INTRODUCTION TO POLITICAL ANALYSIS

MORE HYPOTHESIS TESTING WITH ONE CONFOUNDER

HOUSEKEEPING

- No in-person sections on Friday
- Instead, we will distribute a worksheet to complete at your leisure
  - Due December 1 (Friday in 2 weeks)
  - Graded pass/fail, counts towards section attendance/participation
- If you have questions about the material, please email and/or attend student hours

HOUSEKEEPING

- **Problem Set 8 will be posted this week**
  - Also due December 1
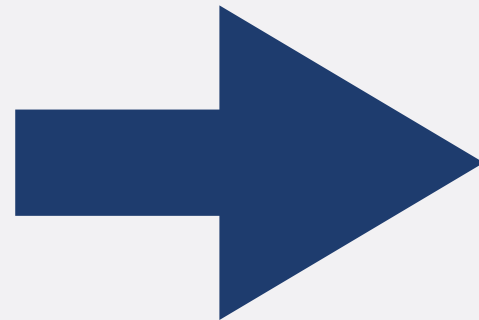
Partisanship → **Feeling safer if more armed security**

PARTISANSHIP & SAFETY

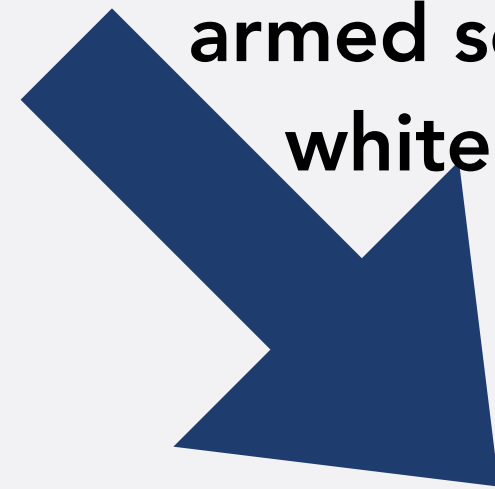|	Democrats	Not Democrats	Total
Feel Safer	48% (27)	56% (18)	51% (45)
Not Feel Safer	52% (29)	44% (14)	49% (43)
Total	100% (56)	100% (32)	100% (88)

MAYBE THIS IS GOING ON?

Non-white students more likely to be Democrats than white students

Race (Z)

Non-white students more likely to not feel safer with armed security than white students

Partisanship (X)

Feeling safer if more armed security (Y)

Partisanship by itself has no effect on feeling safer

POTENTIAL CONCERN

Disproportionately
non-white
students

Disproportionately
white
students

	Democrats	Not Democrats	Total
Feel Safer	48% (27)	56% (18)	51% (45)
Not Feel Safer	52% (29)	44% (14)	49% (43)
Total	100% (56)	100% (32)	100% (88)

MAYBE THIS IS GOING ON?

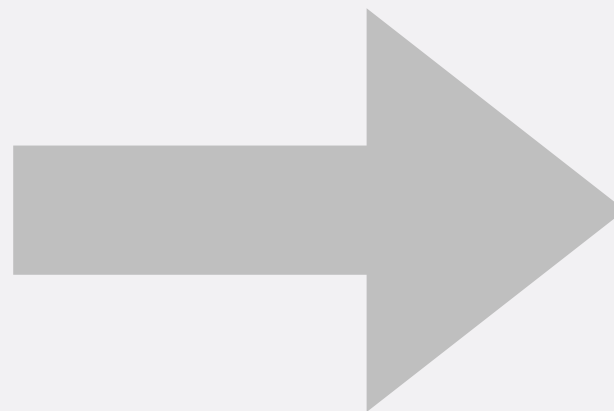Non-white students more likely to be Democrats than white students

Race (Z)

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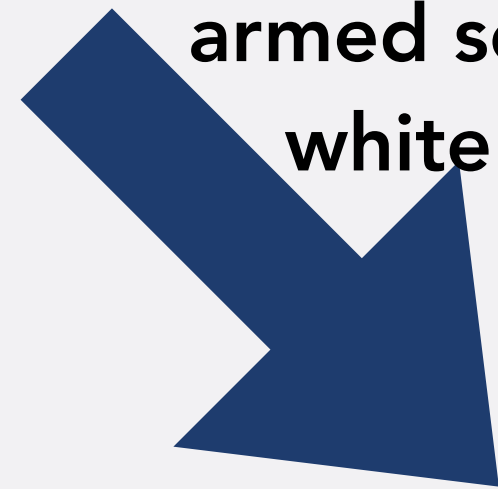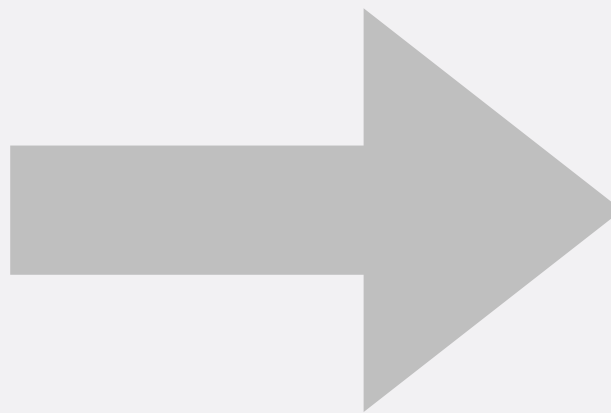
Partisanship (X) → Feeling safer if more armed security (Y)

