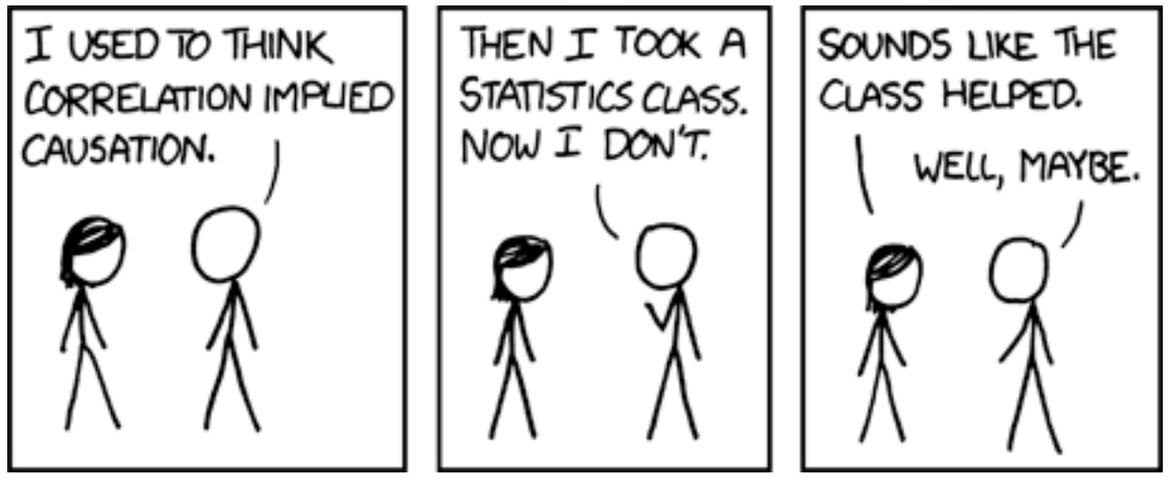
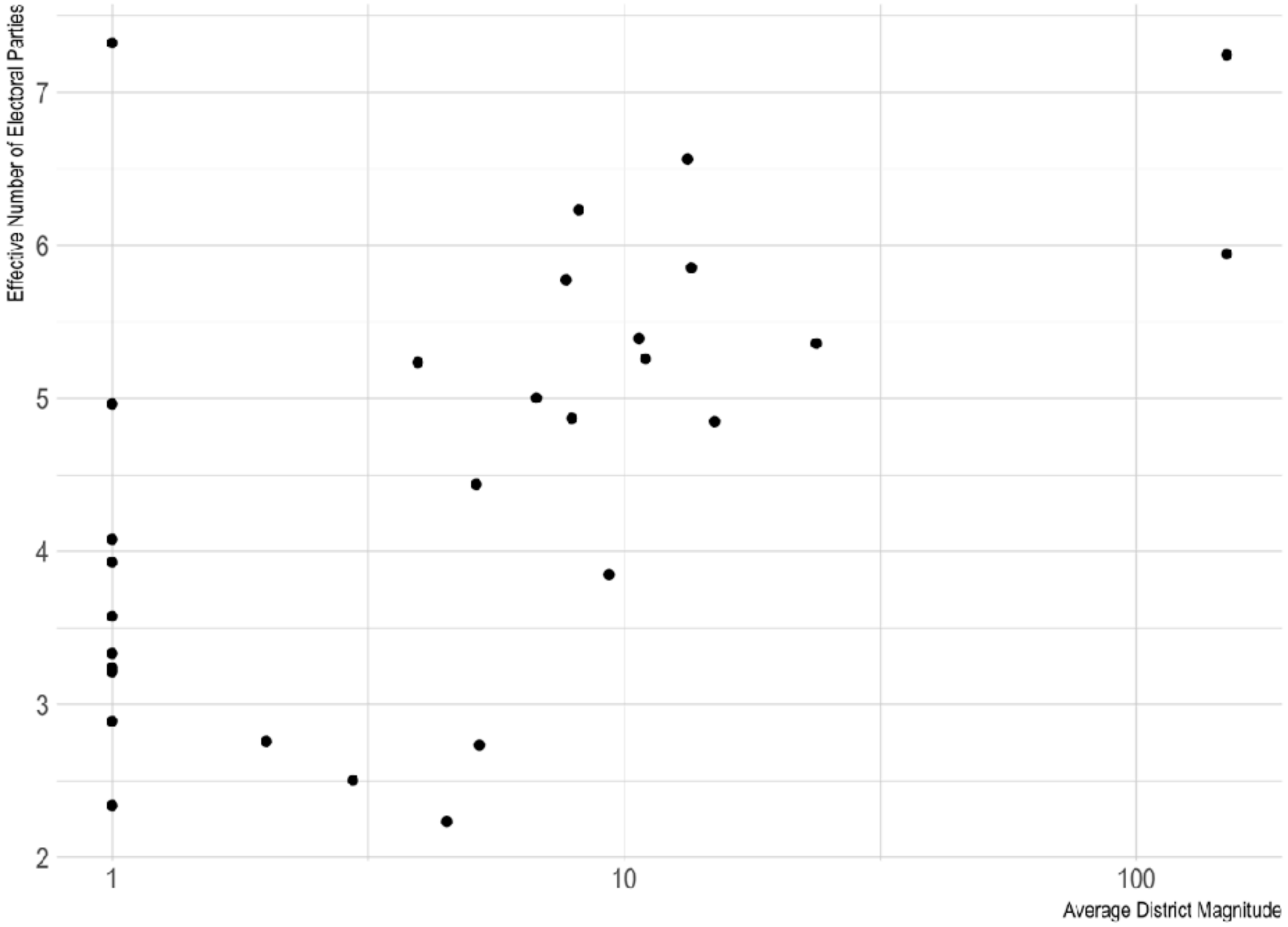
A Partial Solution

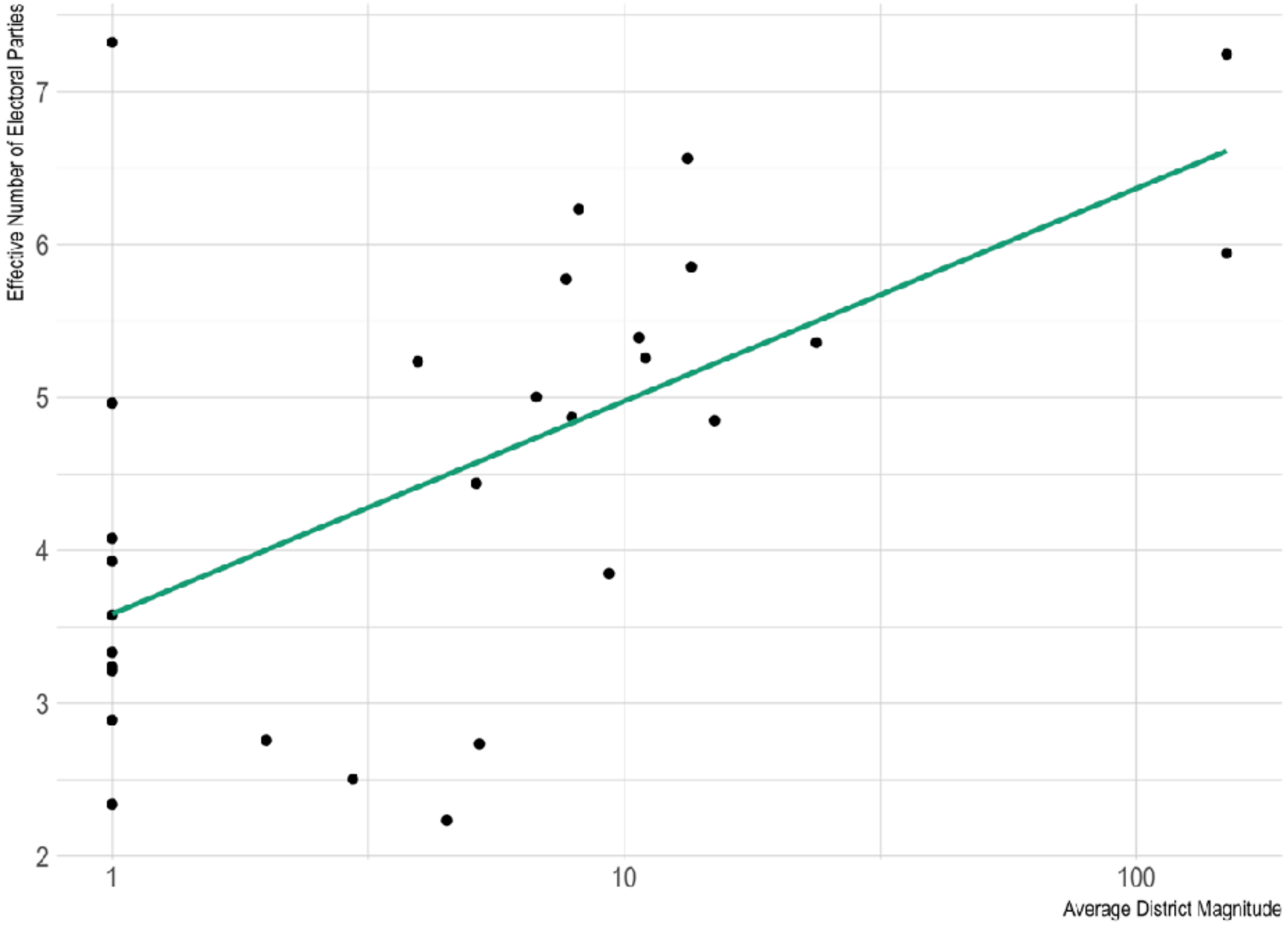
To the Fundamental Problem of Causal Inference



Some of our most important questions are **causal questions**.

Party	Leader	%	Seats
Liberal	Justin Trudeau	39.5%	184
Conservative	Stephen Harper	31.9%	99
New Democratic	Tom Mulcair	19.7%	44
Bloc Québécois	Gilles Duceppe	4.7%	10
Green	Elizabeth May	3.5%	1


Effective Number of Electoral Parties
7
6
5
4
3
2
1
10
100
Average District Magnitude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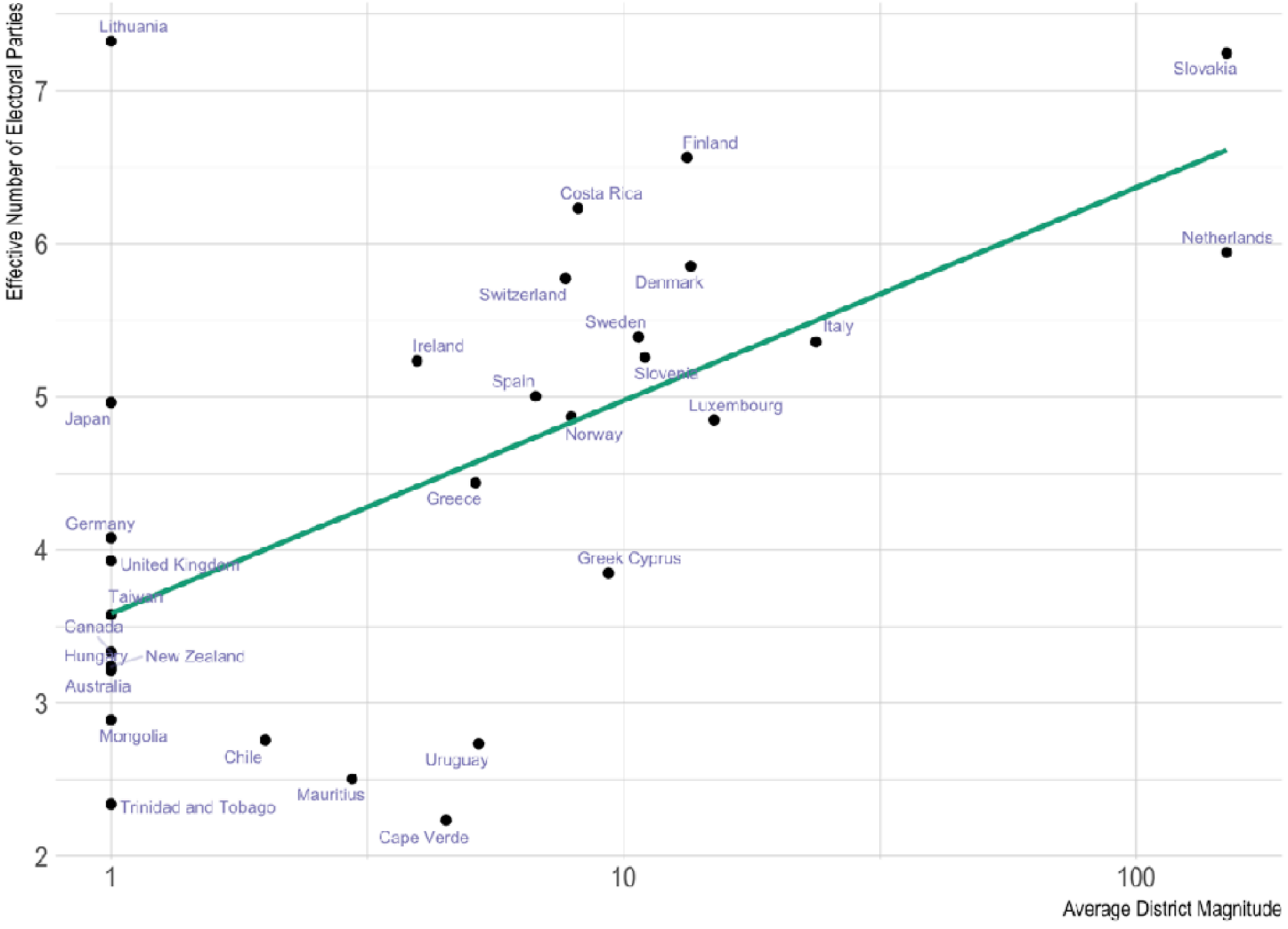
Effective Number of Electoral Parties
7
6
5
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2
1
10
100
Average District Magnitude
Lithuania
Slovakia
Finland
Costa Rica
Netherlands
Switzerland
Denmark
Sweden
Italy
Ireland
Slovenia
Spain
Luxembourg
Japan
Norway
Greece
Germany
United Kingdom
Greek Cyprus
Taiwan
Canada
Hungary
New Zealand
Australia
Mongolia
Chile
Uruguay
Mauritius
Trinidad and Tobago
Cape Verde

