Economics 103 – Statistics for Economists

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Lecture # 1

Racial Bias in Criminal Sentencing

Do you think there is racial bias in criminal sentencing? That is, do you think that judges may assign different sentences purely based on the race of the defendant?

(a) Yes

(b) No

This Course: Use Sample to Learn About Population

Population

Complete set of all items that interest investigator

Sample

Observed subset, or portion, of a population

Sample Size

of items in the sample, typically denoted n

Examples...

In Particular: Use Statistic to Learn about Parameter

Parameter

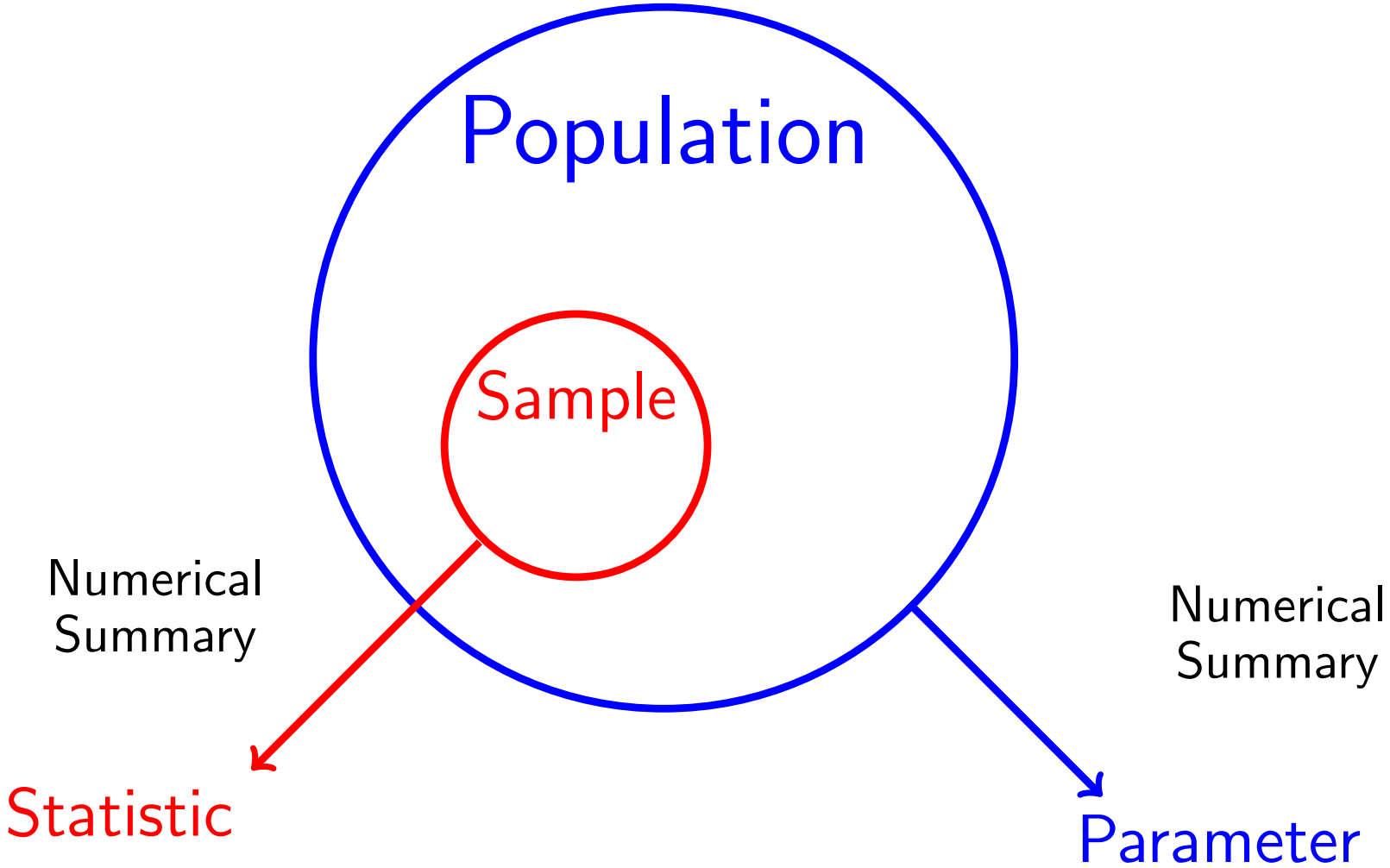
Numerical measure that describes specific characteristic of a population.

