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?

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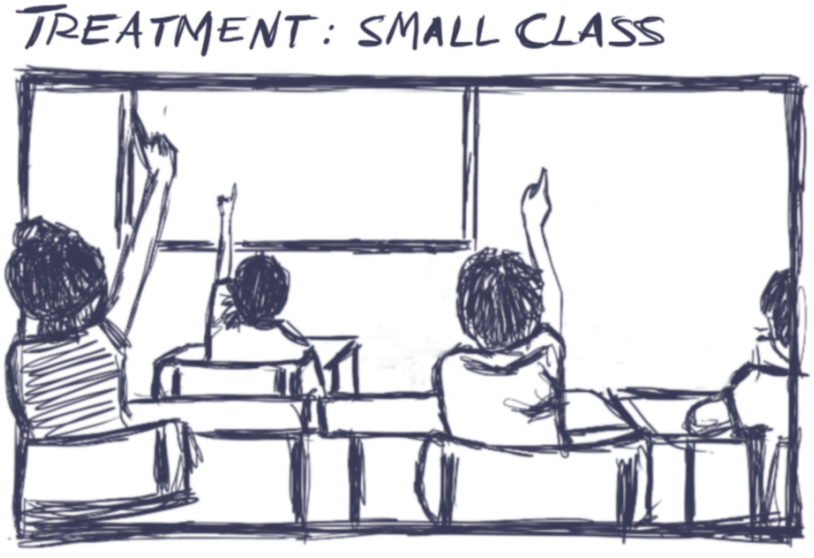

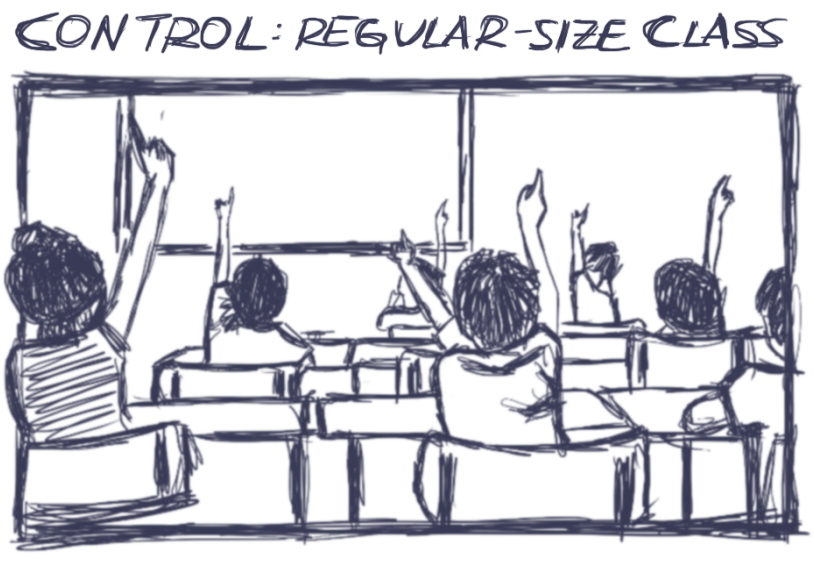

(Based on Mosteller. 1995."The Tennessee Study of Class Size in the Early School Grades," *Future of Children* 5 (2): 113–27.)

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/ma

## 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?

- $\widehat{\beta}_1 = 5.99$
- 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
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```

How not to be fooled with data?

Denominators

Denominators

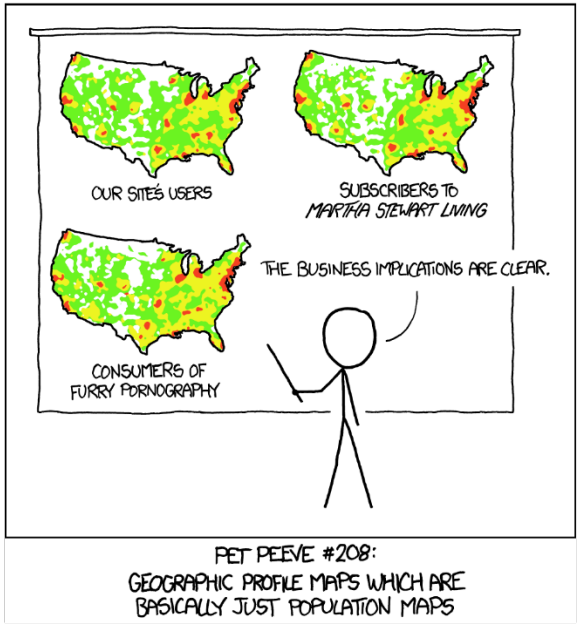
NYT reported 28k COVID cases this week (Mar 13). **Is that bad?**

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

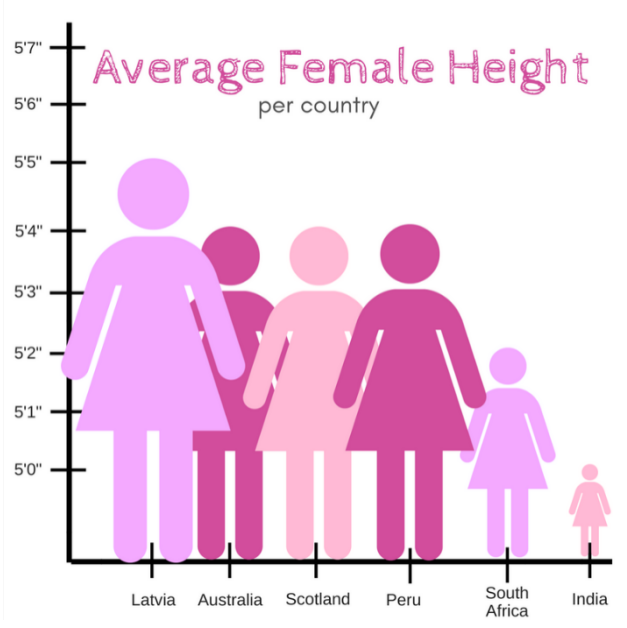
- This one is my favorite!

