Introduction to Telling Stories with Data

Author: Nicholas G Reich

This material is part of the **statsTeachR** *project*

Communicating ideas with evidence

What is a narrative? [From the OED]

An account of a series of events, facts, etc., given in order and with the establishing of connections between them; a narration, a story, an account.

What is data? [From Google: literally, "what is data"]

da·tum

/ˈdātəm,ˈdatəm/

noun

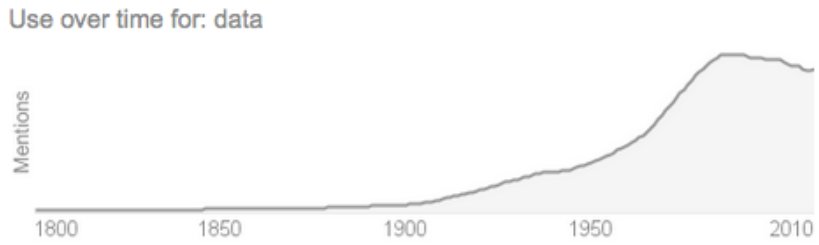
plural noun: **data**

1. a piece of information.
   - an assumption or premise from which inferences may be drawn.
2. a fixed starting point of a scale or operation.

Origin

LATIN	LATIN	
dare	datum	datum
give	something given	*mid 18th century*

mid 18th century: from Latin, literally 'something given,' neuter past participle of *dare* 'give.'



FiveThirtyEight Economics

TRANSPORTATION | 4:44 PM | OCT 13, 2015

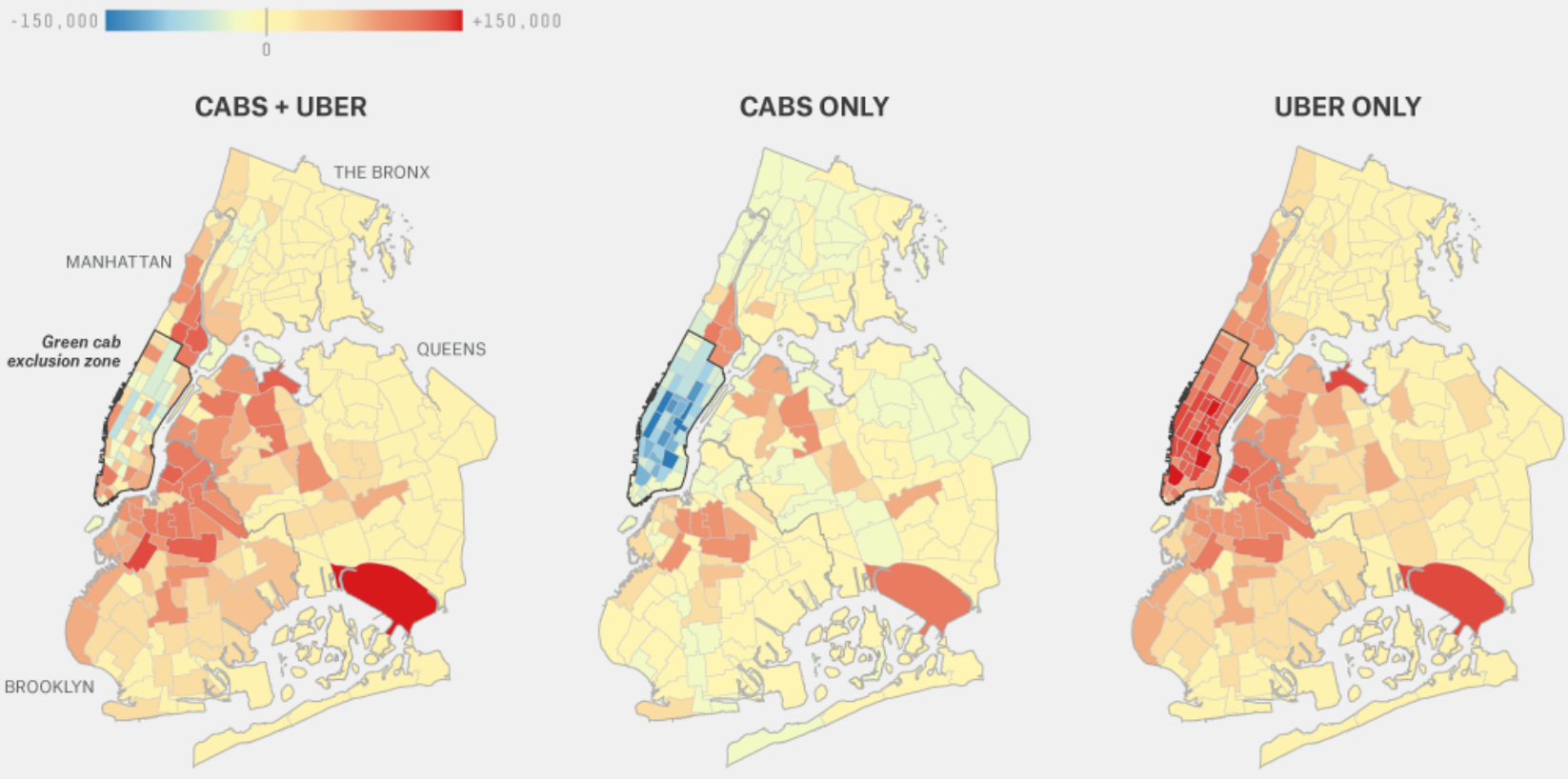
Uber Is Taking Millions Of Manhattan Rides Away From Taxis

The ride-share service probably isn't increasing congestion.

By REUBEN FISCHER-BAUM and CARL BIALIK

Are Ubers Supplementing Or Replacing Cabs?

Change in number of Uber and taxi pickups by taxi zone, April-June 2014 versus April-June 2015



ELLA KOEZE

SOURCE: TAXI & LIMOUSINE COMMISSION

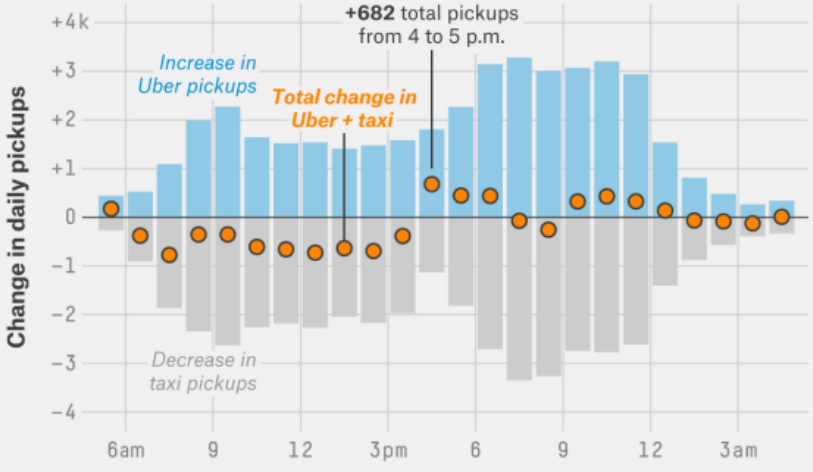
TRANSPORTATION | 11:19 AM | DEC 9, 2015

Is Uber Making NYC Rush-Hour Traffic Worse?

By CARL BIALIK, REUBEN FISCHER-BAUM and DHRUMIL MEHTA

Uber adds (a little) to Manhattan evening rush

Average change in Uber pickups, taxi pickups, and total Uber + taxi pickups by hour of day; April-June 2014 vs. April-June 2015

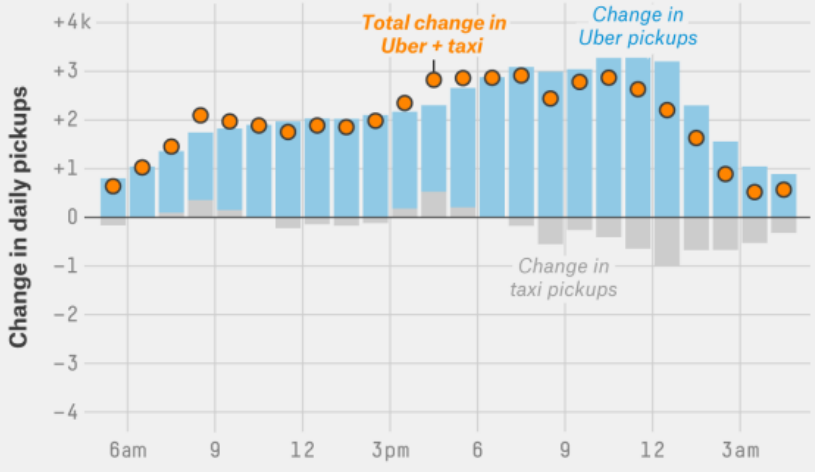


Non-holiday weekdays; Manhattan core taxi zones only

FIVETHIRTYEIGHT SOURCE: NYC TAXI & LIMOUSINE COMMISSION

Thousands of new pickups outside Manhattan core

Average change in Uber pickups, taxi pickups, and total Uber + taxi pickups by hour of day; April-June 2014 vs. April-June 2015



Non-holiday weekdays; includes Manhattan taxi zones outside the core

FIVETHIRTYEIGHT SOURCE: NYC TAXI & LIMOUSINE COMMISSION

How To Spot A Front-Runner On The 'Bachelor' Or 'Bachelorette'

What we learned from analyzing all 33 seasons.