Statistic

Numerical measure that describes specific characteristic of sample.

Examples...

Essential Distinction You Must Remember!



The Field of Statistics

Descriptive Statistics

Graphical and numerical procedures to summarize data.

Inferential Statistics

Using data to estimate, predict, quantify uncertainty.

This Course

1. Descriptive Statistics: summarize data
   - Summary Statistics
   - Graphics
2. Probability: Population $\rightarrow$ Sample
   - deductive: "safe" argument
     - All ravens are black. Mordecai is a raven, so Mordecai is black.
3. Statistics: Sample $\rightarrow$ Population
   - inductive: "risky" argument
     - I've only every seen black ravens, so all ravens must be black.

Sampling and Nonsampling Error

In statistics we use samples to learn about populations, but samples almost never be *exactly* like the population they are drawn from.

1. Sampling Error
   - *Random* differences between sample and population
   - Cancel out on average
   - Decreases as sample size grows
2. Nonsampling Error
   - *Systematic* differences between sample and population
   - Does *not* cancel out on average
   - Does *not* decrease as sample size grows

NEW COLORED MAP OF POLAND IN THIS ISSUE

Showing the Territorial Changes Wrought by the War

The Literary Digest

(Title Reg. U.S. Pat. Off.)

New York FUNK & WAGNALLS COMPANY London

PUBLIC OPINION New York combined with The LITERARY DIGEST

Vol. 68, No. 8. Whole No. 1609 FEBRUARY 19, 1921 Price 10 Cents

Literary Digest – 1936 Presidential Election Poll

FDR versus Kansas Gov. Alf Landon

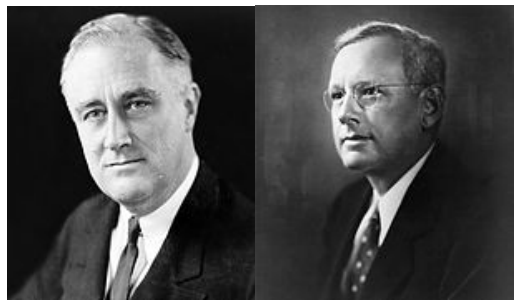
Huge Sample

Sent out over 10 million ballots; 2.4 million replies! (Compared to less than 45 million votes cast in actual election)

Prediction

Landslide for Landon: *Landonslide*, if you will.

Spectacularly Mistaken!



FDR versus Kansas Gov. Alf Landon

	Roosevelt	Landon
Literary Digest Prediction:	41%	57%
Actual Result:	61%	37%

What Went Wrong? *Non-sampling Error (aka Bias)*

Source: Squire (1988)

Biased Sample

Some units more likely to be sampled than others.

- Ballots mailed those on auto reg. list and in phone books.

Non-response Bias

Even if sample is unbiased, can't force people to reply.

- Among those who recieved a ballot, Landon supporters were more likely to reply.

In this case, neither effect *alone* was enough to throw off the result but together they did.

Randomize to Get an Unbiased Sample

Simple Random Sample

Each member of population is chosen strictly by chance, so that: (1) selection of one individual doesn't influence selection of any other, (2) each individual is just as likely to be chosen, (3) every possible sample of size n has the same chance of selection.

What about non-response bias?

"Americans Divided on Outlook for Next Generation"

Source: Gallup

PRINCETON, NJ – Americans are evenly divided about whether it is likely (49%) or unlikely (50%) that the next generation of youth in the country will have a better life than their parents. That is a slightly more positive assessment than in early 2011, when the slight majority, 55%, thought it was unlikely the next generation would achieve this goal.