- How can we find out if this is what's going on?

CONTROLLED COMPARISON TABLE

More Armed Security	White			Non-White		
	Dem	Non-Dem	Total	Dem	Non-Dem	Total
Feel Safer						
Not Feel Safer						
Total						

CONTROLLED COMPARISON TABLE

More Armed Security	White			Non-White		
	Dem	Non-Dem	Total	Dem	Non-Dem	Total
Feel Safer	42% (15)	61% (11)	48% (26)			
Not Feel Safer	58% (21)	39% (7)	52% (28)			
Total	100% (36)	100% (18)	100% (54)			

CONTROLLED COMPARISON TABLE

More Armed Security	White			Non-White		
	Dem	Non-Dem	Total	Dem	Non-Dem	Total
Feel Safer	42% (15)	61% (11)	48% (26)			
Not Feel Safer	58% (21)	39% (7)	52% (28)			
Total	100% (36)	100% (18)	100% (54)			

19%

PARTISANSHIP & VACCINATION

- **Among white students, Democrats are less likely to feel safer with armed security than Non-Democrats**
  - White Democrats 19 percentage points less likely to report feeling safer than white non-Democrats

TERMINOLOGY

- <u>Controlled effect</u>: relationship between an independent variable (X) and a dependent variable (Y) within one value of another independent variable (Z)
    - e.g. relation between partisanship (X) and feeling safer (Y) among white students (one value of Z)

CONTROLLED COMPARISON TABLE

More Armed Security	White			Non-White		
	Dem	Non-Dem	Total	Dem	Non-Dem	Total
Feel Safer	42% (15)	61% (11)	48% (26)	40% (8)	54% (7)	45% (15)
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Total	100% (36)	100% (18)	100% (54)	100% (20)	100% (13)	100% (33)

19%

CONTROLLED COMPARISON TABLE

More Armed Security	White			Non-White		
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Total	100% (36)	100% (18)	100% (54)	100% (20)	100% (13)	100% (33)

19%

14%

PARTISANSHIP & VACCINES

- **Among non-white students, Democrats are less likely to feel safer with armed security than Non-Democrats**
  - **Non-white Democrats 14 percentage points less likely to report feeling safer than non-white non-Democrats**

PARTISANSHIP & VOTING

- **So even if we take race into account, partisanship *still* has effect on safety feelings**
  - Among both white and non-white students, Democrats less likely to feel safer

TERMINOLOGY

- <u>Partial relationship/partial effect</u>: relationship between two variables after taking effect of other variables into account
  - e.g. relation between partisanship and safety feeling, controlling for race
 - Partial relationship summarizes the controlled effects

HOW DOES THIS HELP?

- Is there a credible causal mechanism that connects X to Y?
- Can we rule out the possibility that Y could cause X?
- Is there covariation between X and Y?
- Have we controlled for all confounding variables (Z) that might make the association between X and Y spurious?

HOW DOES THIS HELP?

- Logic of control
- What is the relationship between X and Y when we control for *one* confounder?
  - Ultimate goal: What is the relationship between X and Y when we control for *many* confounders?

PARTISANSHIP & GUN CONTROL
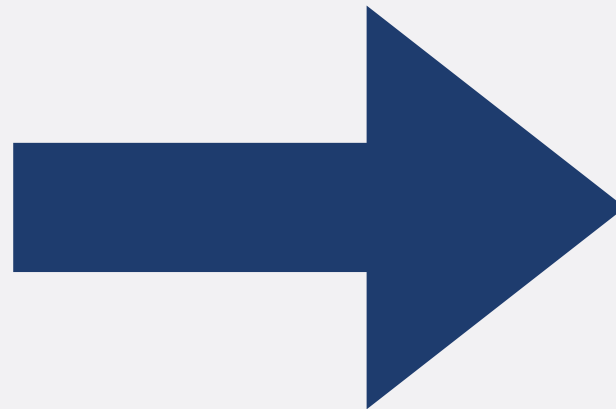
Partisanship (X) → Support for gun control (Y)