Party	Leader	%	Seats
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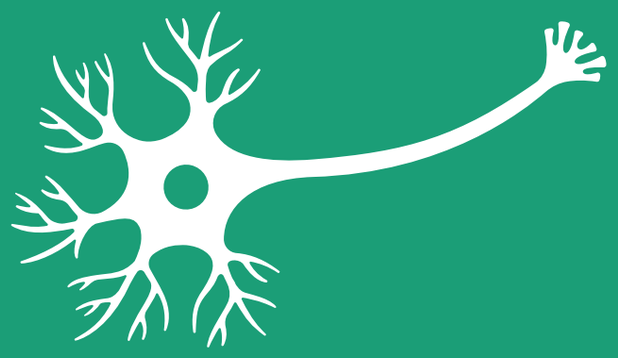
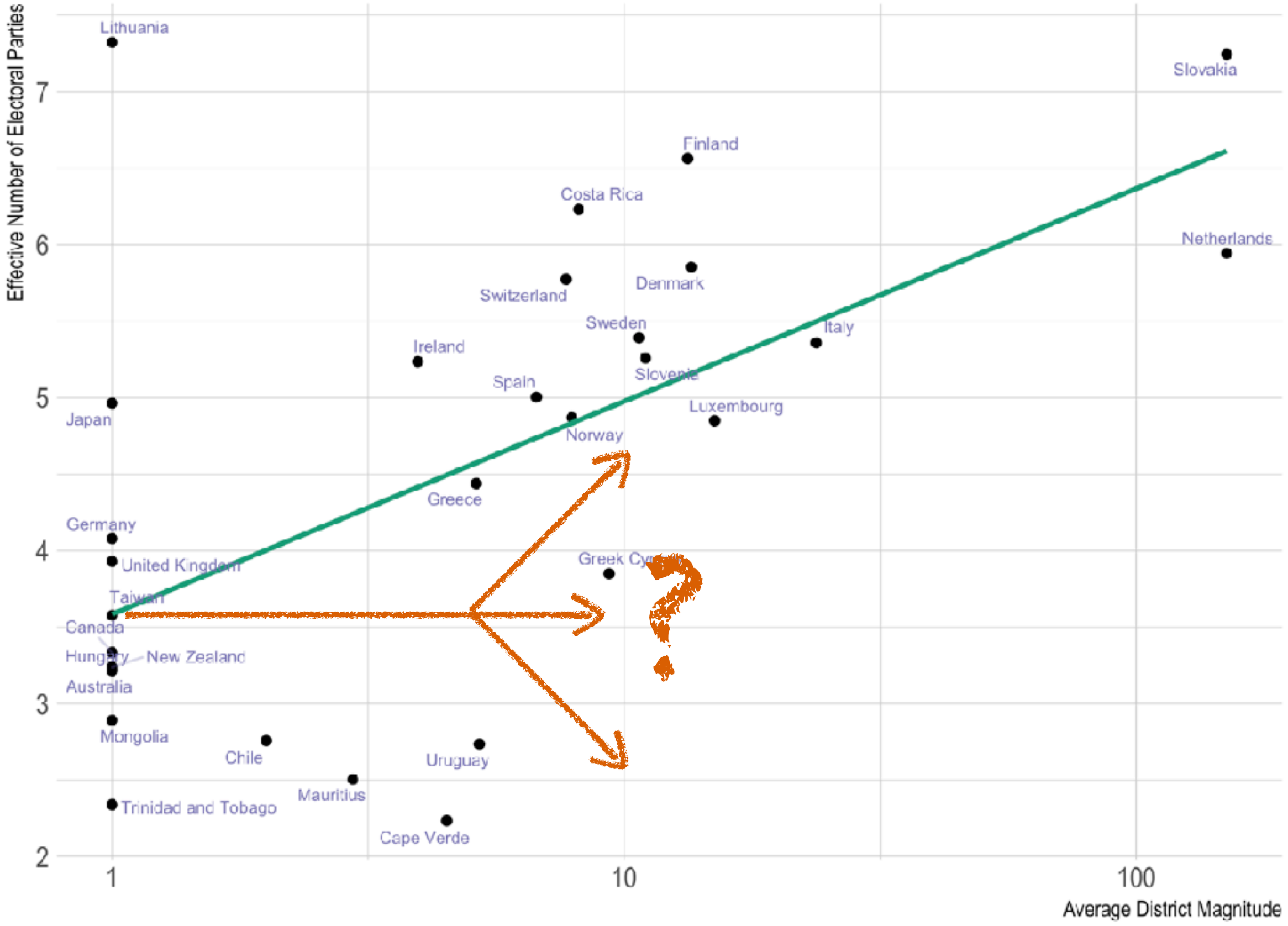
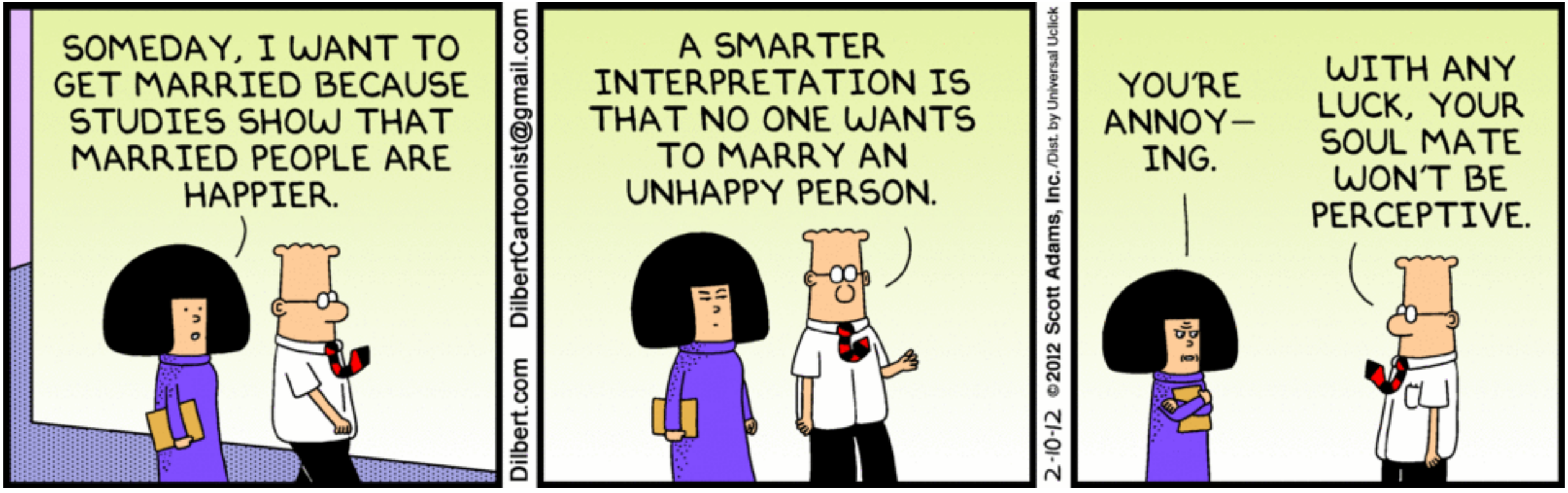
think + write + discuss



If we increased the magnitude from 1 to 10, what would happen to the number of political parties?


Effective Number of Electoral Parties
7
6
5
4
3
2
Lithuania
Slovakia
Finland
Costa Rica
Netherlands
Switzerland
Denmark
Sweden
Italy
Ireland
Slovenia
Spain
Luxembourg
Japan
Norway
Greece
Germany
United Kingdom
Greek Cyprus
Taiwan
Canada
Hungary
New Zealand
Australia
Mongolia
Chile
Uruguay
Mauritius
Trinidad and Tobago
Cape Verde
1
10
100
Average District Magnitude

correlation ↛ causation



Four Ways

to Get a Correlation

AND THEN ONE MORE.