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

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

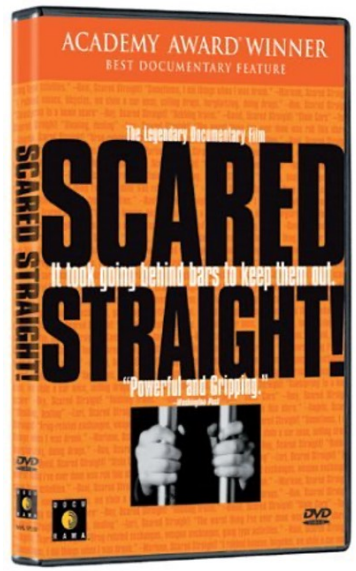
Regression to the Mean

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

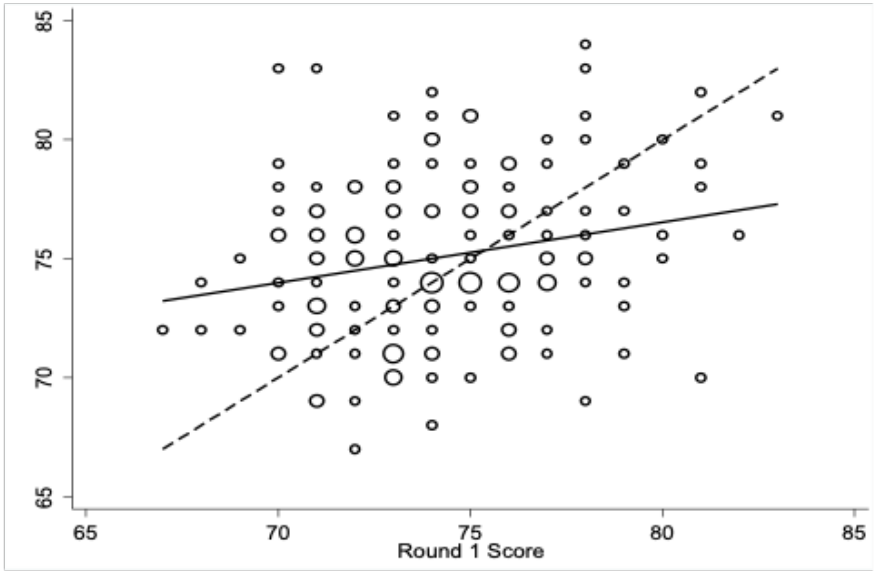


- Guess what? **Increased** the chance of delinquency (oops).

Regression to the Mean

Golf

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



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

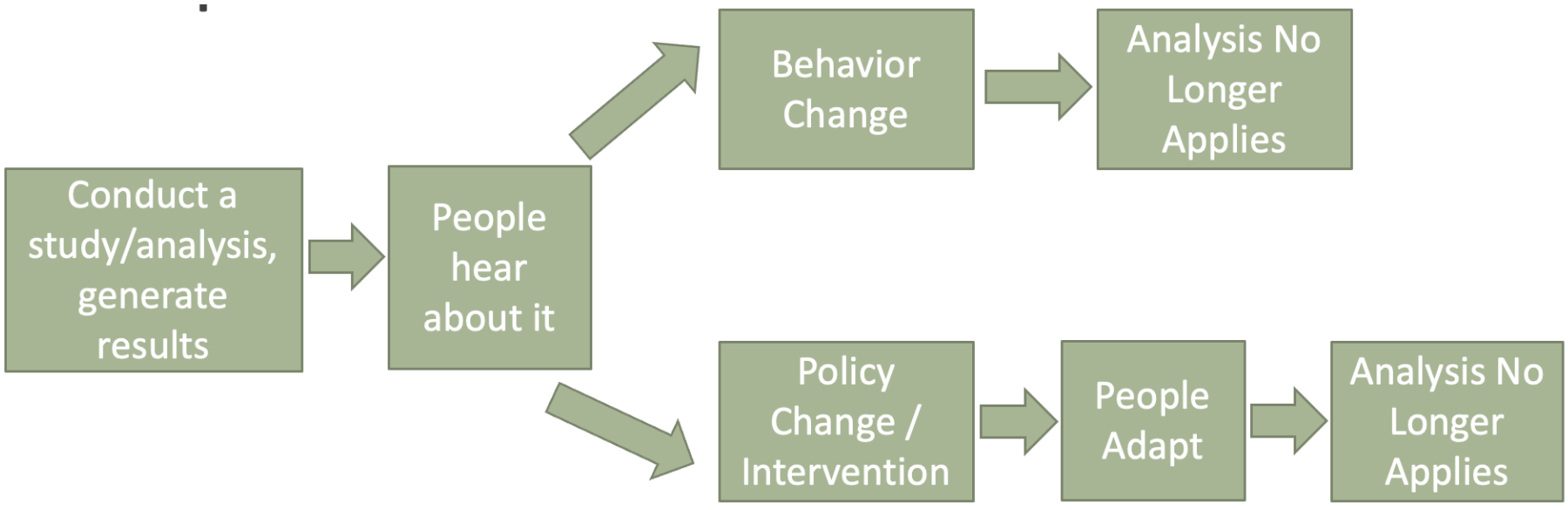
A golf commentator might look at that and say:

- 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?

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:

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!