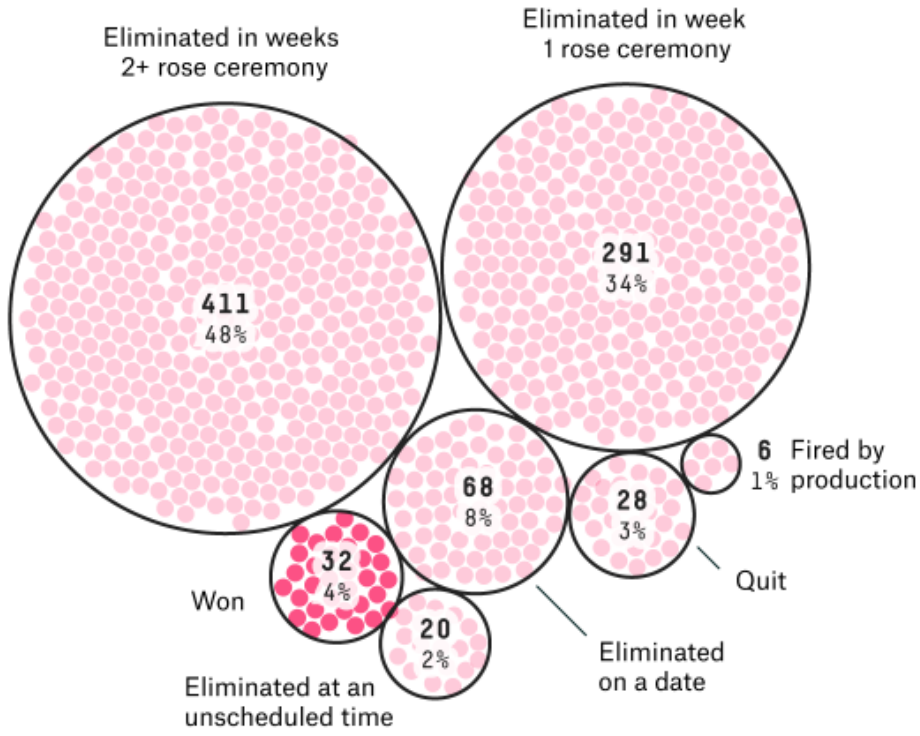
By Ella Koeze and Walt Hickey

Filed under TV

Get the data on GitHub

Published May 22, 2017

The fate of every 'Bachelor' and 'Bachelorette' contestant



BASED ON DATA FROM ABC, WIKIPEDIA AND BACHELOR NATION WIKIA

A rose for every season

The path of every winner on every season of the "Bachelor" and "Bachelorette"

1 **Each petal is a week**

2 **Each section of the petal is a contestant**

3 **Size indicates a contestant's weighted number of dates through that point in the season ...**

4 **... as does order.**

The Bachelor

Broke up · Still together

Alex + Amanda
2002

Aaron + Helene
2002

Andrew + Jen
2003

Bob + Estella
2003

Jesse + Jessica
2004

Byron + Mary
2004

Charlie + Sarah
2005

Travis + Sarah
2006

Lorenzo + Jennifer
2006

Andy + Tessa
2007

Brad
2007

Brad picked neither finalist and returned four seasons later as the bachelor to try again.

Matt + Shayne
2008

Jason + Melissa
2009

In the "After the Final Rose" episode, Jason broke up with Melissa and asked for a second chance with Molly, the runner-up.

Jake + Vienna
2010

Brad + Emily
2011

Ben + Courtney
2012

Sean + Catherine
2013

Juan Pablo + Nikki
2014

Chris + Whitney
2015

Ben + Lauren
2016

Nick + Vanessa
2017

The Bachelorette

Broke up · Still together

Trista + Ryan
2003

Meredith + Ian
2004

Jen + Jerry
2005

DeAnna + Jesse
2008

Jillian + Ed
2009

Ali + Roberto
2010

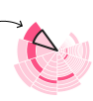
Ashley + J.P.
2011

Emily + Jef
2012

Desiree + Chris
2013

Andi + Josh
2014

Kaitlyn + Shawn
2015



JoJo + Jordan
2016

Contestant Nick was rejected by both Andi and Kaitlyn in their final ceremonies. He went on to be the bachelor in 2017.

For nearly all seasons, dates did not begin until week two. Dates are weighted so that a one-on-one counts as one date, a two-on-one counts as 0.5 dates, etc.

BASED ON DATA FROM ABC, WIKIPEDIA AND BACHELOR NATION WIKIA

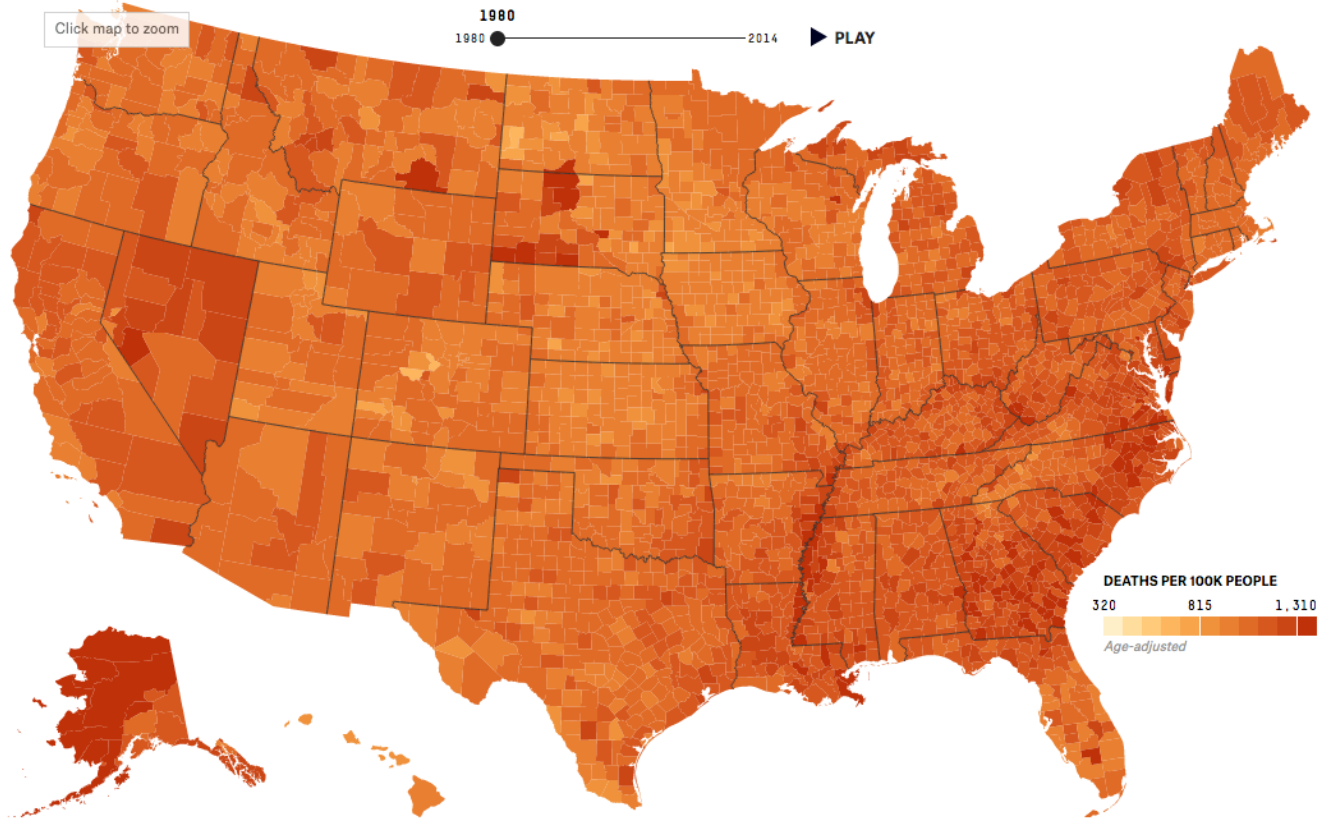
UPDATED 12:00 PM EDT | JUN 19, 2017

35 Years Of American Death

Mortality rates for leading causes of death in every U.S. county from 1980 to 2014.