causation

causation

causation

key explanatory variable

causation

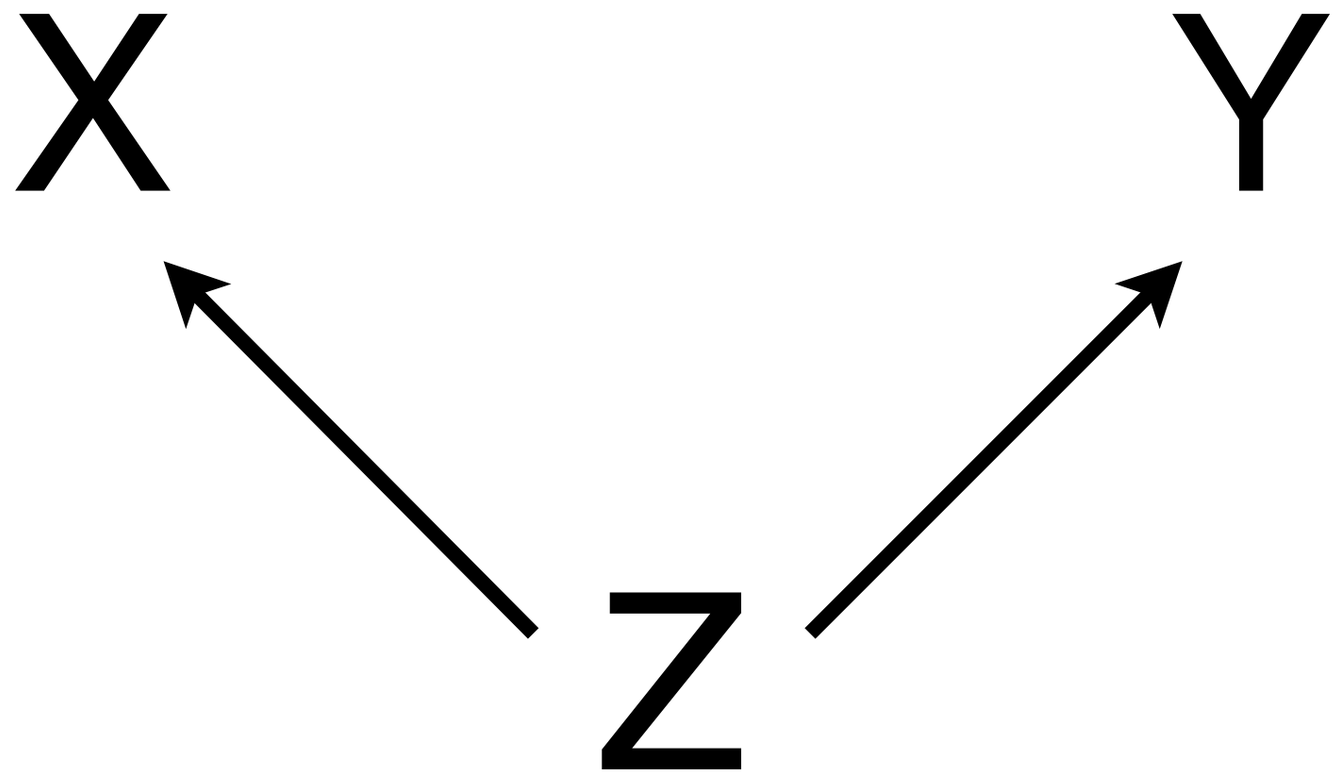
key explanatory variable

outcome variable

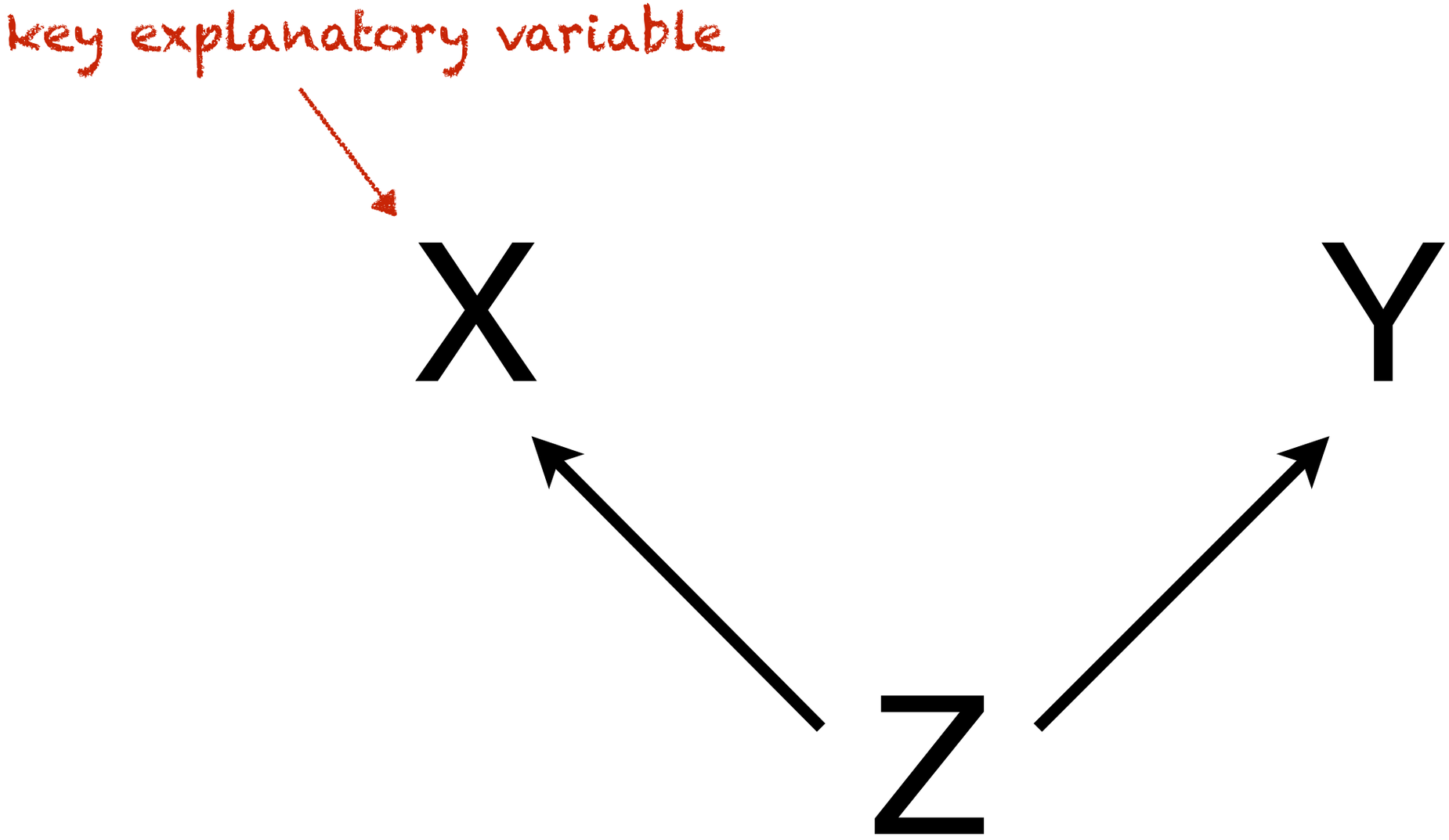
causation

spuriousness

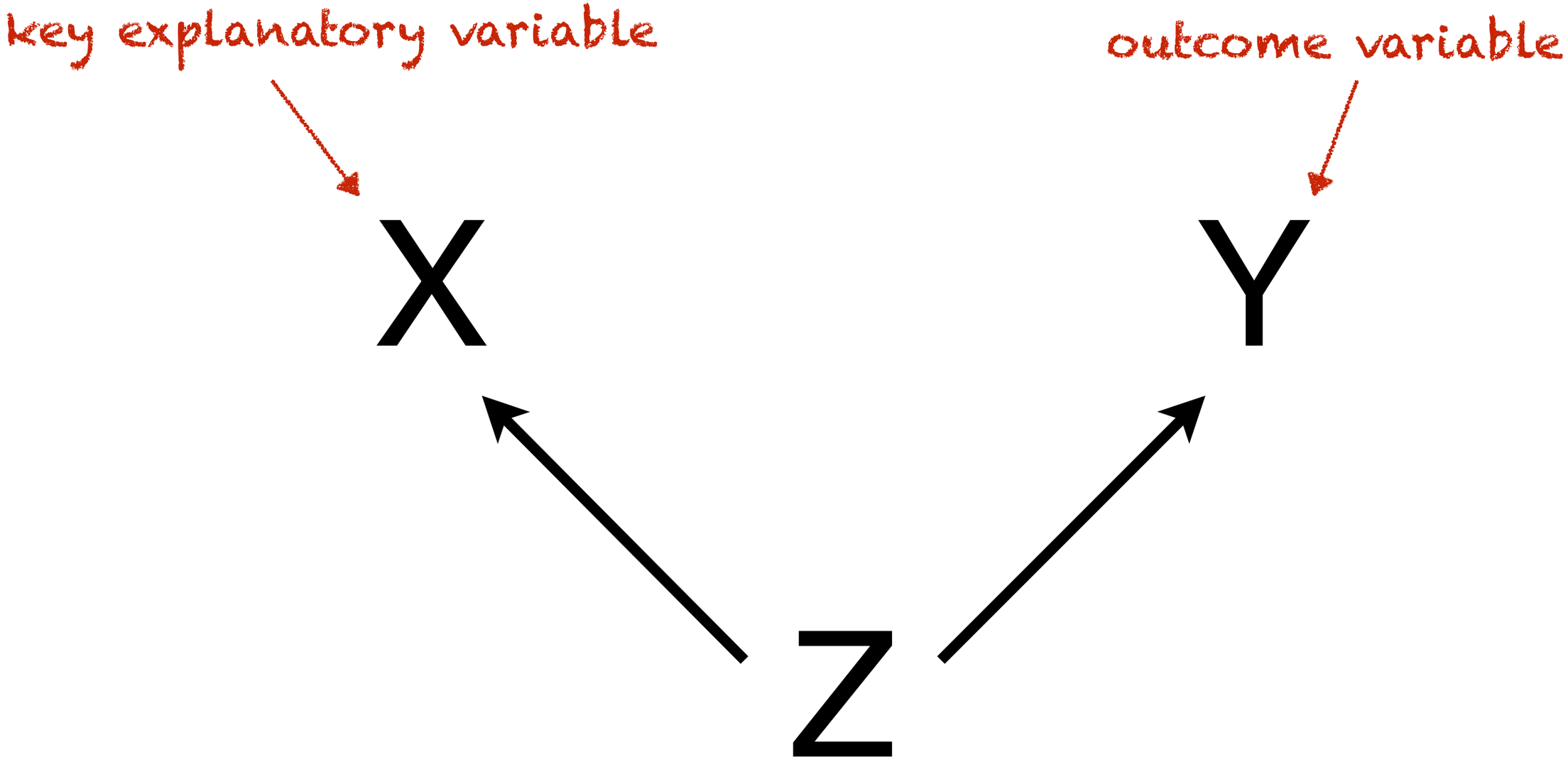
spuriousness



spuriousness



spuriousness



