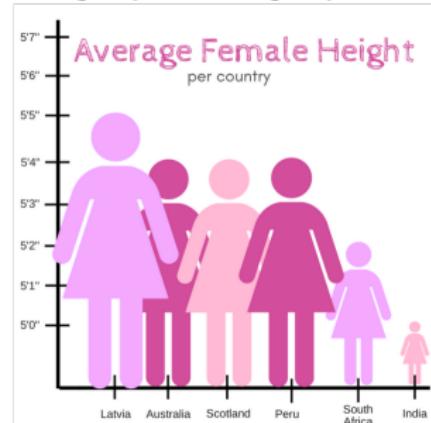


# Denominators

Another typical screw-up:  
forgetting that maps also  
have denominators.



Or the cousin of the  
Denominator problem:  
messing up with graph scales.



# Denominators

## Lesson:

- ▶ Always match the numerator with a denominator!
- ▶ When looking at a statistic, ask yourself:
  1. What question is this answering?
  2. Is it the one I *should* be answering?

Another one of my favorites:  
[Trump on Axios](#)



$$\frac{\text{death}}{\text{cases}} \neq \frac{\text{death}}{\text{population}}$$

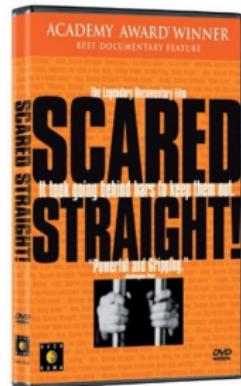
# Regression to the Mean

## Regression to the Mean

- ▶ Scared Straight
  - ▶ Took juvenile offenders on tours of prisons
- ▶ Initial studies chose the worst juvenile offenders.
- ▶ And participants reported less delinquency.
- ▶ What is the problem with this?
  - ▶ **Signal:** The kid could be really *bad*
  - ▶ **Noise:** Wrong place at the wrong time.

- ▶ Regression:

Outcome = Signal+Noise

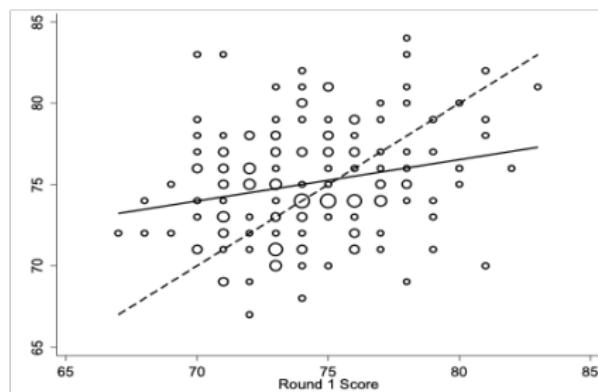


- ▶ Guess what? **Increased** the chance of delinquency (oops).

## Golf

## Regression to the Mean

- ▶ There is a correlation between rounds, but the regression coefficient is less than one!



A golf commentator might look at that and say:

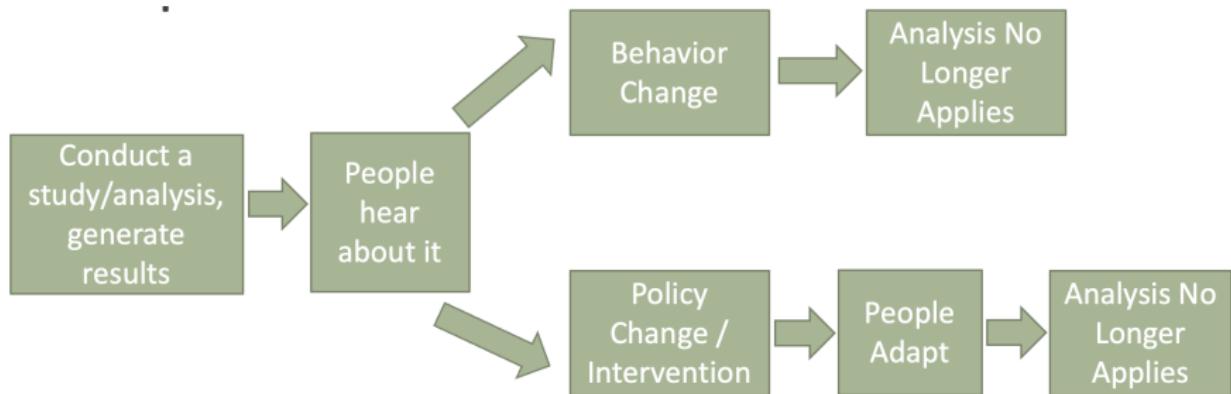
- ▶ Player X had a good first round but succumbed to the pressure.
- ▶ Player Y, who had a bad first round, realized she had nothing to lose.
- ▶ What do you think?