Example of Sampling Error

"...evenly divided about whether it is likely (49%) or unlikely (50%) that the next generation of youth in the country will have a better life..."

> *Results for this USA Today/Gallup poll are based on telephone interviews conducted Dec. 14-17, 2012, with a random sample of 1025 adults, aged 18 and older, living in all 50 U.S. states and the District of Columbia. For results based on the total sample of national adults, one can say with 95% confidence that the maximum margin of sampling error is 4 percentage points.*

Quantifying Sampling Error

95% Confidence Interval for Poll Based on Random Sample

$$ME \approx 2\sqrt{P(1-P)/n}$$

We Report: $P \pm ME$

Survey to find effect of Polio Vaccine

Ask random sample of parents if they vaccinated their kids or not and if the kids later developed polio. Compare those who were vaccinated to those who weren't.

Would this procedure:

(a) Overstate effectiveness of vaccine

(b) Correctly identify effectiveness of vaccine

(c) Understate effectiveness of vaccine

Problem

Parents who vaccinate their kids may differ systematically from those who don't in *other ways* that impact child's chance of contracting polio!

Wealth is related to vaccination *and* whether child grows up in a hygenic environment.

Confounder

Factor than influences both outcomes and whether subjects are treated or not. Masks true effect of treatment.

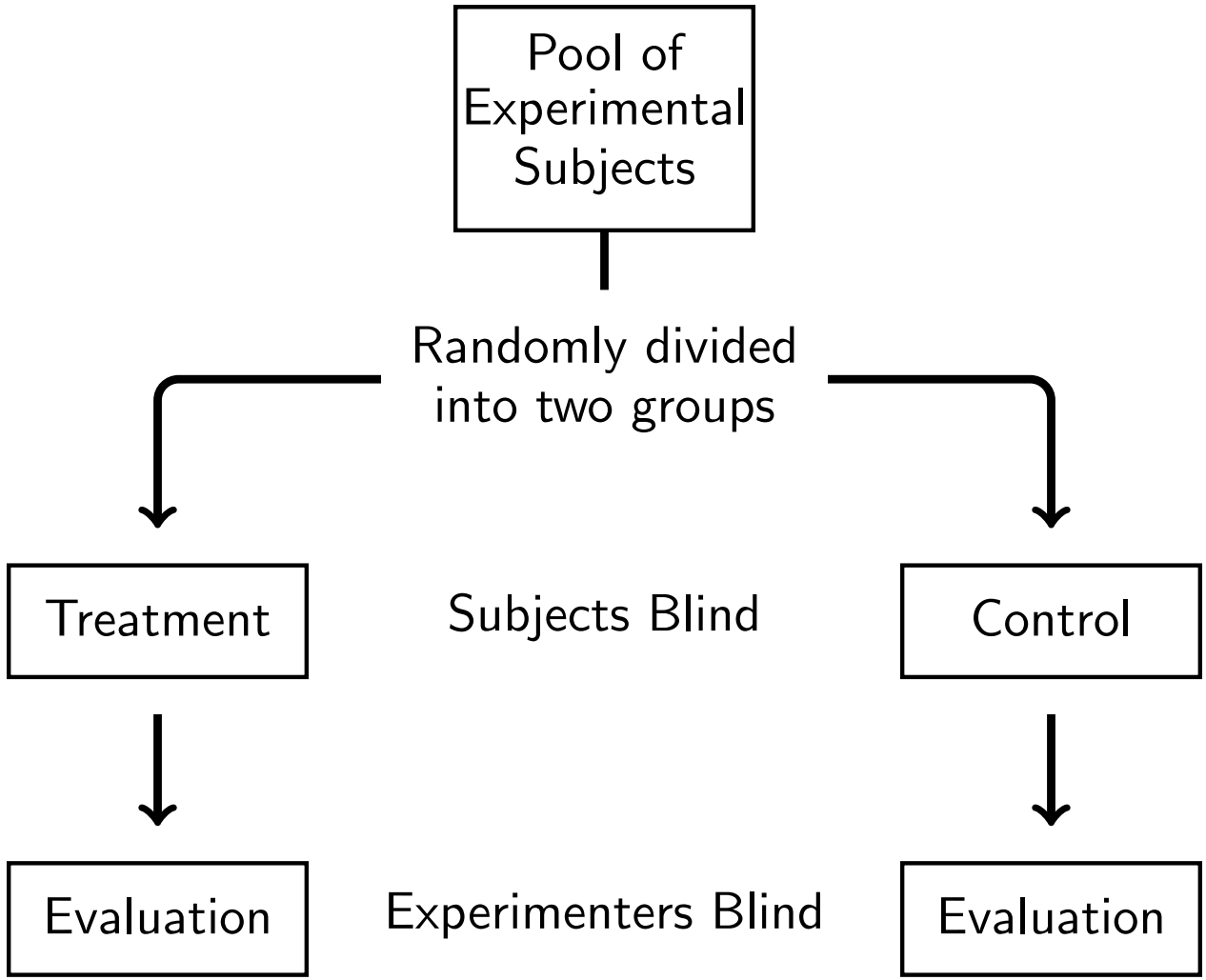
Experiment Using Random Assignment: Randomized Experiment