By Ella Koeze

All causes of death



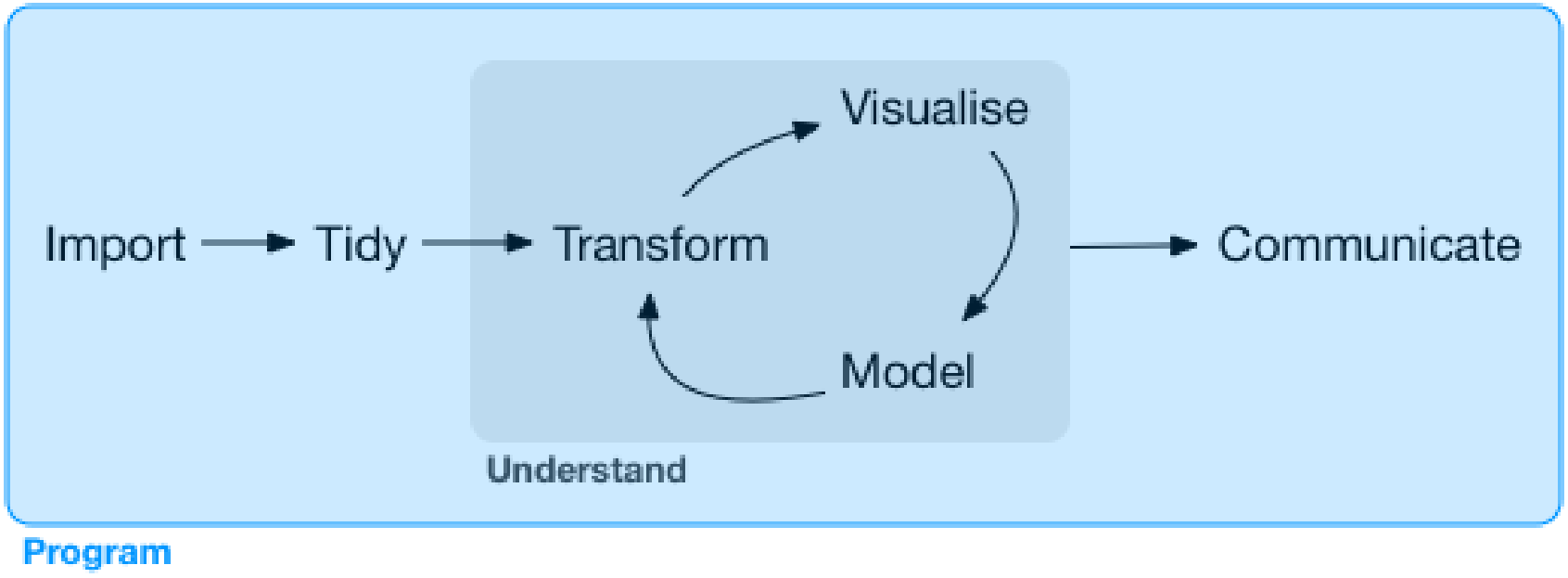
Mortality rates are age adjusted to account for higher mortality in older populations and geographic variations in the ages of county populations.

How to tell a story using data

Telling stories with data requires

- detective work
- creativity, both scientific and artistic
- experimentation with different storylines
- good data, (good data does not nescessarily equal “big data”)

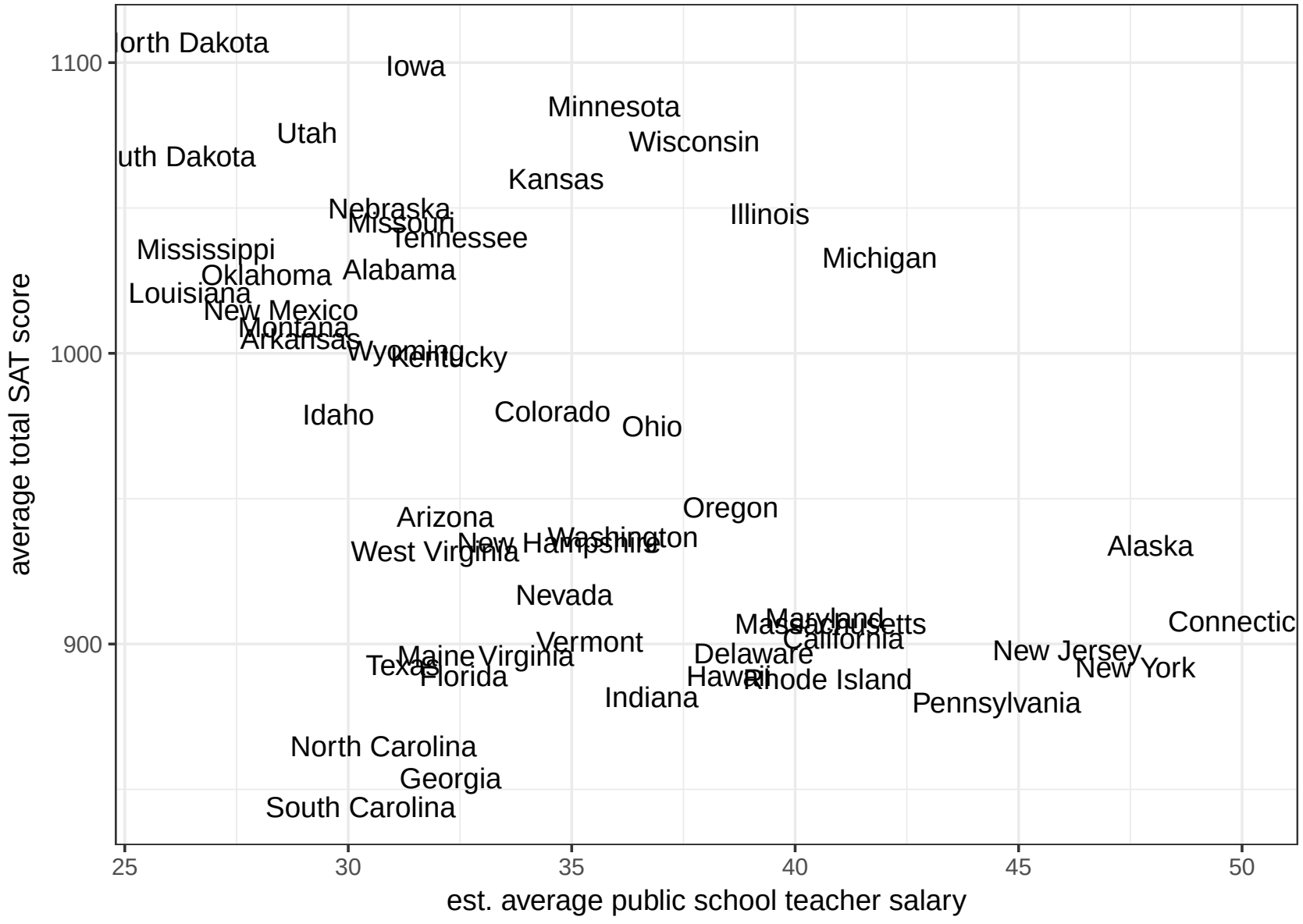
The tidy-verse: a process for data analysis



A common modeling tool: regression

- The goal is to learn about the relationship between two variables: a "covariate" (or "predictor") of interest and an "outcome" of interest.
  - Some models focus on prediction.
  - Other models focus on description.
- Regression is an exercise in inferential statistics: we are drawing evidence and conclusions from data about "complex aspects of reality", i.e. "noisy" systems.