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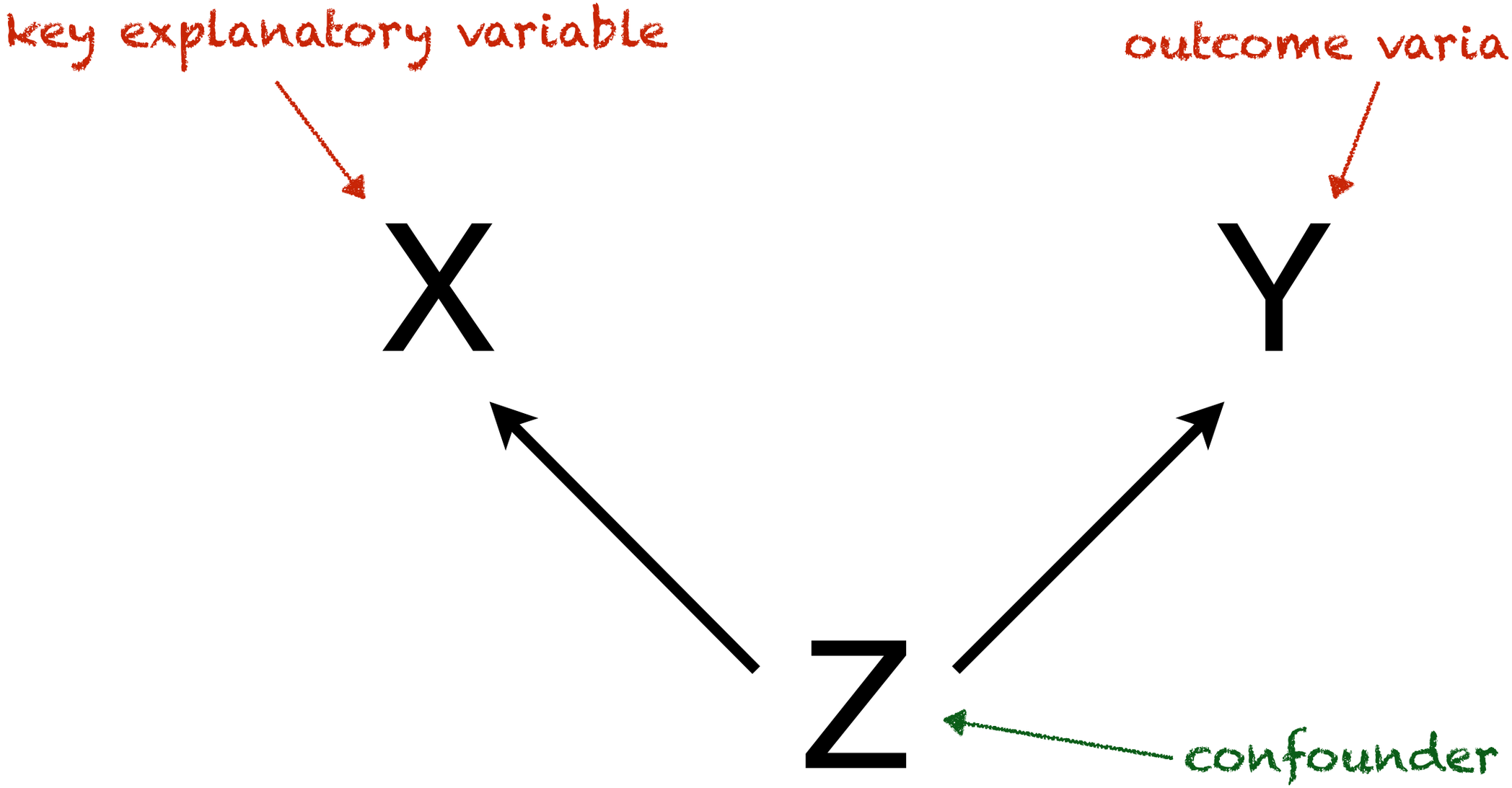
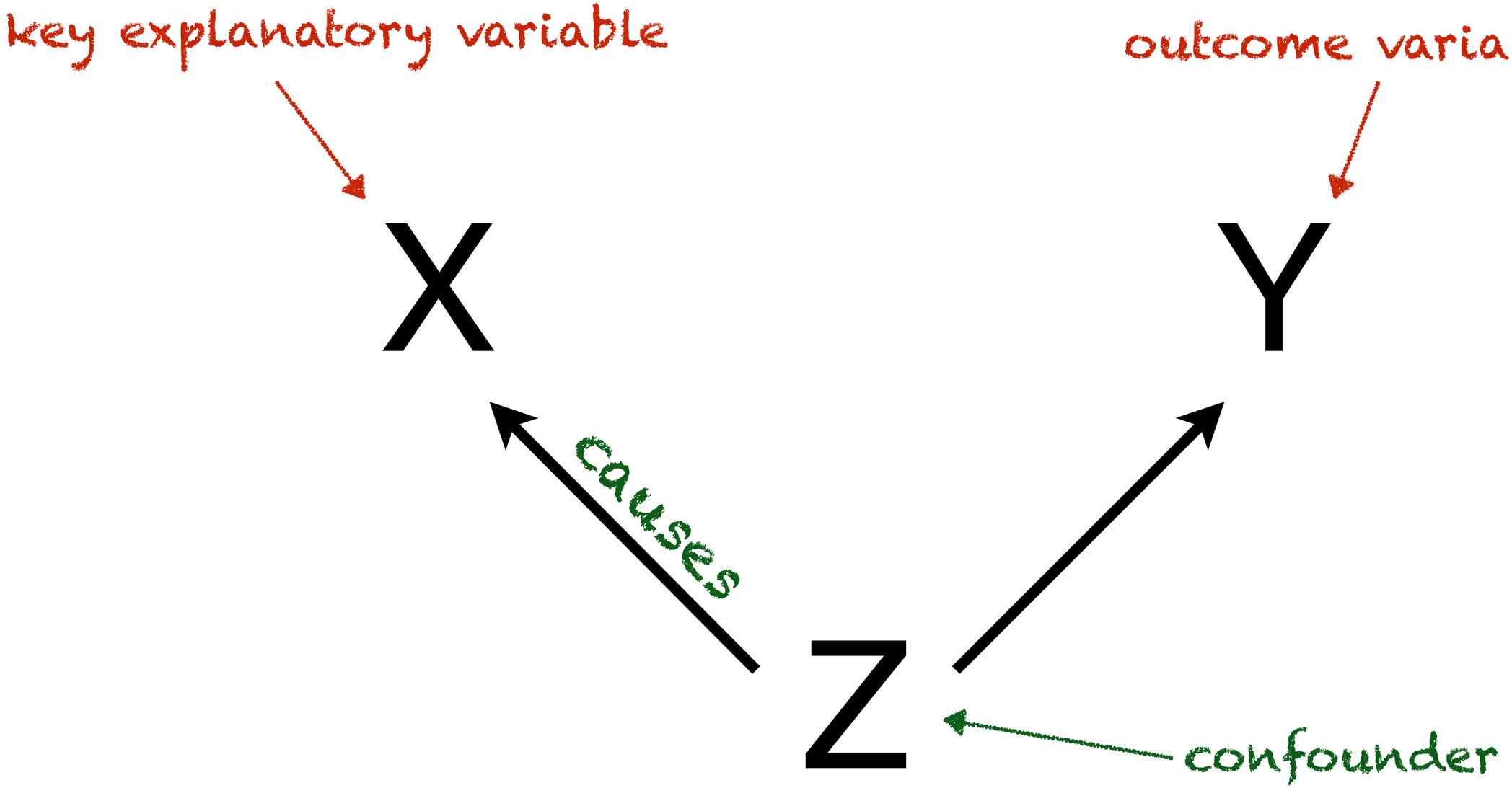
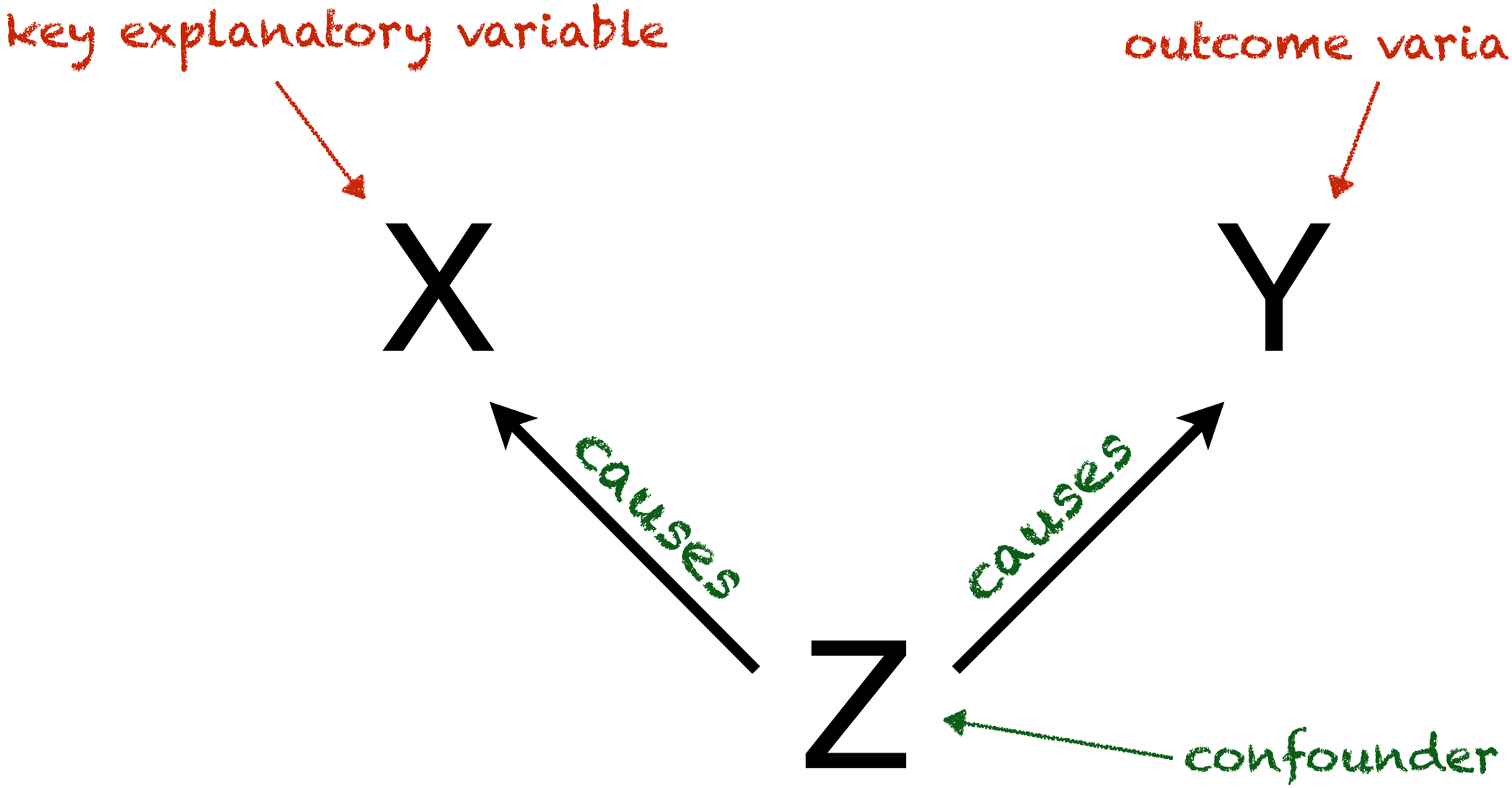


spuriousness

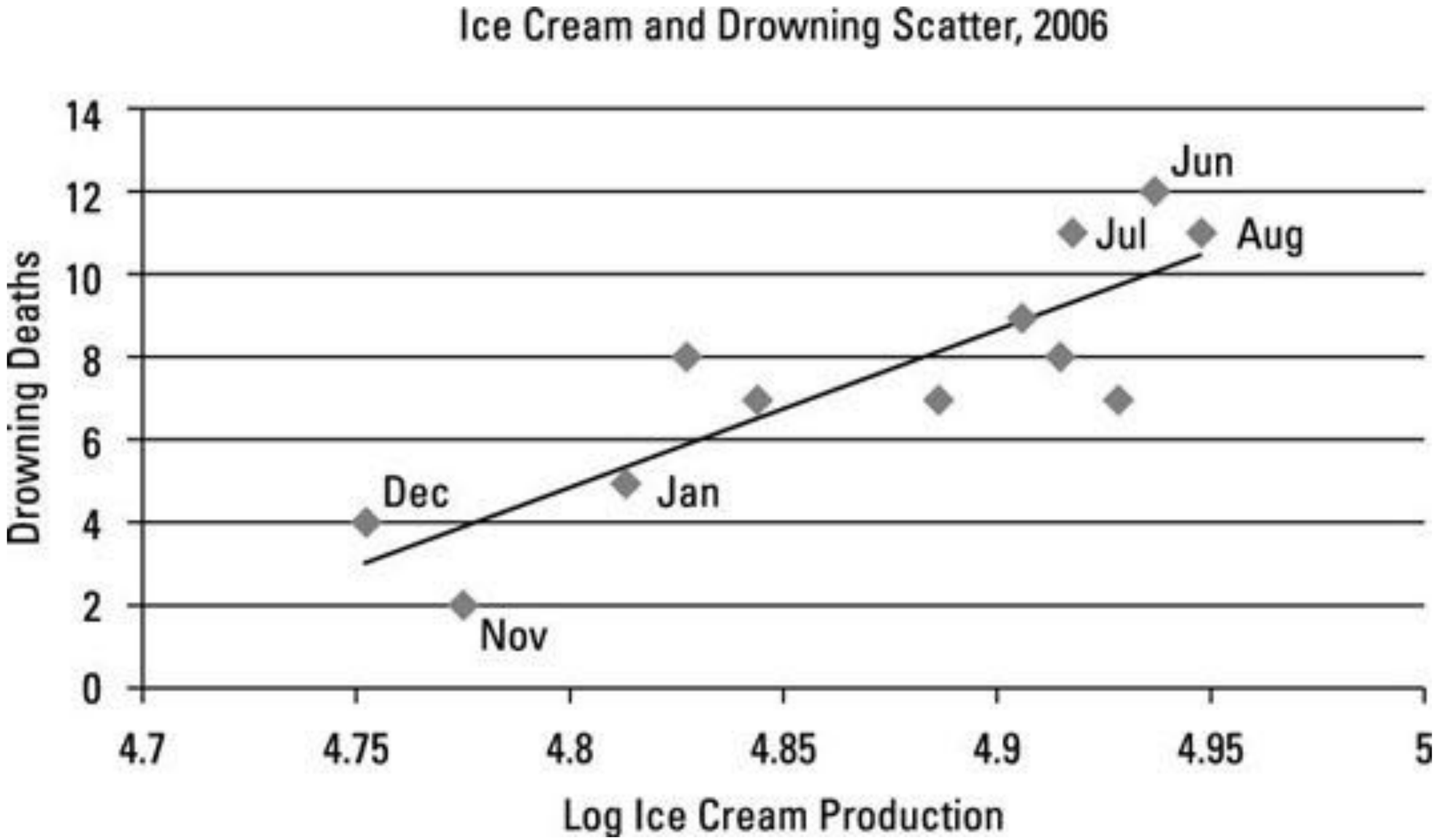


spuriousness



Note: a confounder is a variable that causes both X and Y.