PARTISANSHIP & GUN CONTROL

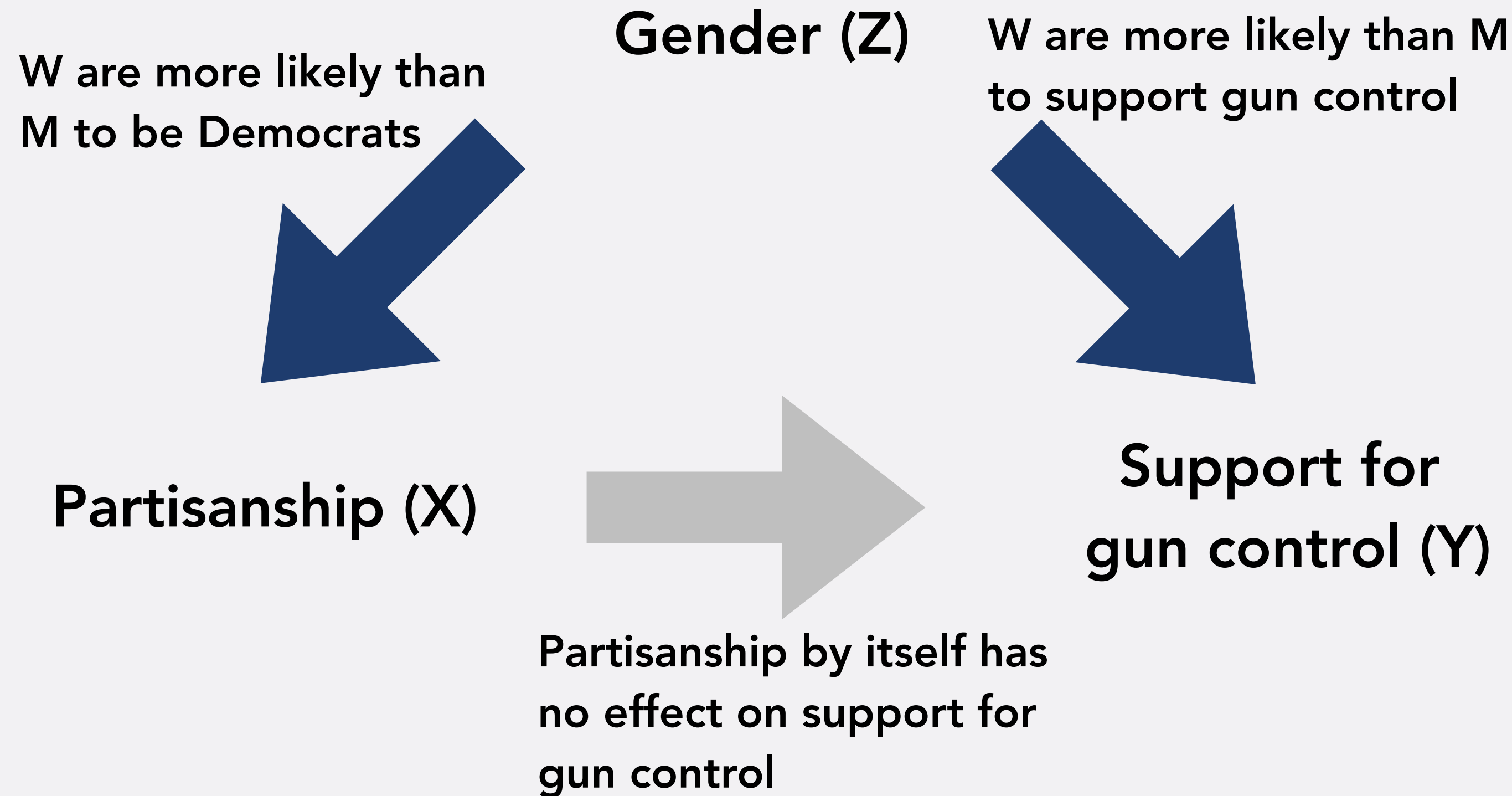|	Democrats	Republicans	Total
Stricter Gun Control	58% (7)	42% (5)	50% (12)
Not Stricter Gun Control	42% (5)	58% (7)	50% (12)
Total	100% (12)	100% (12)	100% (24)

• **Hypothetical example**

ZERO-ORDER EFFECT

	Democrats	Republicans	Total
Stricter Gun Control	58% (7) 16%	42% (5)	50% (12)
Not Stricter Gun Control	42% (5)	58% (7)	50% (12)
Total	100% (12)	100% (12)	100% (24)

CONFOUNDER?