State-level SAT score data (1994-95)



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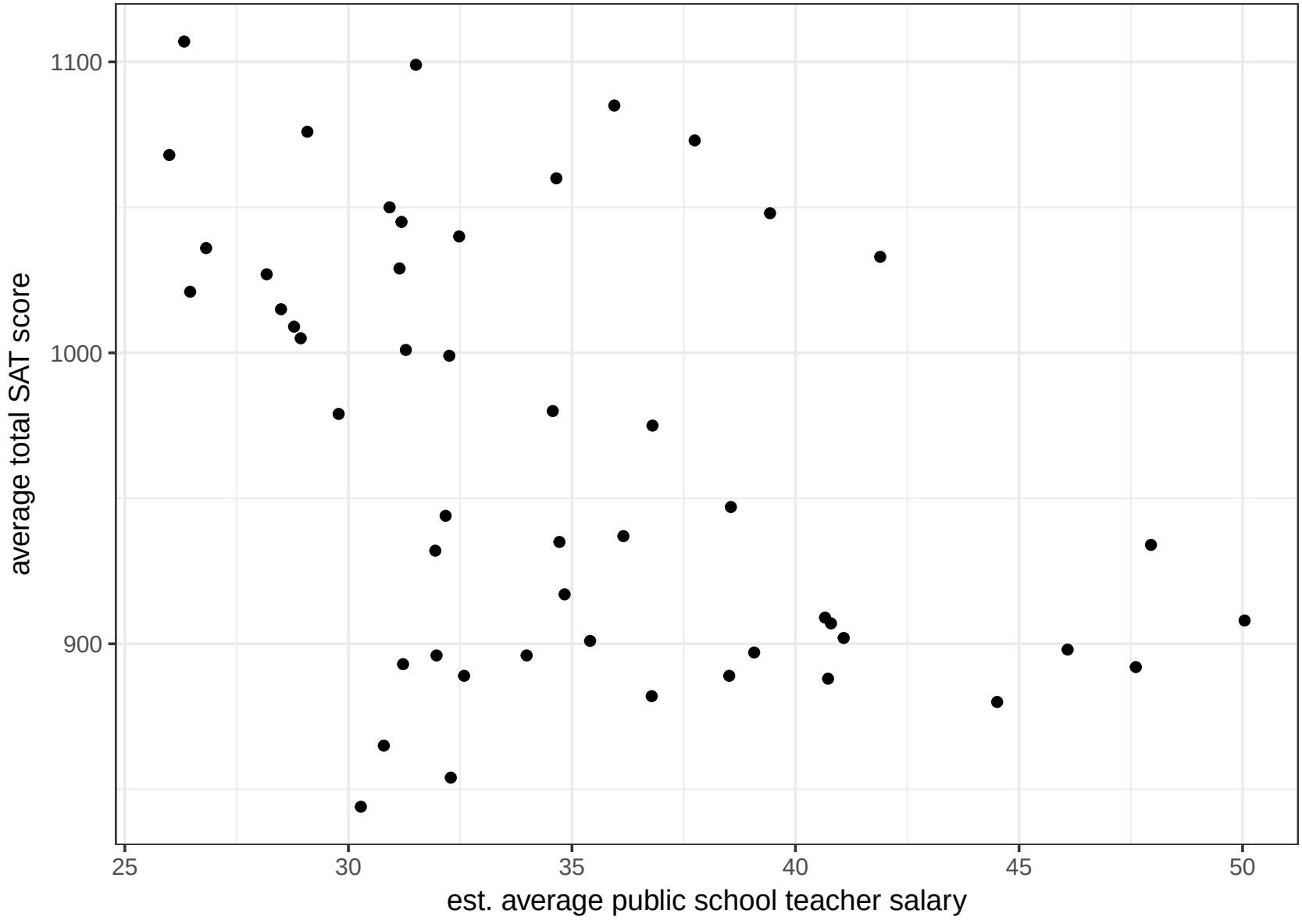

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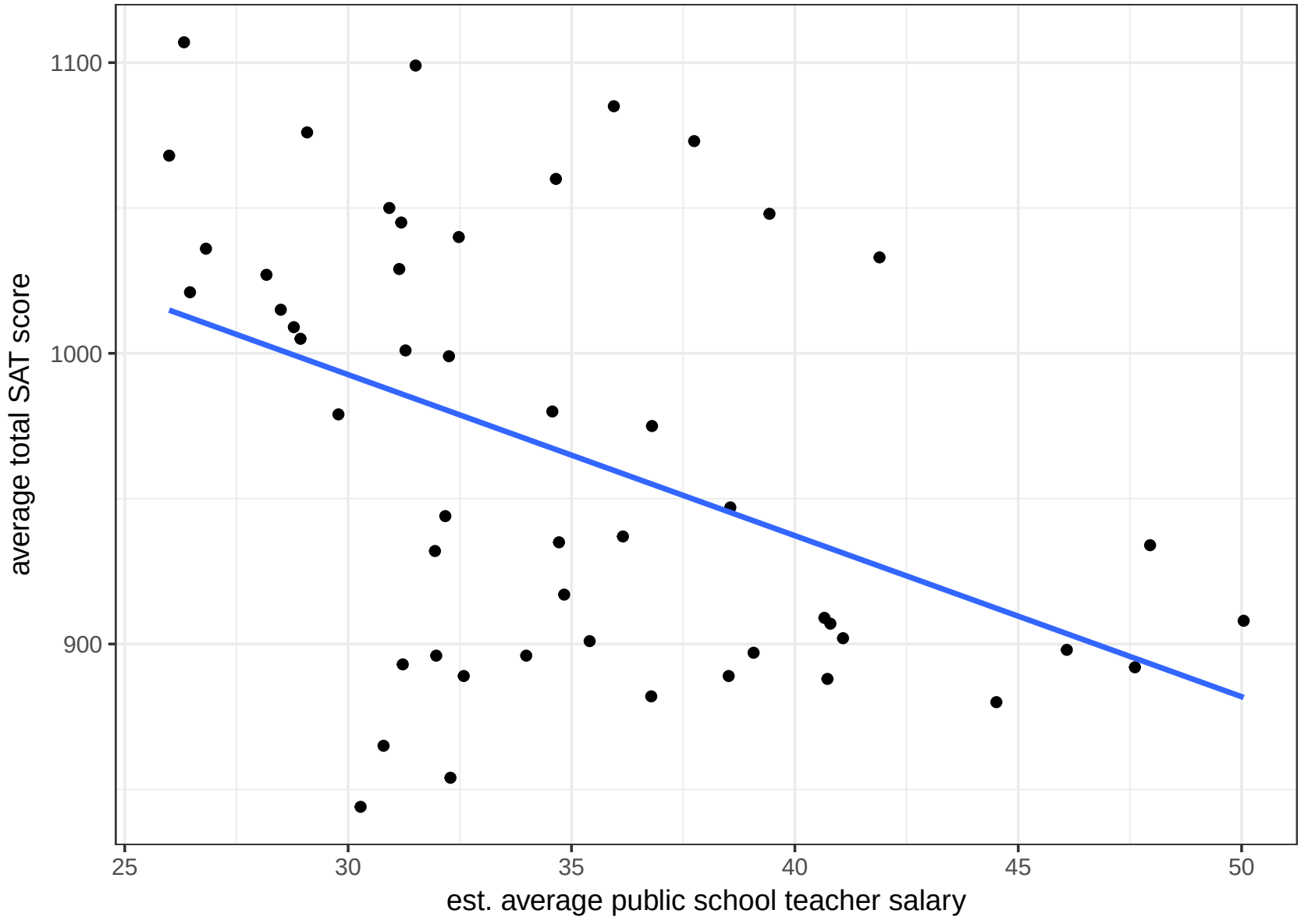