spuriousness

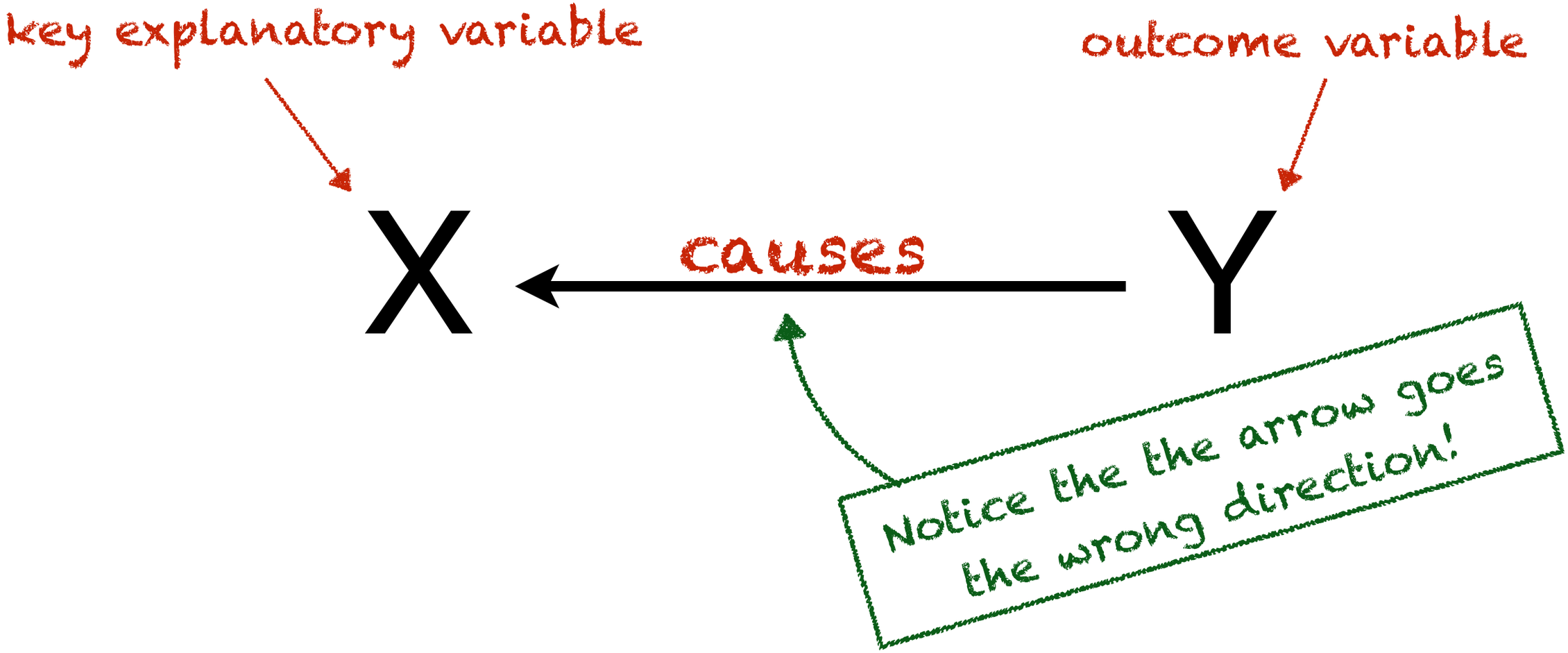

Ice Cream and Drowning Scatter, 2006
Drowning Deaths
14
12
10
8
6
4
2
0
Jun
Jul
Aug
Dec
Jan
Nov
4.7
4.75
4.8
4.85
4.9
4.95
5
Log Ice Cream Production

reverse causation

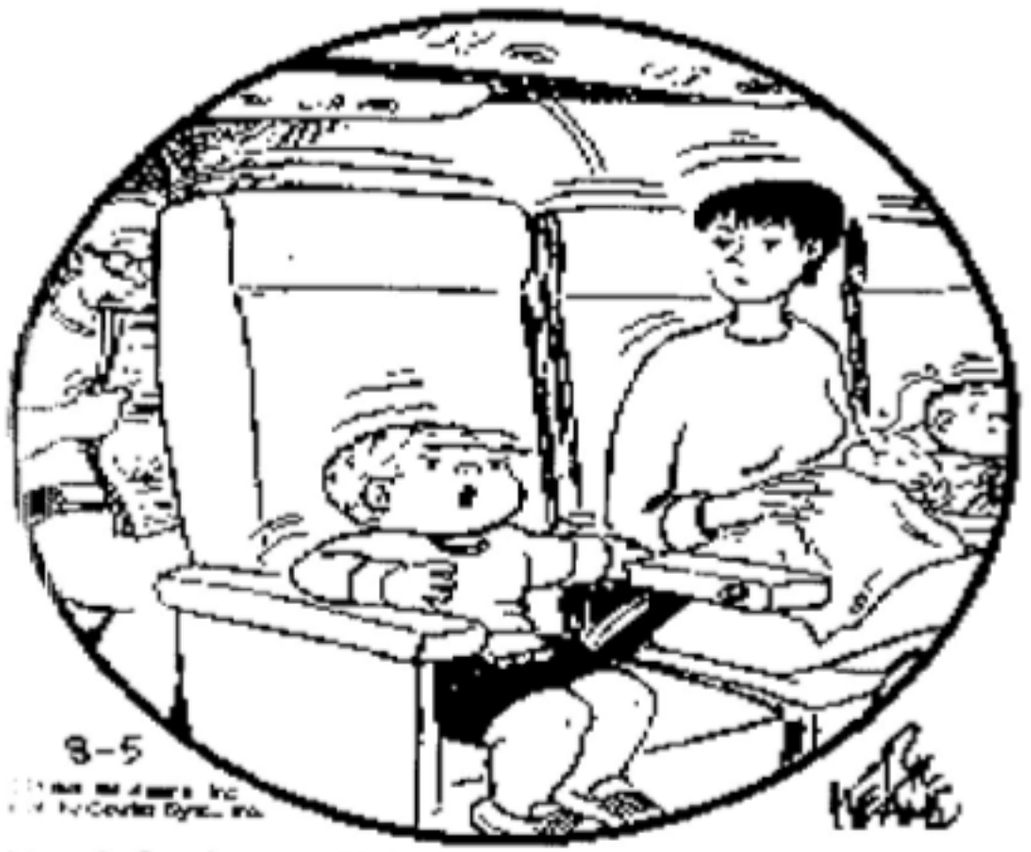
reverse causation

reverse causation

reverse causation



THE FAMILY CIRCUS



"I wish they didn't turn on that seatbelt sign so much! Every time they do, it gets bumpy."

chance

chance

X

Y

chance

key explanatory variable

X

outcome variable

Y

Sometimes, X and Y will be correlated just by chance,
even when there is no systematic relationship between the two.

chance

key explanatory variable

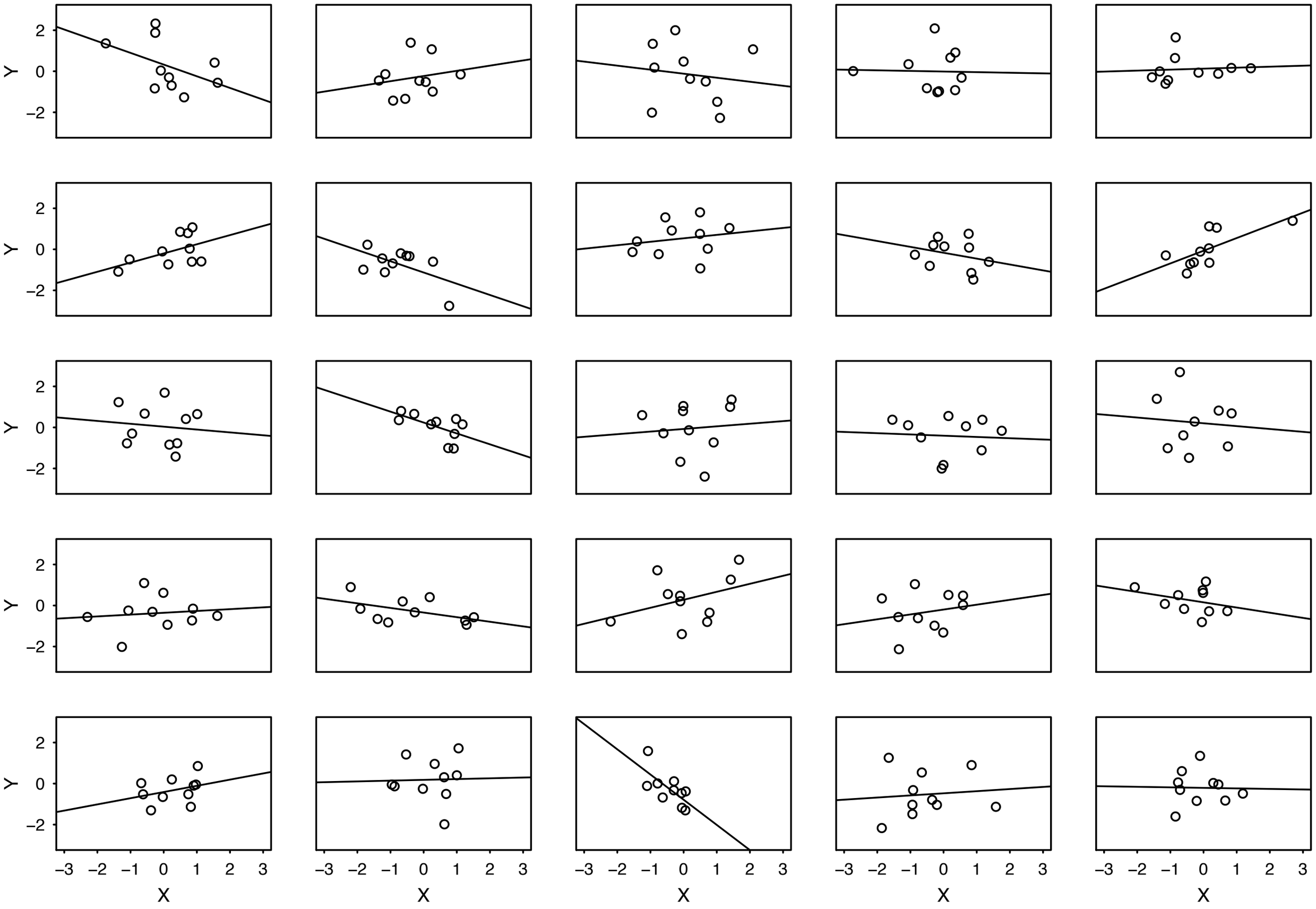
X

outcome variable

Y

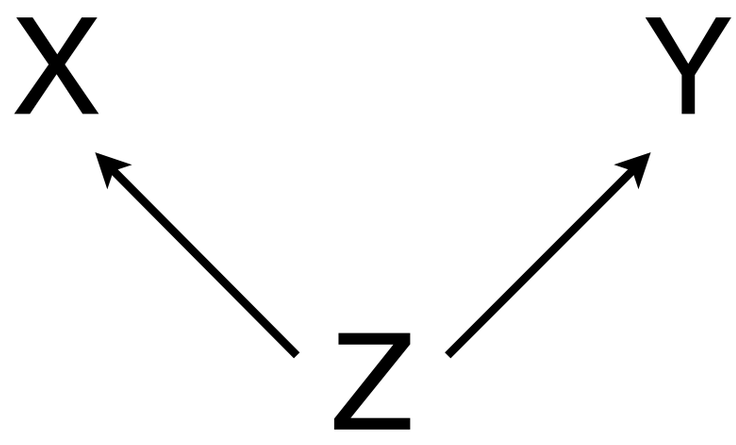
Notice there is no causal arrow!