Gender (Z)

W are more likely than
M to be Democrats

W are more likely than M
to support gun control

Partisanship (X)

Support for
gun control (Y)

Partisanship by itself has
no effect on support for
gun control

PARTISANSHIP & GUN CONTROL

	Female			Male		
	Dem	Rep	Total	Dem	Rep	Total
Stricter Gun Control						
Not Stricter Gun						
Total						

PARTISANSHIP & GUN CONTROL

	Female			Male		
	Dem	Rep	Total	Dem	Rep	Total
Stricter Gun Control	75% (6)	75% (3)	75% (9)			
Not Stricter Gun	25% (2)	25% (1)	25% (3)			
Total	100% (8)	100% (4)	100% (12)			

PARTISANSHIP & GUN CONTROL

	Female			Male		
	Dem	Rep	Total	Dem	Rep	Total
Stricter Gun Control	75% (6)	75% (3)	75% (9)	25% (1)	25% (2)	25% (3)
Not Stricter Gun	25% (2)	25% (1)	25% (3)	75% (3)	75% (6)	75% (9)
Total	100% (8)	100% (4)	100% (12)	100% (4)	100% (8)	100% (12)

PARTISANSHIP & GUN CONTROL

	Female			Male		
	Dem	Rep 0%	Total	Dem	Rep 0%	Total
Stricter Gun Control	75% (6)	75% (3)	75% (9)	25% (1)	25% (2)	25% (3)
Not Stricter Gun	25% (2)	25% (1)	25% (3)	75% (3)	75% (6)	75% (9)
Total	100% (8)	100% (4)	100% (12)	100% (4)	100% (8)	100% (12)

- **Partial effect of partisanship, "controlling for" gender**

SPURIOUS RELATIONSHIP

Gender (Z)

Partisanship (X)

Support for
gun control (Y)
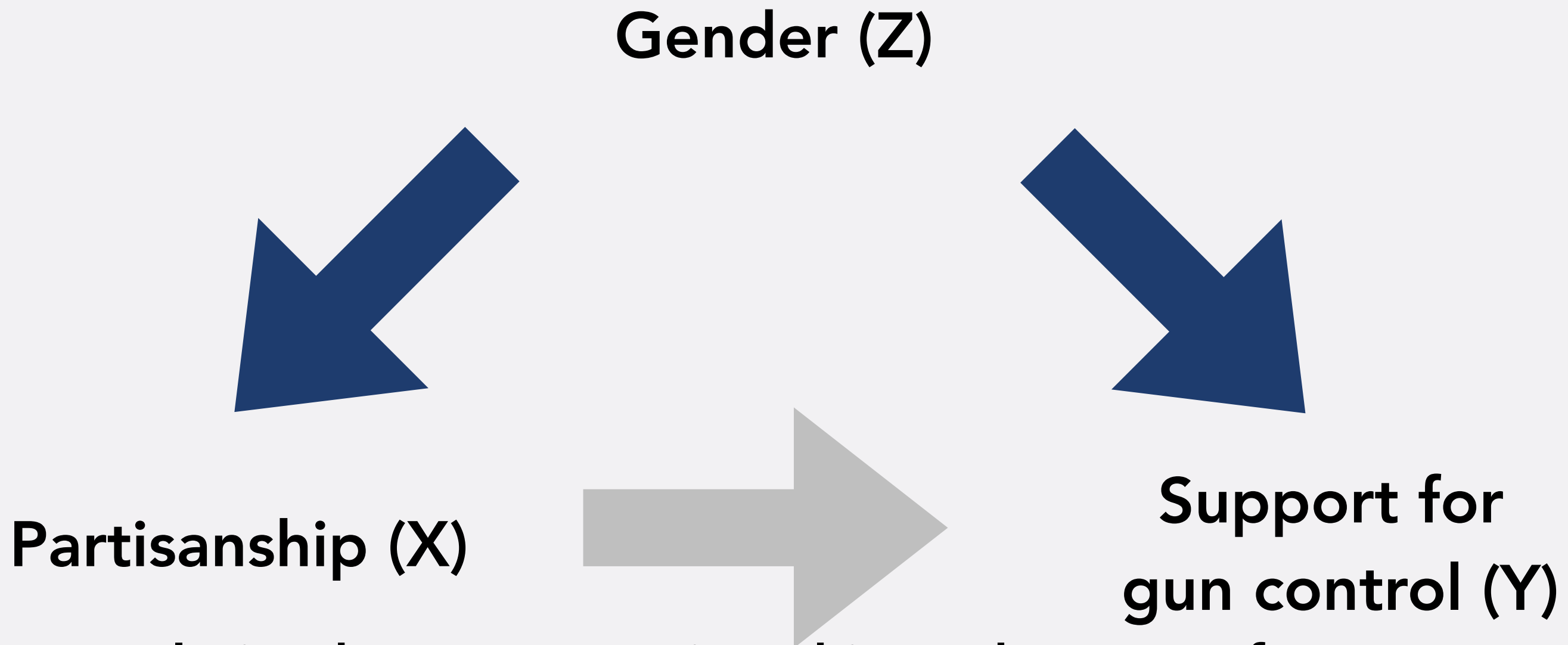
- Relation between partisanship and support for gun control was *spurious*
  - Caused by compositional differences
  - Once we "control for" gender, no *independent* effect of partisanship