- ▶ This means that a person doing very well tends to do poorly later.

# Behavior Adaptation

# Behavior Adaptation

Any social scientist knows that: *people adapt...*



## Behavior Adaptation

### Window tax

- ▶ 1696: King William III needs to raise money.
- ▶ Wants a progressive tax: higher rates for those with more
- ▶ Analysis: rich people tended to have houses with more windows, so tax based on that!
- ▶ Windows are easily assessed from outside the home. Genius!

Well, maybe not that genius after all:



# Behavior Adaptation

## COVID-19 Close Contacts

- ▶ Paulding County, Georgia schools wanted to reopen in fall 2020.
  - ▶ CDC defines a *close contacts*: anyone spending 15+ minutes within 6 feet of an infected person
  - ▶ It is great to follow the rules.

Or maybe not:



Zachary Binney @zbinney\_nflini · Aug 9

To all my students: this is Goodhart's Law in the wild (when a measure becomes a target it's no longer a good measure).

It's really important that you learn it.



 Black  Aziz  aNANSI  @Freeyourmindkid : Aug 8

Per the Georgia Department of Health, schools are required to classify anyone who has been within 6 feet of a covid victim for 15 mins or more as a close contact. Theresa Lyons, who sits on the Paulding County BOE, suggested students change seats every 14 mins to get around this.

Show this thread

**Open Houses**

**SCHOOL BOARD**

July 29, Wednesday, 6:30 PM - 7:30 PM  
Virtual Zoom meeting via Microsoft Teams.  
Meeting ID: 861 4256 1222  
Passcode: 123456

July 29, Wednesday, 6:30 PM - 7:30 PM  
Virtual Zoom meeting via Microsoft Teams.  
Meeting ID: 861 4256 1222  
Passcode: 123456

**MEETINGS**

July 29, Wednesday, 6:30 PM - 7:30 PM  
Virtual Zoom meeting via Microsoft Teams.  
Meeting ID: 861 4256 1222  
Passcode: 123456

July 29, Wednesday, 6:30 PM - 7:30 PM  
Virtual Zoom meeting via Microsoft Teams.  
Meeting ID: 861 4256 1222  
Passcode: 123456

**Business Items**

03:14 384.1K views

**School Reopening Update**

03:14/20 07:54 PM  
Regular Meeting

# Reporting Bias and P-Hacking

## Reporting Bias and P-Hacking

Paul the Octopus:

- ▶ Predicted winners of games involving the German National Team
- ▶ Made prediction by choosing a box with a country's flag to eat from first
- ▶ 11/13, correct.  
Impressive!



## Reporting Bias and P-Hacking

Paul the Octopus:

- ▶ p-value =  
 $P(11 \text{ right}|\text{null}) +$   
 $P(12 \text{ right}|\text{null}) +$   
 $P(13 \text{ right}|\text{null}) =$   
 $0.011$
- ▶ Thus, significant!
- ▶ It is impressive that this octopus did this feat, but think a bit: does this mean that this octopus predicts the future?
- ▶ Well...

- ▶ Chance of at least one octopus doing this (one octopus world):  
 $1 - 0.967^1 = 0.033$
- ▶ Chance of at least one octopus doing this (two octopuses world):  
 $1 - 0.967^2 = 0.065$
- ▶ Chance of at least one octopus doing this (fifty octopuses world):  
 $1 - 0.967^{50} = 0.813$
- ▶ Guess what? In a world with many octopuses, one is going to do that.

# Reporting Bias and P-Hacking

And if you want to laugh and learn my favorite combo, check out [this video](#)



# Dangers of Uncritical Analyses

## Dangers of Uncritical Analyses

- ▶ Numbers: make things appear *precise*.
- ▶ But that is not true!
- ▶ How to not let numbers fool you (follow the [Calling BS](#) advice)
  1. Who is telling me this?
  2. How does she know it? Is she an expert on the topic?
  3. Why is she telling me this? What is this person trying to sell me? Does she have the incentive to lie to me?

# Summary

- ▶ Today's Class:
  - ▶ Interpret hypothesis testing
  - ▶ Denominators
  - ▶ Regression to the mean
  - ▶ Behavior Adaptation
  - ▶ Reporting Bias and P-Hacking
  - ▶ Dangers of Uncritical Analyses

Questions?

Thank you for the great quarter!