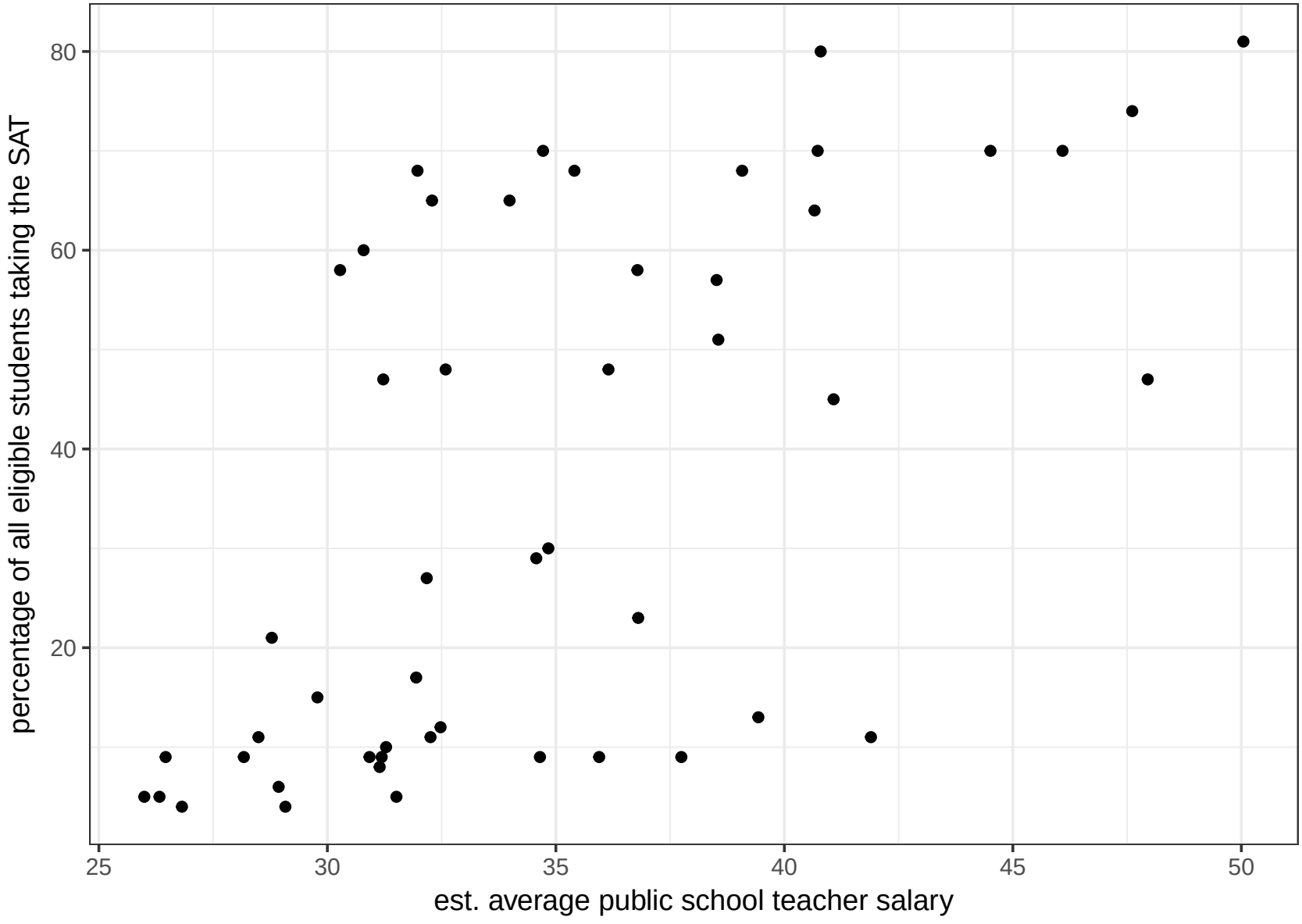
The SAT example

What is the outcome variable?

What is the covariate or predictor variable?

What other data might be part of this story?

State-level SAT score data (1994-95)



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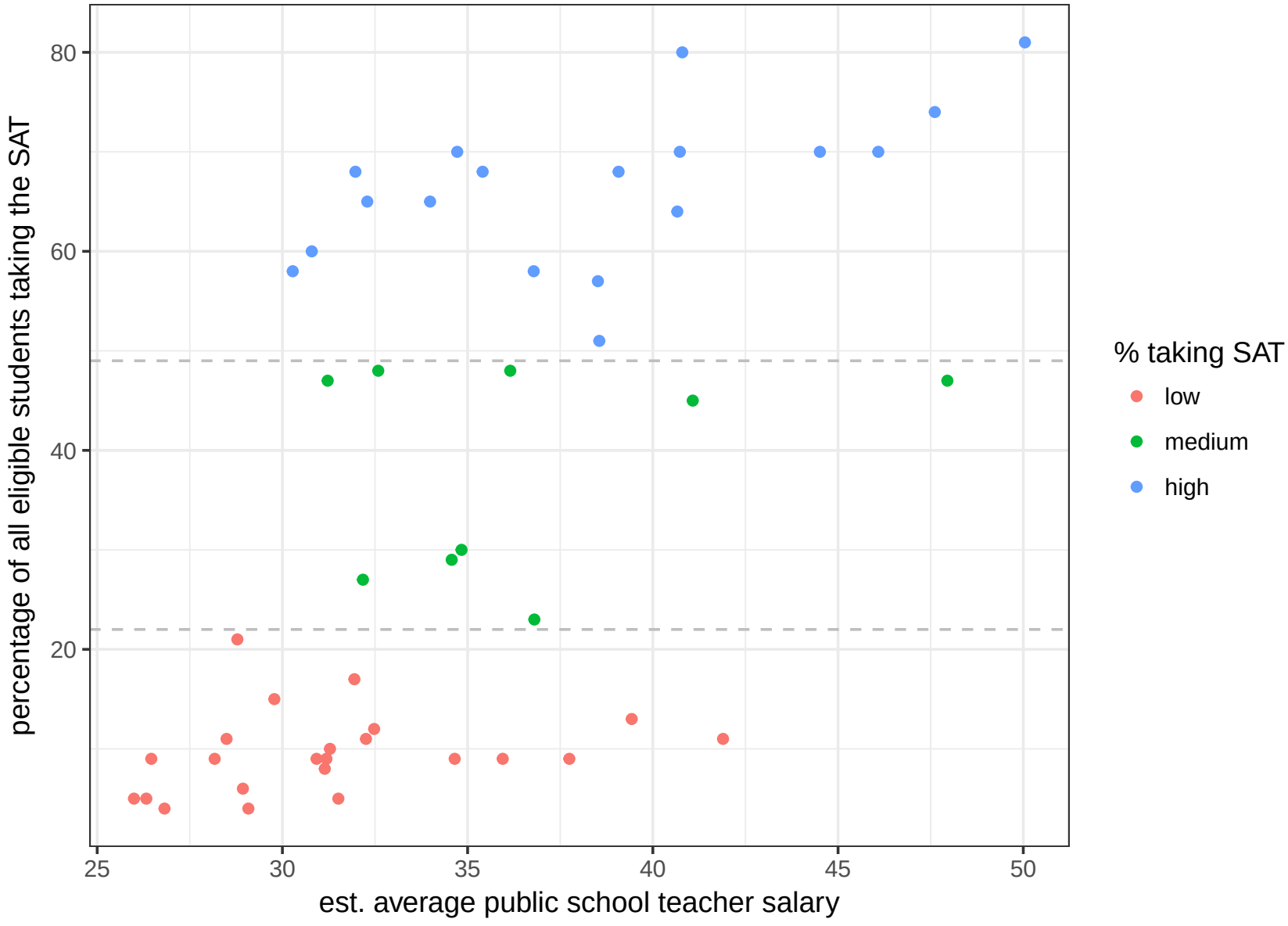