Pure Noise Generated by a Computer

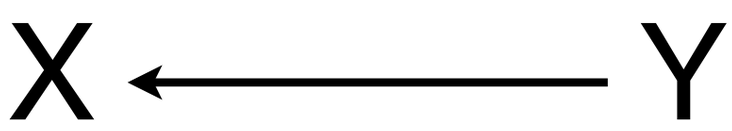


causation

spuriousness



reverse causation

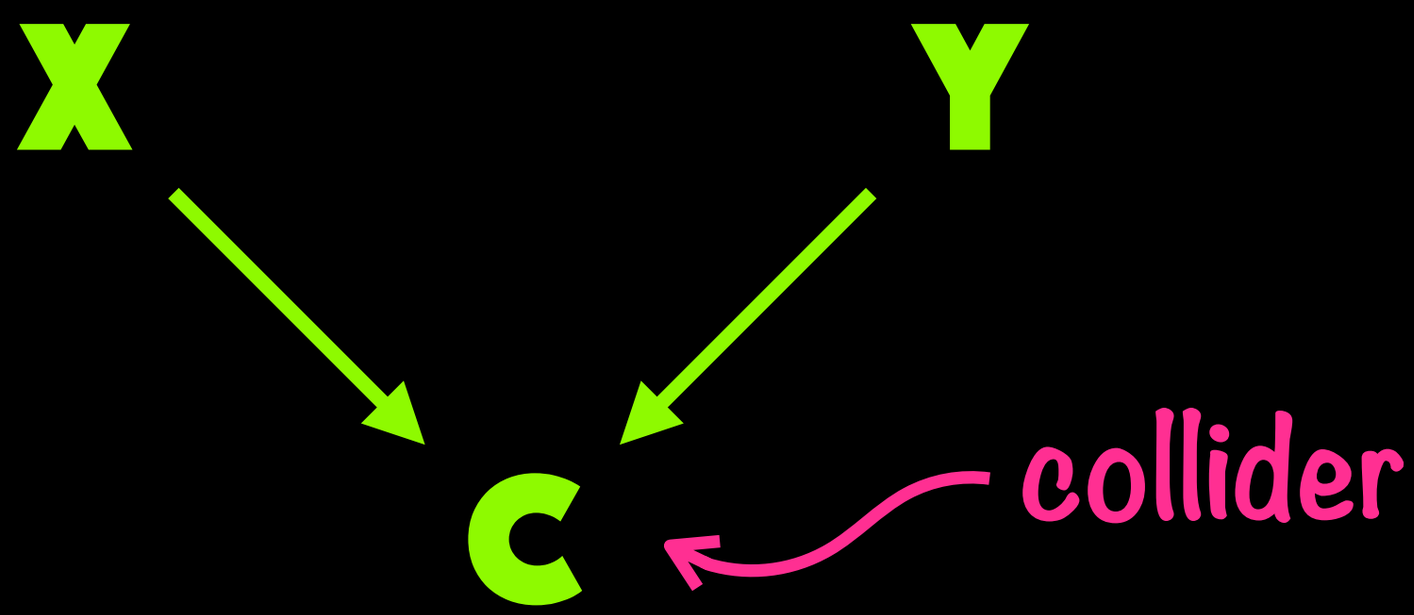


chance

no systematic relationship;
correlation simply due to chance

ASIDE: A 5TH WAY

CONDITION ON A COLLIDER




LAKERS
34
LAKERS
8


24

Posted by [SAS] Kawhi Leonard u/thematterasserted 3 years ago

56

Why can't big men traditionally hit free throws?

Is it just a skill they didn't feel the need to develop as big men typically score inside? Does being big actually make it harder to shoot free throws? I don't get it.

80 Comments Share Save ••• 87% Upvoted

Lakers br0di3 54 points · 3 years ago

Being physically big probably doesn't have much to do with it (see Yao Ming, LaMarcus Aldridge, Roy Hibbert, Pau and Marc, Brook Lopez). Growing up and being bigger than everyone, the bigs were effective without taking their game out to the perimeter, so not needing to work on their shot was probably encouraged by their coaches too.

Warriors TwoTacoTuesdays 88 points · 3 years ago

It's simple: It's the same exact reason why left-handed pitchers don't throw as hard as righties in baseball, except even more extreme.

If you're right-handed there's so much competition for your roster spot in baseball that only the very very best with the most naturally gifted tools make it. Lefties have an easier path dude to less competition, so the average lefty throws softer than the average righty in the pros.

Same thing here. If you're blessed with being 7'0", you pretty much need zero basketball skills to make it on a college team. Think about all of the big men currently on NBA rosters that aren't all that skilled, but are still worth their roster spot because they're huge. If you're only 6'3", you need to be the best of the best to even sniff an NBA roster.

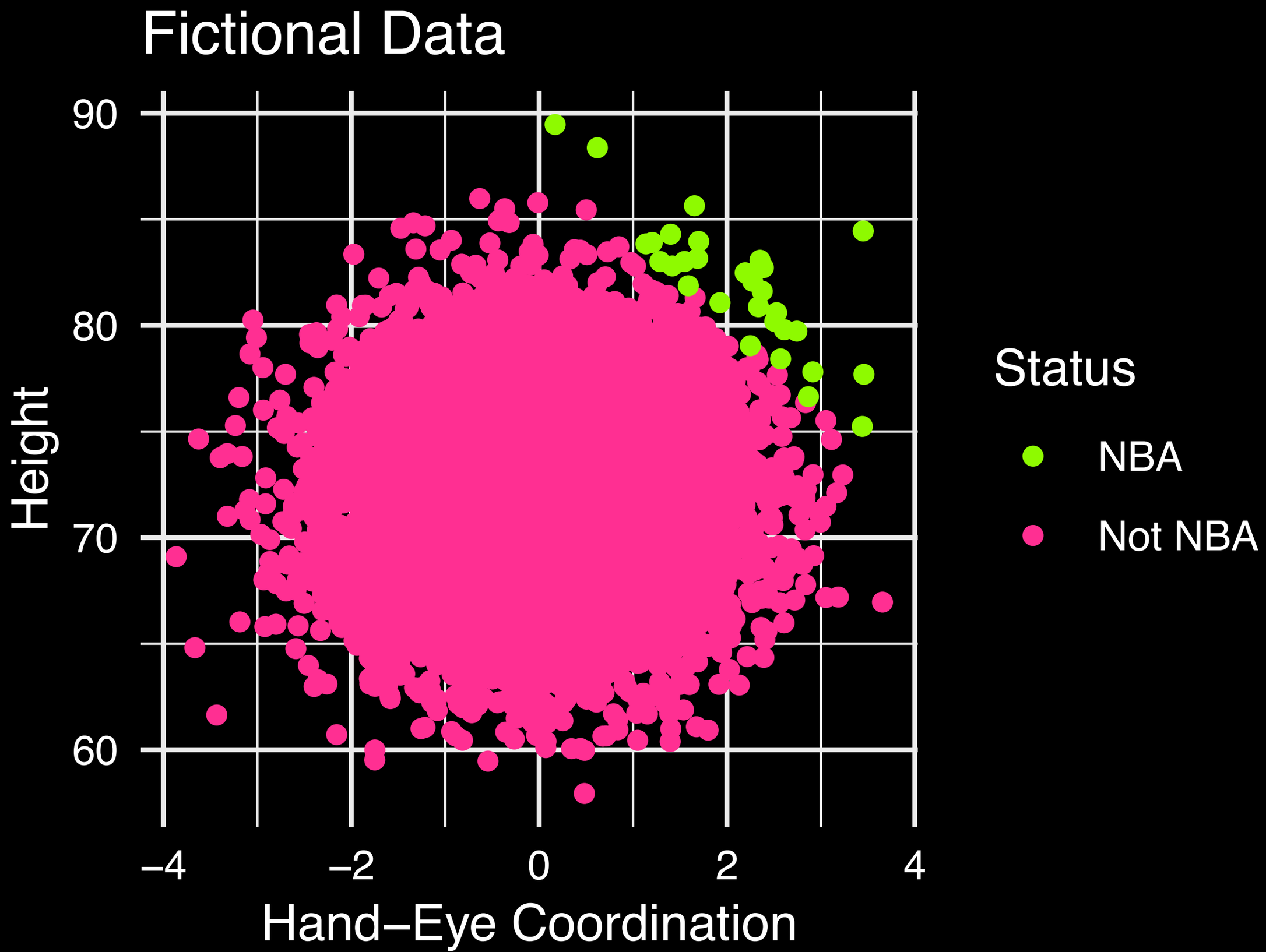
Lakers NBAGuyUK 12 points · 3 years ago

Just because it isn't part of their game in the open court.

Shooting's got a lot to do with muscle memory and co-ordination. In game situations, guards will be taking elbow jumpers all the time and need to have a good jump shot to be efficient with it. So naturally they'll practice shooting from that range anyway and a free throw is just part of it. (i.e, working on your pull-ups, step-backs etc. will inadvertently improve your free throw shooting.) If all you really do is layup and dunk, when you're polishing your natural offense, you won't work on the muscle memory needed for free throws.

In my opinion, that should mean you do EXTRA work at the line in training, but ahh well.

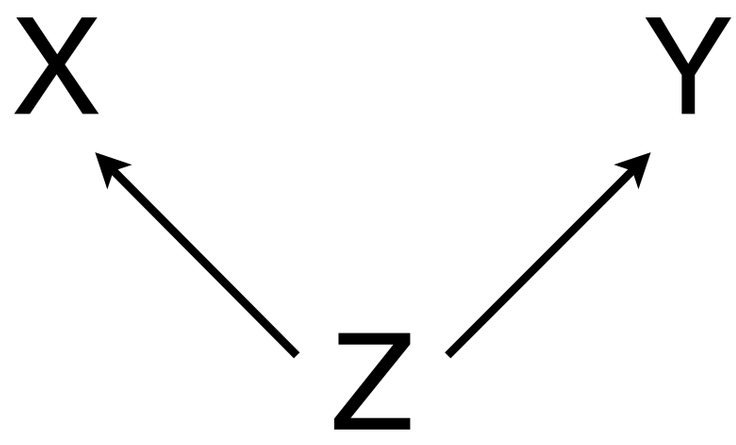
ASIDE: A 5TH WAY



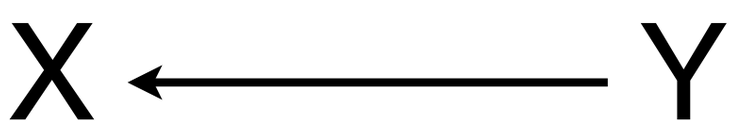
DON'T CONDITION ON A COLLIDER.

causation

spuriousness



reverse causation



chance

no systematic relationship;
correlation simply due to chance

Ruling Out the Alternatives

spuriousness and reverse causation

- a compelling theoretical model (?)
- randomization

spuriousness

- controlling for confounders

chance

- statistical inference

Ruling Out the Alternatives

spuriousness and reverse causation

- a compelling theoretical model (?)
- randomization

This is what we've been doing.

spuriousness

- controlling for confounders

chance

- statistical inference

Ruling Out the Alternatives

spuriousness and reverse causation

- a compelling theoretical model (?)
- randomization We're about to do this.

spuriousness

- controlling for confounders

chance

- statistical inference

Ruling Out the Alternatives

spuriousness and reverse causation

- a compelling theoretical model (?)
- randomization

spuriousness

- controlling for confounders We'll do this by subsetting.