A DIFFERENT EXAMPLE

	Female			Male		
	Dem	Rep	Total	Dem	Rep	Total
Stricter Gun Control	66% (4)	50% (3)	58% (7)	33% (2)	17% (1)	25% (3)
Not Stricter Gun	33% (2)	50% (3)	42% (5)	66% (4)	83% (5)	75% (9)
Total	100% (6)	100% (6)	100% (12)	100% (6)	100% (6)	100% (12)

- **What are the controlled effects?**

PARTIAL EFFECTS

	Female			Male		
	Dem	Rep	Total	Dem	Rep	Total
	16%			**16%**		
Stricter Gun Control	**66%** (4)	**50%** (3)	**58%** (7)	**33%** (2)	**17%** (1)	**25%** (3)
Not Stricter Gun	**33%** (2)	**50%** (3)	**42%** (5)	**66%** (4)	**83%** (5)	**75%** (9)
Total	**100%** (6)	**100%** (6)	**100%** (12)	**100%** (6)	**100%** (6)	**100%** (12)

WHAT WE FIND...

- **Partisanship still has an independent effect on attitudes among both men and women**

ADDITIVE RELATIONSHIP

Gender (Z)

Partisanship (X)

Support for
gun control (Y)
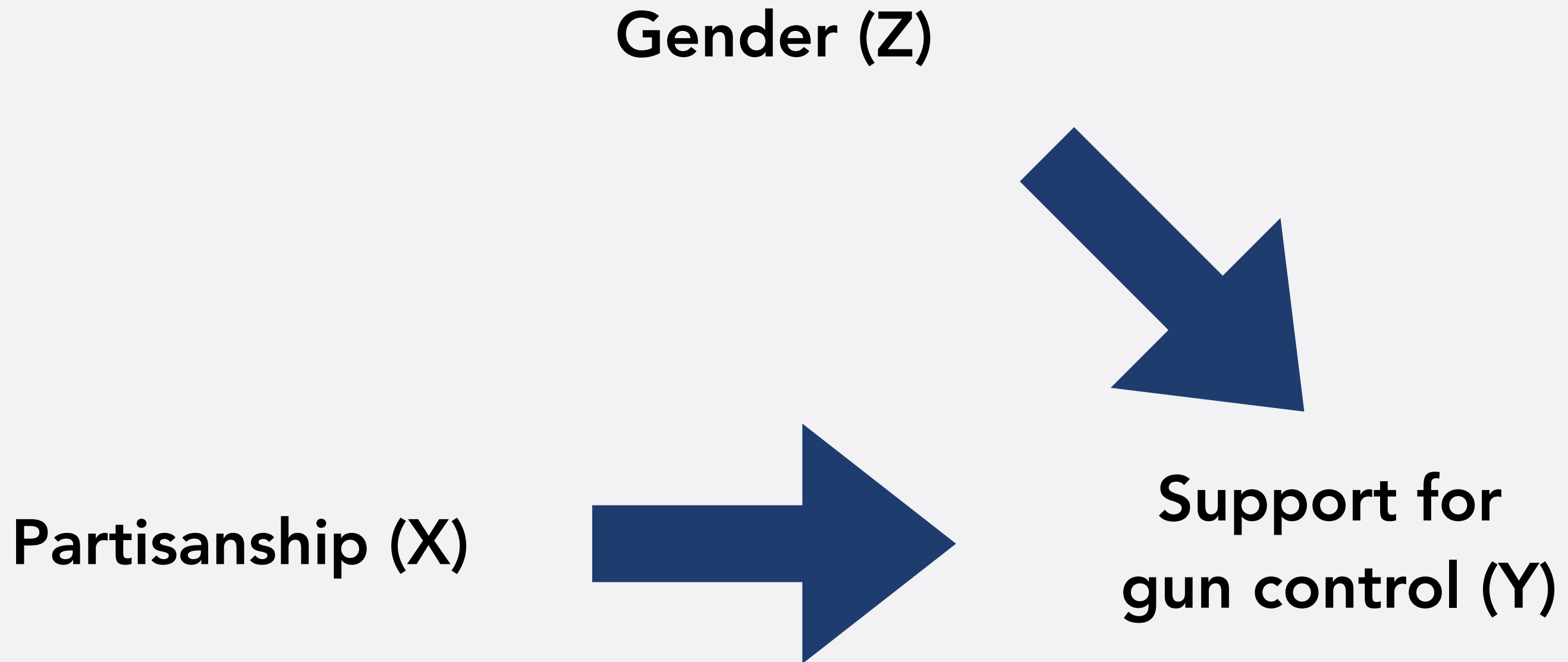
- Both partisanship *and* gender determine gun control attitudes