Treatment Group Gets Vaccine, Control Group Doesn't

Essential Point!

Random assignment *neutralizes* effect of all confounding factors: since groups are initially equal, on average, any difference that emerges must be the treatment effect.

Placebo Effect and Randomized Double Blind Experiment


Pool of Experimental Subjects
Randomly divided into two groups
Treatment
Subjects Blind
Control
Evaluation
Experimenters Blind
Evaluation

Gold Standard: Randomized, Double-blind Experiment

Randomized blind experiments ensure that on average the two groups are initially equal, and continue to be treated equally. Thus a fair comparison is possible.

Randomized, double-blind experiments are generally the best way to untangle causation.

Sugar Doesn't Make Kids Hyper

http://www.youtube.com/watch?v=mkr9YsmrPAI

Racial Bias in Sentencing

Could we use a randomized experiment to learn whether there is racial discrimination in criminal sentencing?

(a) Yes

(b) No

Randomization is not always possible, practical, or ethical.

Observational Data

Data that do not come from a randomized experiment.

It is very difficult to untangle cause and effect using observational data because of confounders.

Does Racial Discrimination Affect Criminal Sentencing?

Source: Penn Law Website

Social scientists have studied the issue for decades, but the seemingly simple question Does race affect sentencing? is surprisingly difficult to answer on the basis of empirical evidence.

Abrams explains: "The most straightforward way you might look at it is to say, Lets look at what sentences people get and see whether sentence length varies by race. If it looks like people of one race receive longer sentences than another, that might indicate that the criminal justice system is unfair. But the shortcoming to that approach is that its also possible that sentences can differ for many reasons; for example, its possible people of different races might have different criminal histories on average, and that could also explain the difference in sentence length"

Reducing Bias in Observational Studies

Regression

Technique that allows us to remove influence of confounders.

Works well if we can identify and gather data on all of them. But...

Does Racial Discrimination Affect Criminal Sentencing?

Source: Penn Law Website

To address that difficulty [confounders] social scientists have ... applied control variables to standard regression equations, a statistical method for identifying significant correlations between observed events. For instance, controlling for type of crime committed or for the defendants criminal history, researchers look to see whether the results of their equation still show racial disparity. "The problem with that is you still leave the possibility that any differences you see are due to unobserved variables, differences that might be there but that you can't control for" Abrams says. "That might be demeanor in the courtroom, it might be the quality of the attorney you can afford, it might be some details about the crime that you might not capture in your data. If those things are correlated with race, which they probably are, youre not going to know whether the effect you think youre detecting is really race or is something else"