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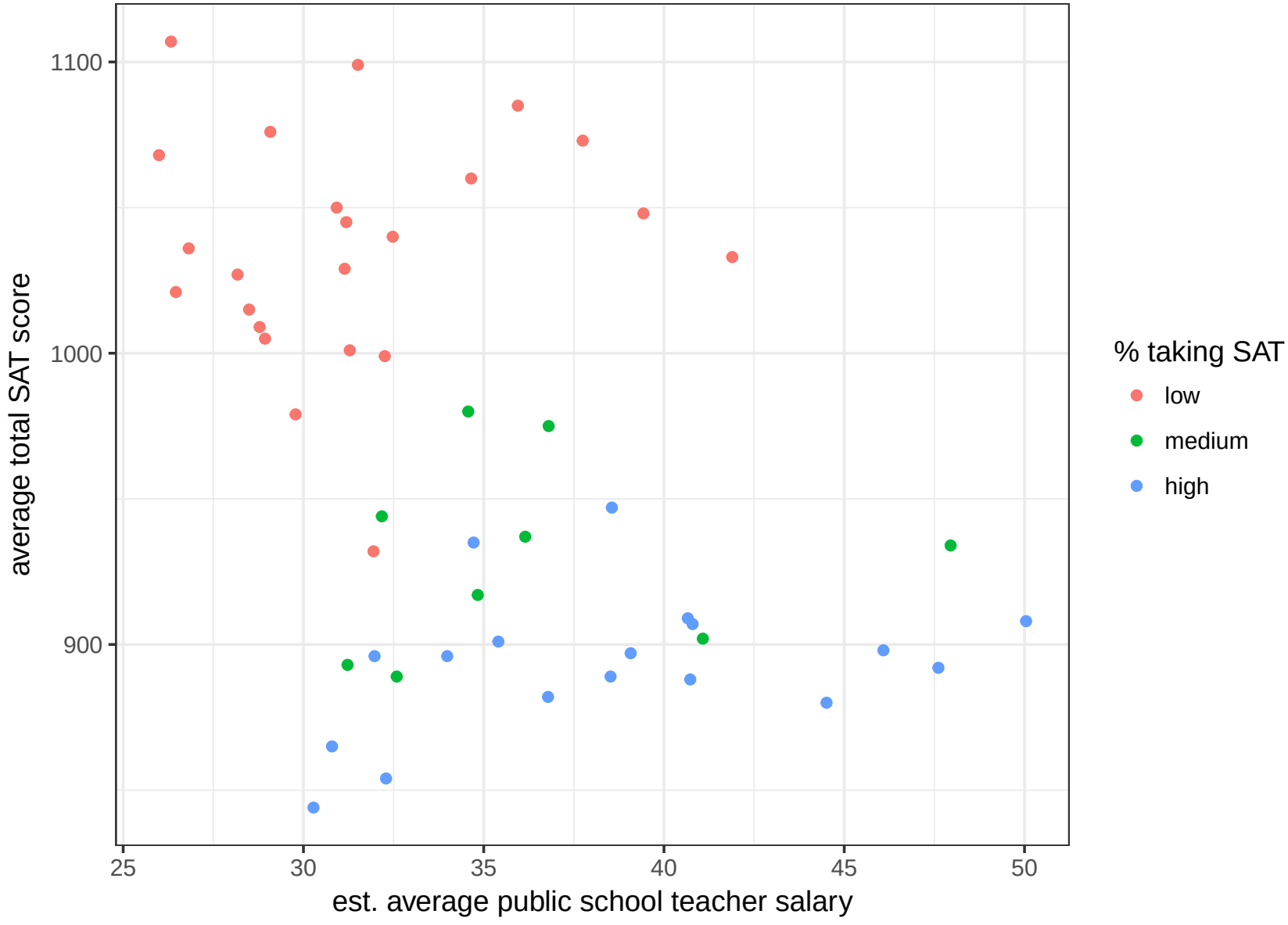
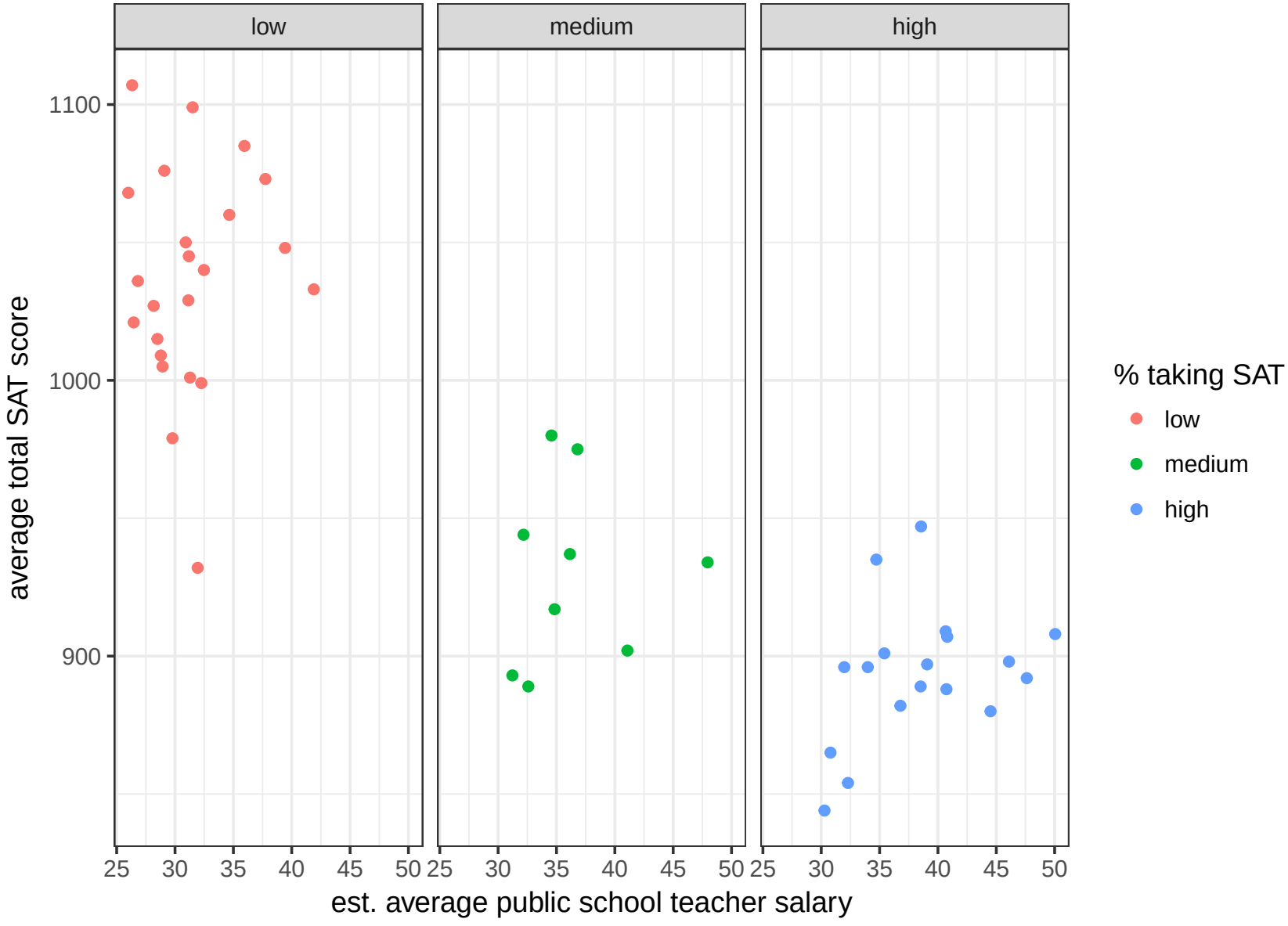
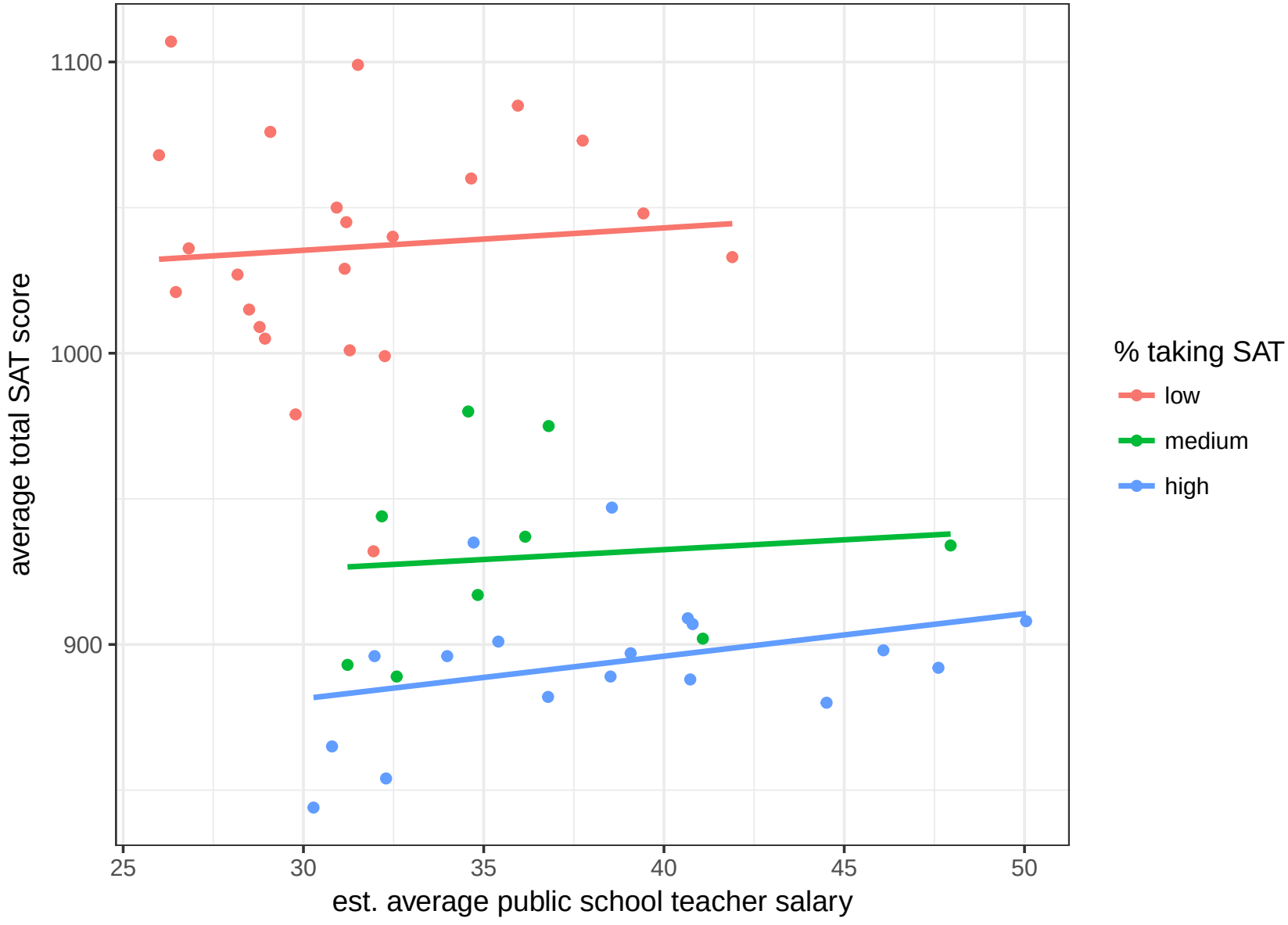