YET ANOTHER EXAMPLE

	Female			Male		
	Dem	Rep	Total	Dem	Rep	Total
Stricter Gun Control	57% (4)	50% (2)	55% (6)	60% (3)	38% (3)	46% (6)
Not Stricter Gun	43% (3)	50% (2)	45% (5)	40% (2)	62% (5)	54% (7)
Total	100% (7)	100% (4)	100% (11)	100% (5)	100% (8)	100% (13)

PARTIAL EFFECTS

	Female			Male		
	Dem	Rep	Total	Dem	Rep	Total
		7%			**22%**	
Stricter Gun Control	57% (4)	50% (2)	55% (6)	60% (3)	38% (3)	46% (6)
Not Stricter Gun	43% (3)	50% (2)	45% (5)	40% (2)	62% (5)	54% (7)
Total	100% (7)	100% (4)	100% (11)	100% (5)	100% (8)	100% (13)

WHAT WE FIND...

- Partisanship still has an independent effect on attitudes among both men and women
- But these effects are of different size!
  - The effect of partisanship is stronger among men than among women

WHAT WE FIND...

	Female			Male		
	Dem	Rep 7%	Total	Dem	Rep 22%	Total
Stricter Gun Control	57% (4)	50% (2)	55% (6)	60% (3)	38% (3)	46% (6)
Not Stricter Gun	43% (3)	50% (2)	45% (5)	40% (2)	62% (5)	54% (7)
Total	100% (7)	100% (4)	100% (11)	100% (5)	100% (8)	100% (13)

INTERACTIVE RELATIONSHIP

Gender (Z)

Partisanship (X)

Support for gun control (Y)
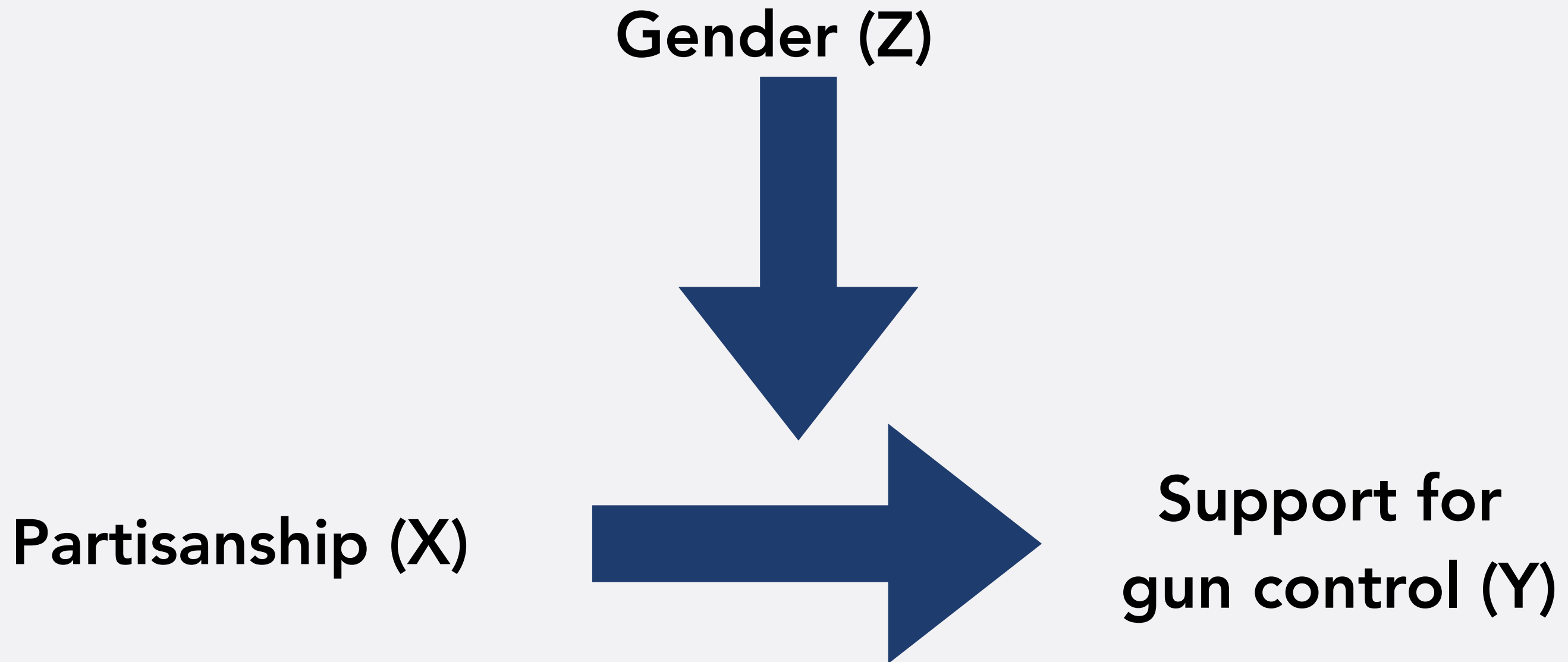
- Gender determines how much partisanship affects gun control attitudes