chance

- statistical inference

Ruling Out the Alternatives

spuriousness and reverse causation

- a compelling theoretical model (?)
- randomization

spuriousness

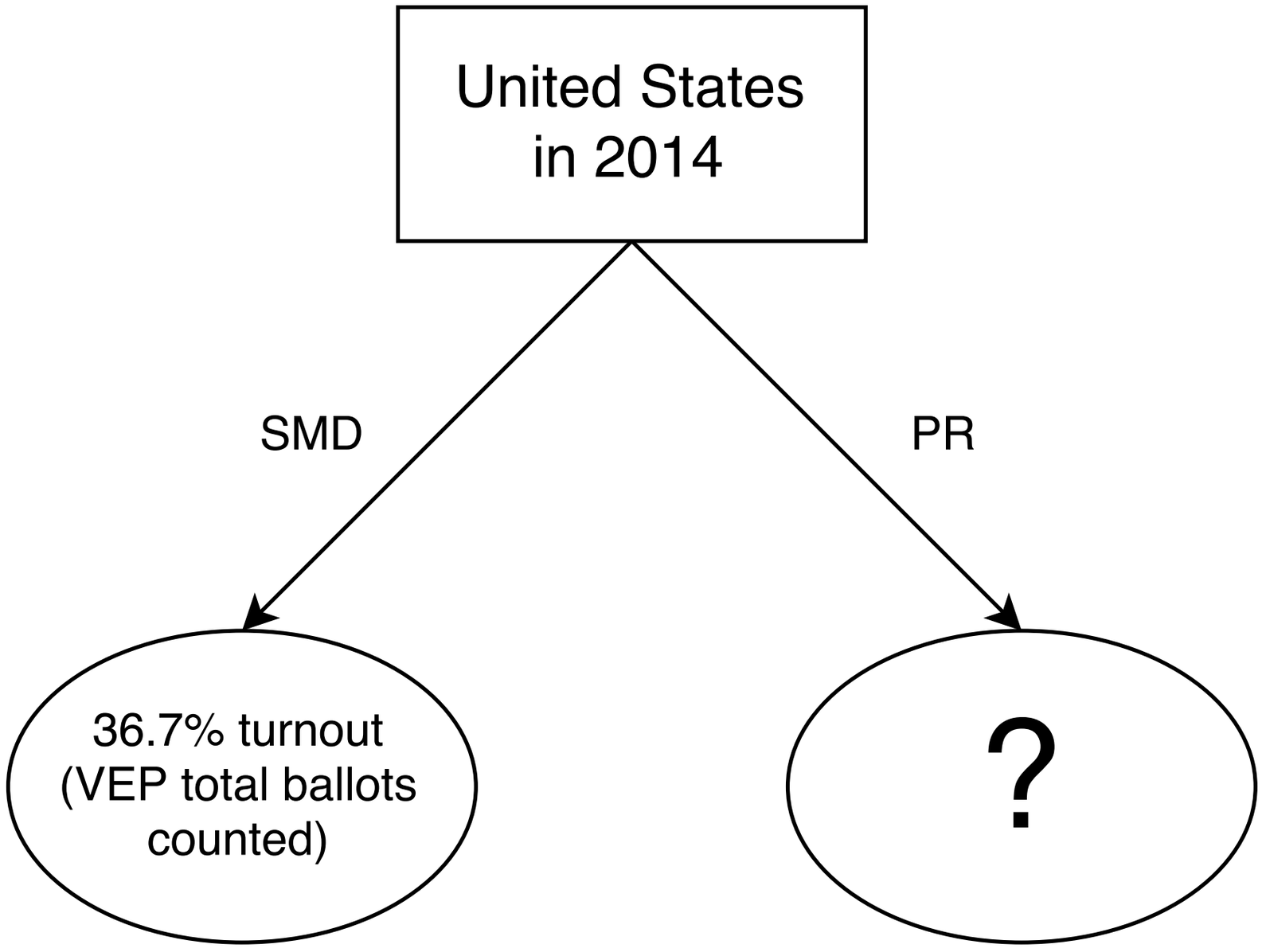
- controlling for confounders

chance

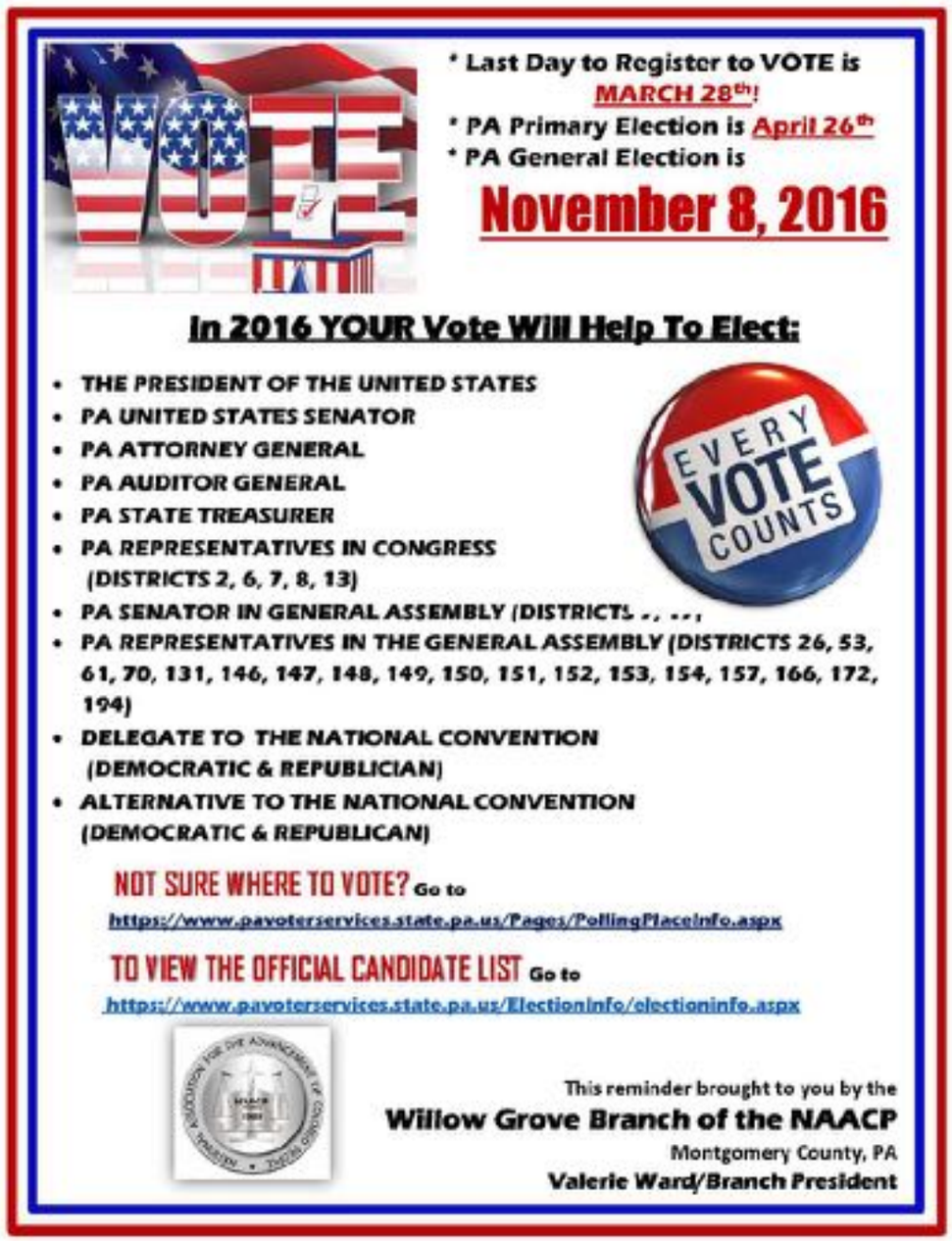
- statistical inference

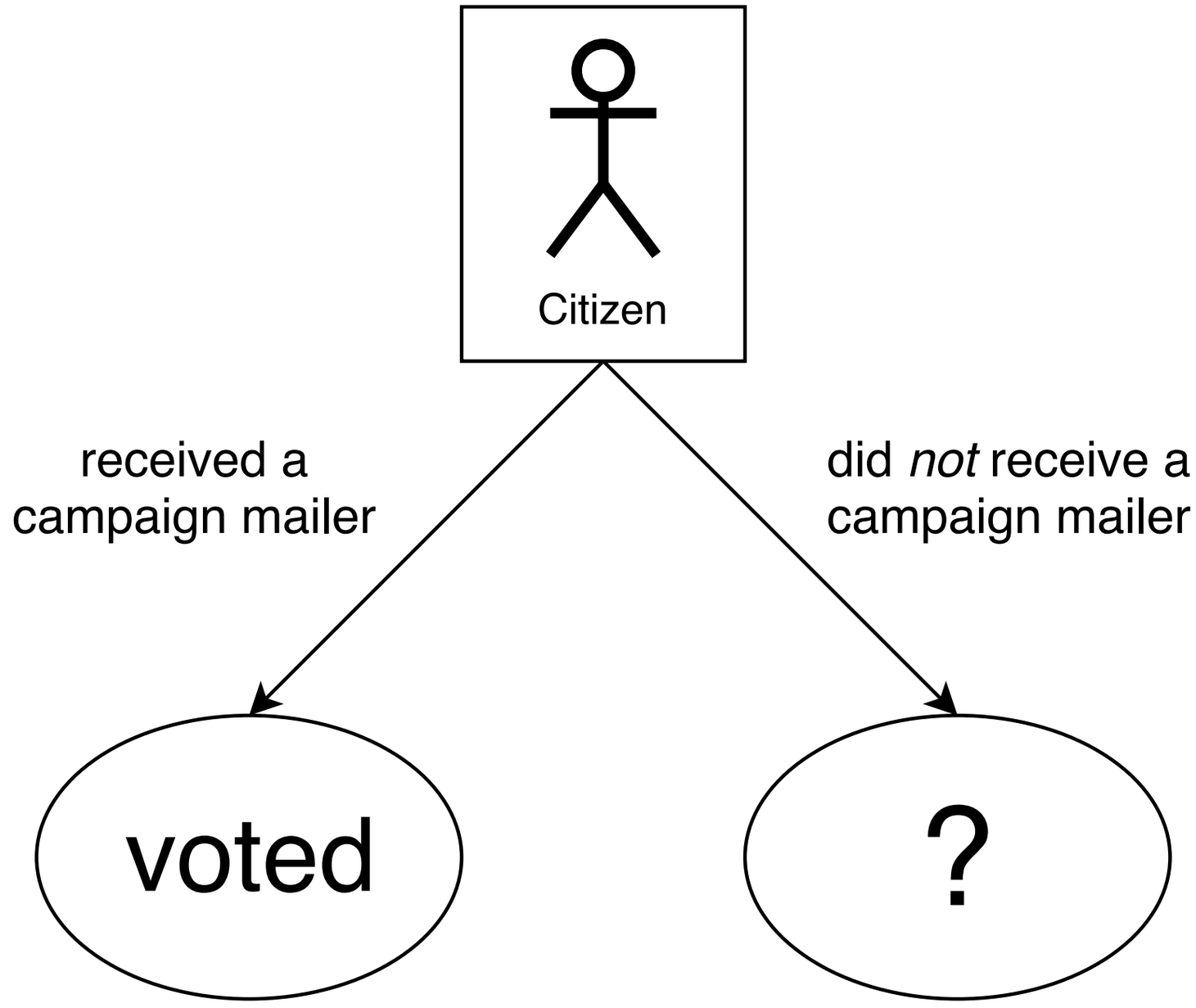
last 3rd of the class

Randomization


United States
in 2014
SMD
PR
36.7% turnout
(VEP total ballots
counted)
?

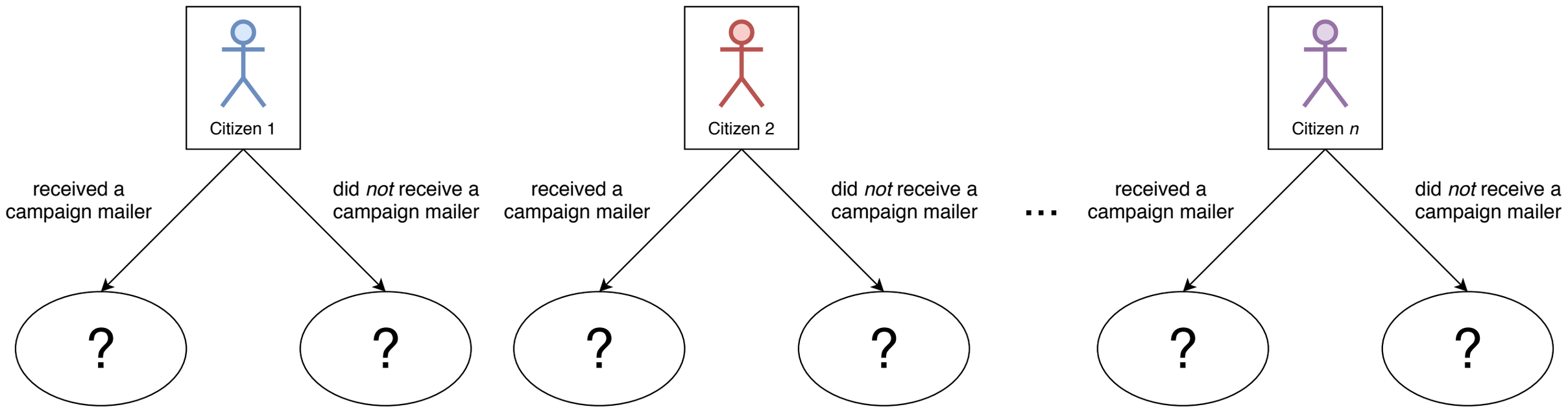
What is the effect of a campaign mailer on a citizen's decision to turn out and vote?




Citizen
received a campaign mailer
did *not* receive a campaign mailer
voted
?