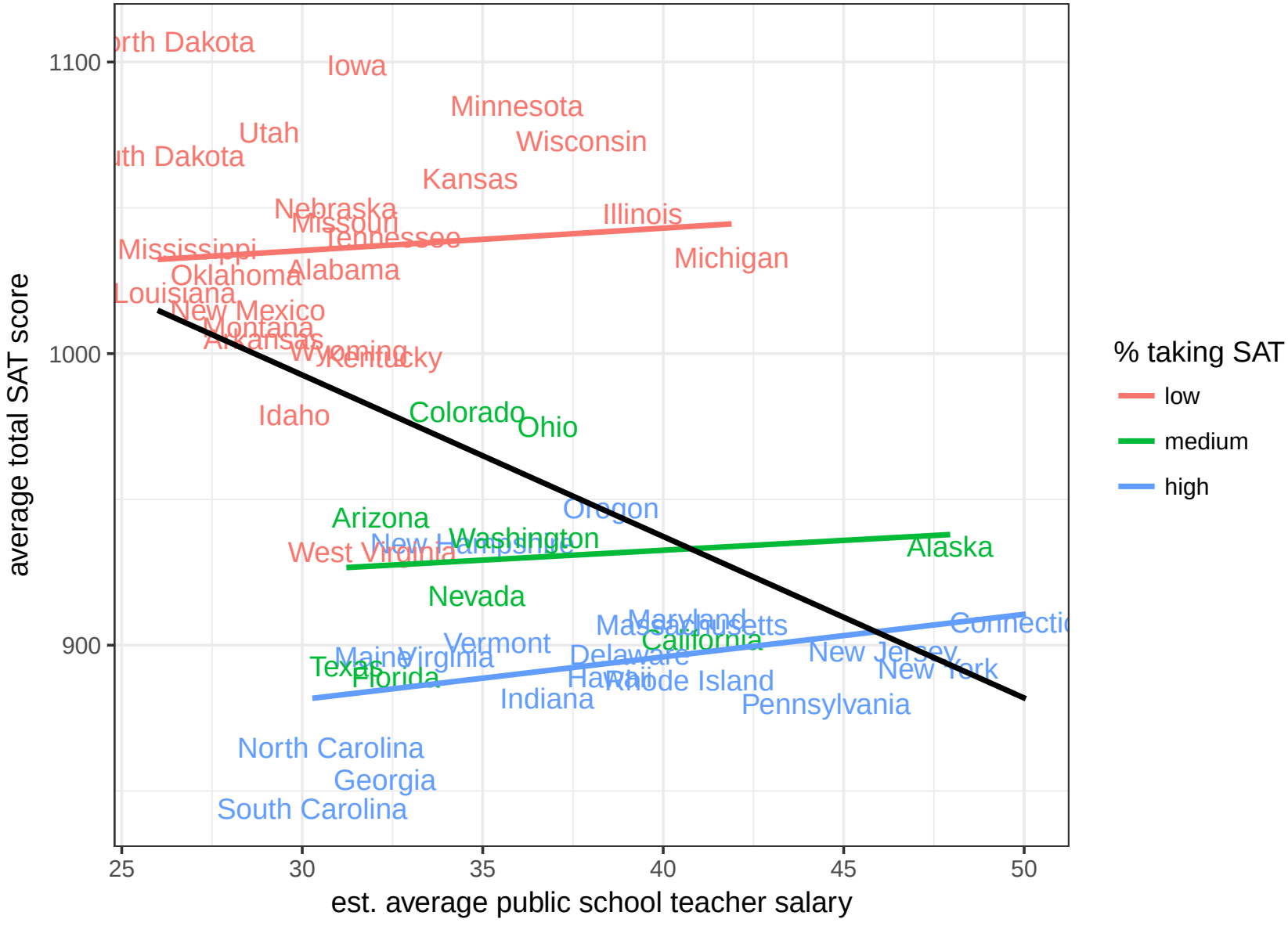
State-level SAT score data (1994-95)



State-level SAT score data (1994-95)



State-level SAT score data (1994-95)



State-level SAT score data (1994-95)

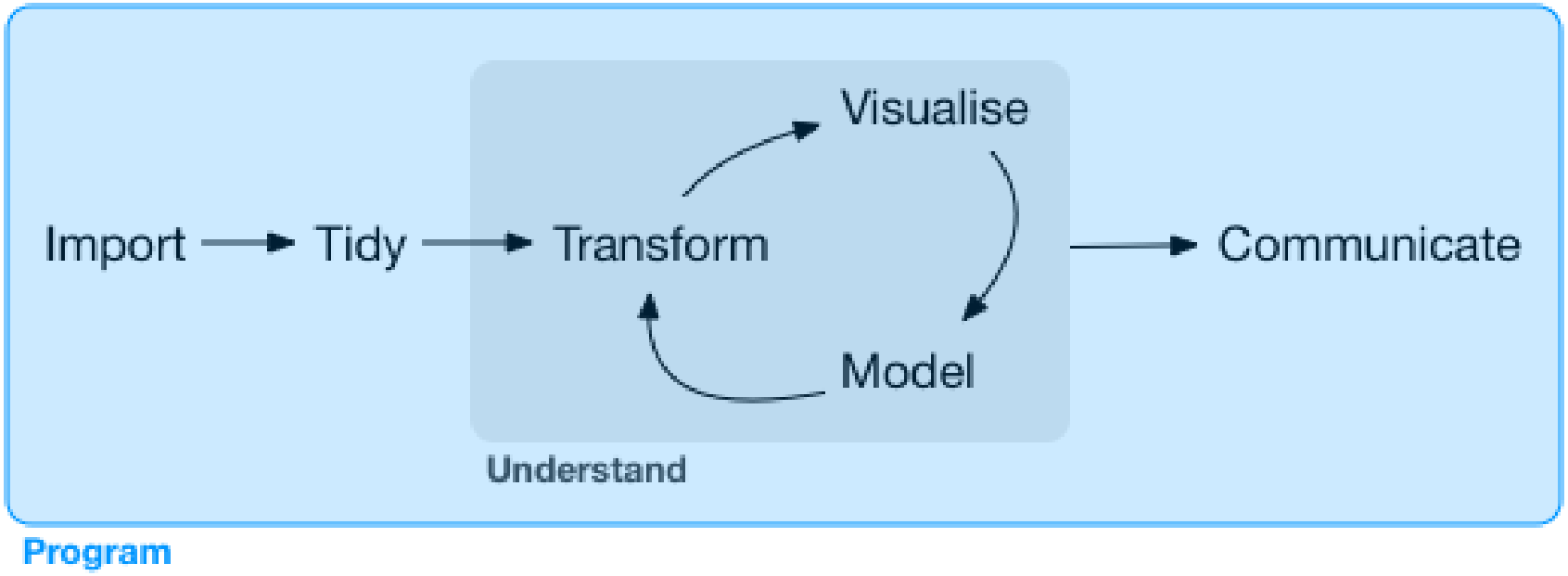
What can we conclude from all of this? (BTW, this is an example of "Simpson's Paradox".)