WHAT HAVE WE LEARNED?

- Want to know: Is there an effect of X on Y?
  - Zero-order relationship not 0? Great!
  - But what about Z?
- Learned: How to check if X has an *independent* effect on Y, controlling for Z
  - Spurious relationship
  - Additive relationship
  - Interactive relationship

NOW...

- **How can we tell whether a relation is spurious, additive, or interactive?**

HOW CAN WE TELL WHICH ONE?

1. **Are all controlled/partial effects zero or very close to zero?**
   - Yes? ⇒ relationship between x and y is *spurious*
   - No? ⇒ either additive or interactive

2. **Are all controlled/partial effects approximately the same size?**
   - Yes? ⇒ *additive* relationship
   - No? ⇒ *interactive* relationship

BACK TO OUR SURVEY

More Armed Security	White			Non-White		
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19%

14%

- **Partial effect of partisanship, "controlling for" race**

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BACK TO OUR SURVEY

More Armed Security	White			Non-White		
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   - Yes? ⇒ *additive* relationship
   - No? ⇒ *interactive* relationship

   Would also be ok to conclude additive

INTERACTIVE RELATIONSHIP

Race (Z)

Partisanship (X) → Feeling safer if more armed security (Y)
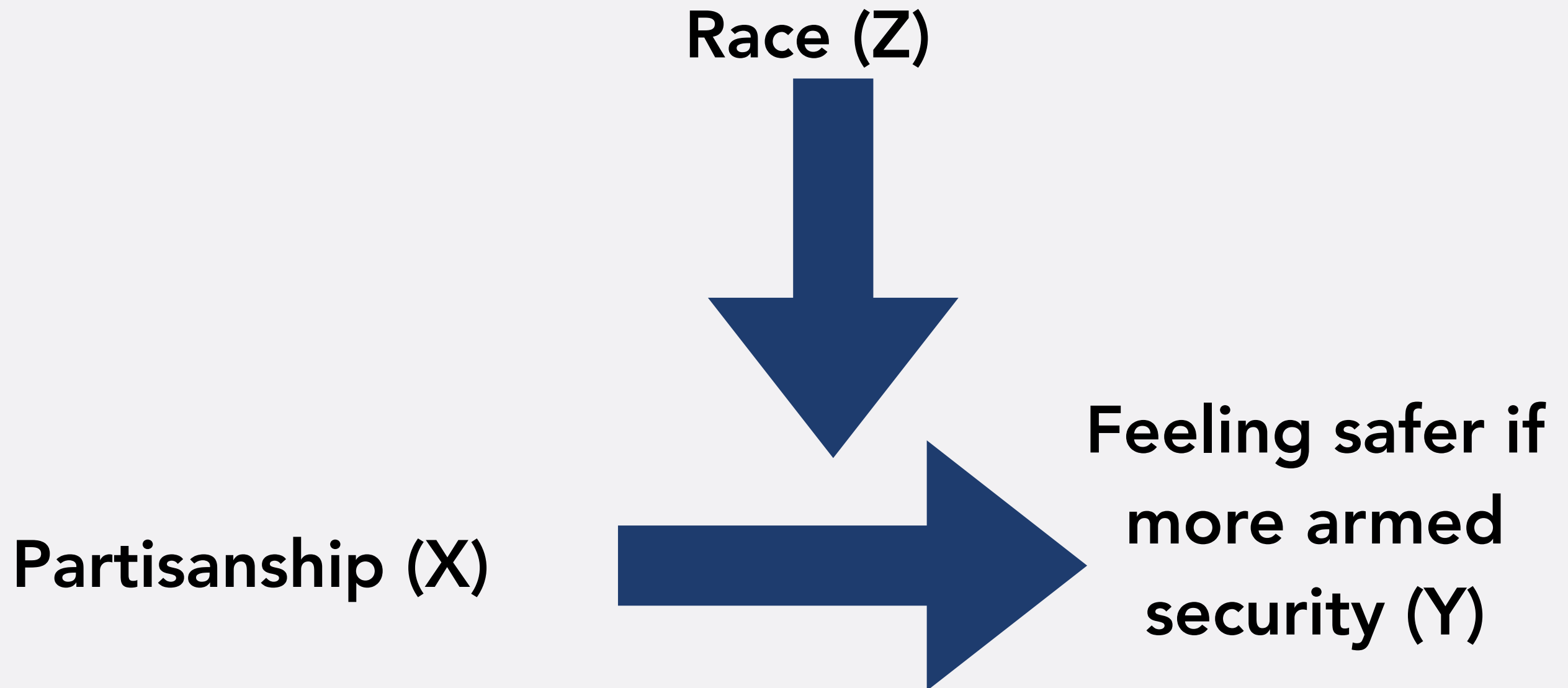
- Race determines how much of an effect partisanship has on Y
  - Partisanship matters among both white and non-white students, but it matters more among white students