Imagine we're in the following **ideal situation**:

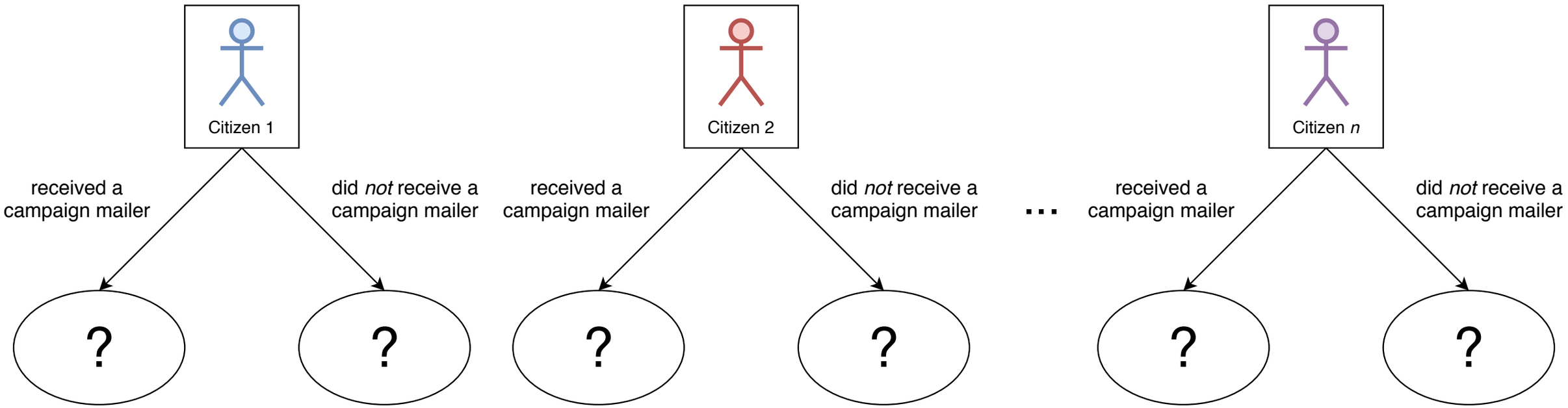
A. we have *n* potential voters,
B. the election hasn't yet happened, and
C. we can control the assignment of the treatment.



R_T^{hyp}: The hypothetical turnout Rate if everyone was in the Treatment group.

R_C^{hyp}: The hypothetical turnout Rate if everyone was in the Control group.

$R_T^{hyp} - R_C^{hyp}$: average treatment effect (ATE)


Citizen 1
received a campaign mailer
did *not* receive a campaign mailer
?
Citizen 2
received a campaign mailer
did *not* receive a campaign mailer
?
...
Citizen *n*
received a campaign mailer
did *not* receive a campaign mailer
?

R_T^{obs}: The observed turnout Rate in the Treatment group.

R_C^{obs}: The observed turnout Rate in the Control group.

$$R_T^{obs} - R_C^{obs} \approx R_T^{hyp} - R_C^{hyp}$$

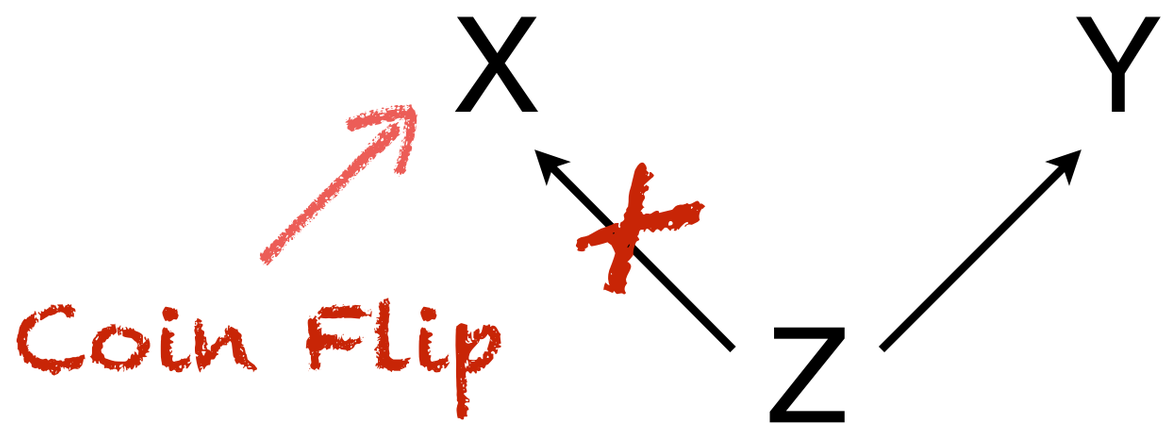
R_T^{obs}: The observed turnout Rate in the Treatment group.

R_C^{obs}: The observed turnout Rate in the Control group.

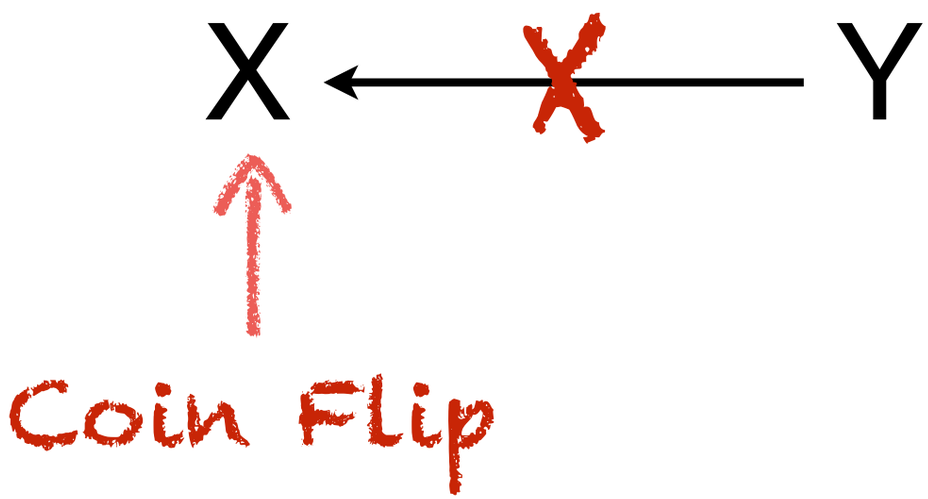
$$\underbrace{R_T^{obs} - R_C^{obs}}_{\text{estimate}} \approx \overbrace{R_T^{hyp} - R_C^{hyp}}^{\text{ATE}}$$

causation

spuriousness



reverse causation



chance

no systematic relationship;
correlation simply due to chance

TABLE 2. Effects of Four Mail Treatments on Voter Turnout in the August 2006 Primary Election

	Experimental Group				
	Control	Civic Duty	Hawthorne	Self	Neighbors
Percentage Voting					
N of Individuals					

TABLE 2. Effects of Four Mail Treatments on Voter Turnout in the August 2006 Primary Election

	Experimental Group				
	Control	Civic Duty	Hawthorne	Self	Neighbors
Percentage Voting	29.7%				
N of Individuals	191,243				

Dear Registered Voter:

DO YOUR CIVIC DUTY AND VOTE!

Why do so many people fail to vote? We've been talking about this problem for years, but it only seems to get worse.

The whole point of democracy is that citizens are active participants in government; that we have a voice in government. Your voice starts with your vote. On August 8, remember your rights and responsibilities as a citizen. Remember to vote.

DO YOUR CIVIC DUTY — VOTE!

TABLE 2. Effects of Four Mail Treatments on Voter Turnout in the August 2006 Primary Election

	Experimental Group				
	Control	Civic Duty	Hawthorne	Self	Neighbors
Percentage Voting	29.7%	31.5%			
N of Individuals	191,243	38,218			

Dear Registered Voter:

YOU ARE BEING STUDIED!

Why do so many people fail to vote? We've been talking about this problem for years, but it only seems to get worse.

This year, we're trying to figure out why people do or do not vote. We'll be studying voter turnout in the August 8 primary election.

Our analysis will be based on public records, so you will not be contacted again or disturbed in any way. Anything we learn about your voting or not voting will remain confidential and will not be disclosed to anyone else.

DO YOUR CIVIC DUTY — VOTE!

TABLE 2. Effects of Four Mail Treatments on Voter Turnout in the August 2006 Primary Election

	Experimental Group				
	Control	Civic Duty	Hawthorne	Self	Neighbors
Percentage Voting	29.7%	31.5%	32.2%		
N of Individuals	191,243	38,218	38,204		

Dear Registered Voter:

WHO VOTES IS PUBLIC INFORMATION!

Why do so many people fail to vote? We've been talking about the problem for years, but it only seems to get worse.

This year, we're taking a different approach. We are reminding people that who votes is a matter of public record.

The chart shows your name from the list of registered voters, showing past votes, as well as an empty box which we will fill in to show whether you vote in the August 8 primary election. We intend to mail you an updated chart when we have that information.

We will leave the box blank if you do not vote.

DO YOUR CIVIC DUTY—VOTE!

OAK ST	Aug 04	Nov 04	Aug 06
9999 ROBERT WAYNE		Voted	_____
9999 LAURA WAYNE	Voted	Voted	_____

TABLE 2. Effects of Four Mail Treatments on Voter Turnout in the August 2006 Primary Election

	Experimental Group				
	Control	Civic Duty	Hawthorne	Self	Neighbors
Percentage Voting	29.7%	31.5%	32.2%	34.5%	
N of Individuals	191,243	38,218	38,204	38,218	

Dear Registered Voter:

WHAT IF YOUR NEIGHBORS KNEW WHETHER YOU VOTED?

Why do so many people fail to vote? We've been talking about the problem for years, but it only seems to get worse. This year, we're taking a new approach. We're sending this mailing to you and your neighbors to publicize who does and does not vote.

The chart shows the names of some of your neighbors, showing which have voted in the past. After the August 8 election, we intend to mail an updated chart. You and your neighbors will all know who voted and who did not.

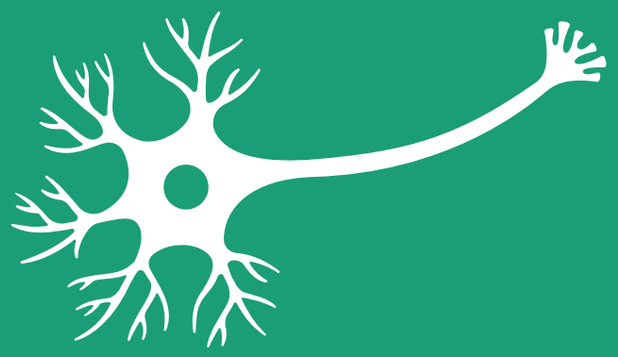
DO YOUR CIVIC DUTY — VOTE!

MAPLE DR	Aug 04	Nov 04	Aug 06
9995 JOSEPH JAMES SMITH	Voted	Voted	_____
9995 JENNIFER KAY SMITH		Voted	_____
9997 RICHARD B JACKSON		Voted	_____
9999 KATHY MARIE JACKSON		Voted	_____
9999 BRIAN JOSEPH JACKSON		Voted	_____
9991 JENNIFER KAY THOMPSON		Voted	_____
9991 BOB R THOMPSON		Voted	_____
9993 BILL S SMITH			_____
9989 WILLIAM LUKE CASPER		Voted	_____
9989 JENNIFER SUE CASPER		Voted	_____
9987 MARIA S JOHNSON	Voted	Voted	_____
9987 TOM JACK JOHNSON	Voted	Voted	_____
9987 RICHARD TOM JOHNSON		Voted	_____
9985 ROSEMARY S SUE		Voted	_____
9985 KATHRYN L SUE		Voted	_____
9985 HOWARD BEN SUE		Voted	_____
9983 NATHAN CHAD BERG		Voted	_____
9983 CARRIE ANN BERG		Voted	_____
9981 EARL JOEL SMITH			_____
9979 DEBORAH KAY WAYNE		Voted	_____
9979 JOEL R WAYNE		Voted	_____

TABLE 2. Effects of Four Mail Treatments on Voter Turnout in the August 2006 Primary Election

	Experimental Group				
	Control	Civic Duty	Hawthorne	Self	Neighbors
Percentage Voting	29.7%	31.5%	32.2%	34.5%	37.8%
N of Individuals	191,243	38,218	38,204	38,218	38,201

think + write + discuss



Is this ethical?