Regression modeling

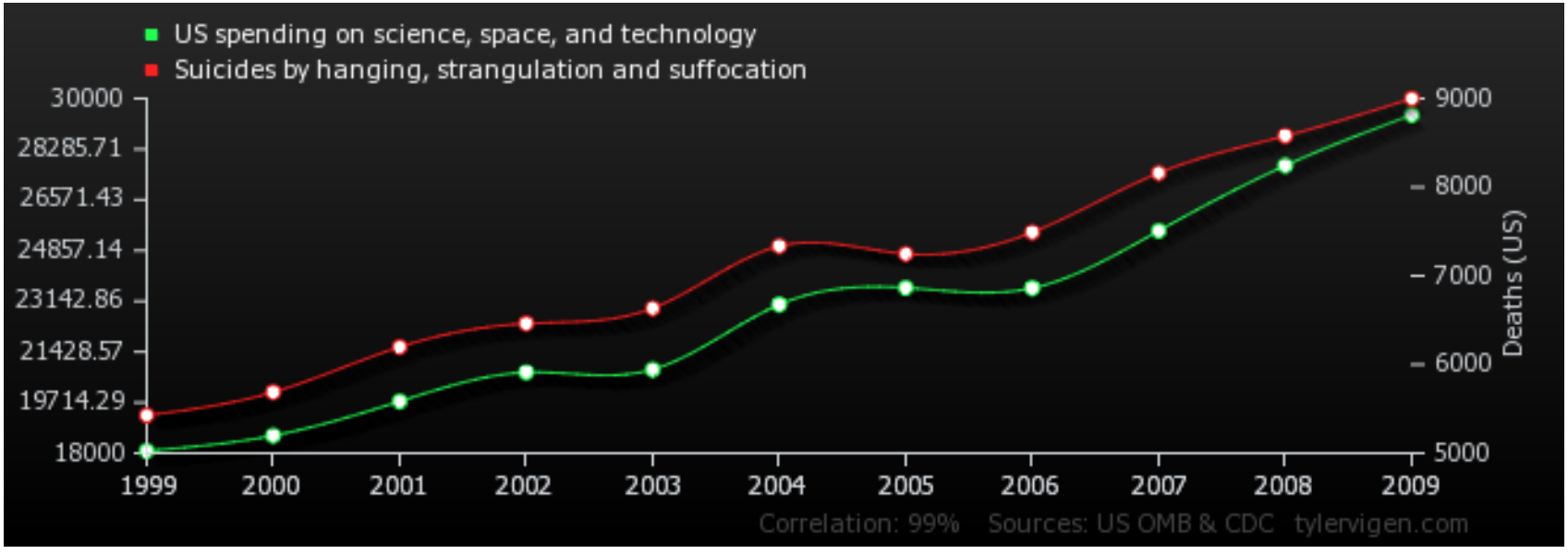
The process of using data to describe the relationship between outcomes and predictors is called modeling.

- Models are models, not reality.
- "All models are wrong, but some are useful."
- Introduce structure to our model that balances realism with "goodness of fit".

Things to come



Beware of correlation!



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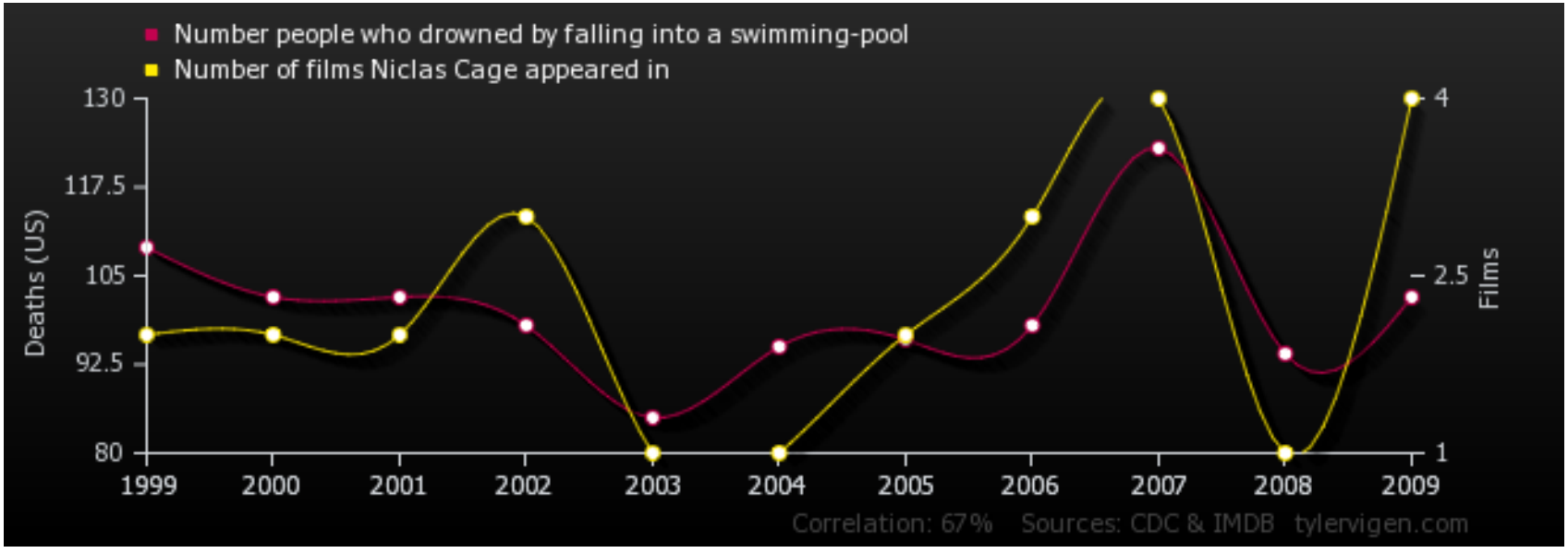
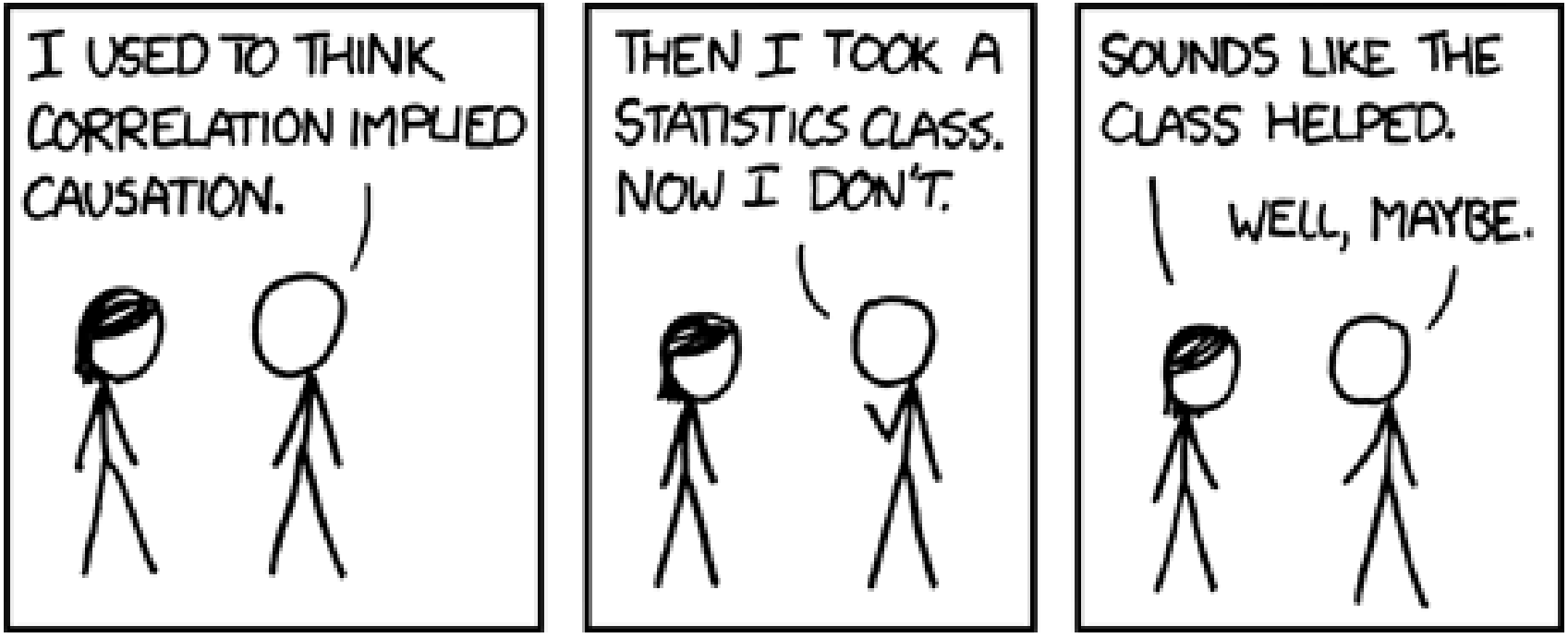


Hat tip to www.tylervigen.com



https://xkcd.com/552/

Appendix: Code for plotting

```
library(mosaicData)
library(ggplot2)
theme_set(theme_bw())
data(SAT)
SAT$fracgrp = cut(SAT$frac, breaks=c(0, 22, 49, 81),
                  labels=c("low", "medium", "high"))
ggplot(SAT) +
    geom_text(aes(x=salary, y=sat, label=state), size=4, show.legend=FALSE) +
    xlab("est. average public school teacher salary") +
    ylab("average total SAT score")
```

More plotting code available here.