REMEMBER VARIABLE LEVELS

- **So far: Dependent variable was nominal-level**
- **Now: DV is interval level**
  - e.g. GPA
  - We use <u>mean comparison</u>
  - Determination if spurious, additive, interactive works just the same

ZERO-ORDER RELATIONSHIP

	How much sleep during finals?	
	More Than 6 Hours/Night	**6 Or Fewer Hours/Night**
Average Gpa	**3.64** (39)	**3.55** (51)
	0.09	

- **Frequency in parentheses**

GPA

Number of Classes (Z)

Sleep (X) → GPA
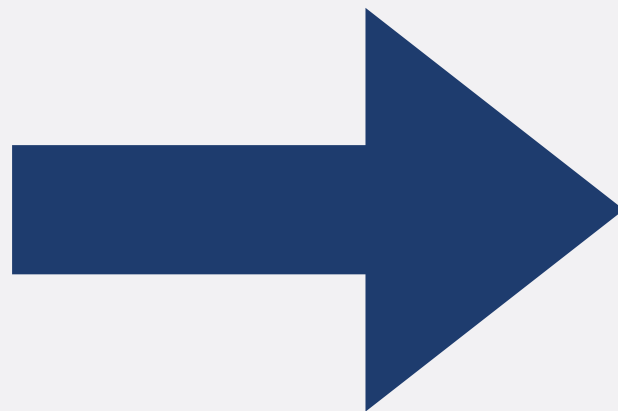
- Spurious? Additive? Interactive?

ZERO-ORDER RELATIONSHIP

Sleep	5 Or Fewer Classes		6 Or More Classes	
	More Than 6 Hours/Night	6 Or Fewer Hours/Night	More Than 6 Hours/Night	6 Or Fewer Hours/Night
Average Gpa	3.49 (20)	3.51 (34)	3.78 (20)	3.63 (18)

- **Frequency in parentheses**

HOW CAN WE TELL WHICH ONE?

1. Are all controlled effects zero or very close to zero?
   - Yes? ⇒ relationship between x and y is spurious
   - No? ⇒ either additive or interactive

2. Are all controlled effects approximately the same size?
   - Yes? ⇒ additive relationship
   - No? ⇒ interactive relationship

CONTROLLED EFFECTS

Sleep	5 Or Fewer Classes		6 Or More Classes	
	More Than 6 Hours/Night	6 Or Fewer Hours/Night	More Than 6 Hours/Night	6 Or Fewer Hours/Night
Average Gpa	3.49 (20)	3.51 (34)	3.78 (20)	3.63 (18)
		-0.02		0.15

- **Frequency in parentheses**

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Average Gpa	3.49 (20)	3.51 (34)	3.78 (20)	3.63 (18)
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   - No? ⇒ either additive or interactive

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   - Yes? ⇒ additive relationship

   - No? ⇒ interactive relationship

# INTERACTIVE RELATIONSHIP

Number of Classes (Z)
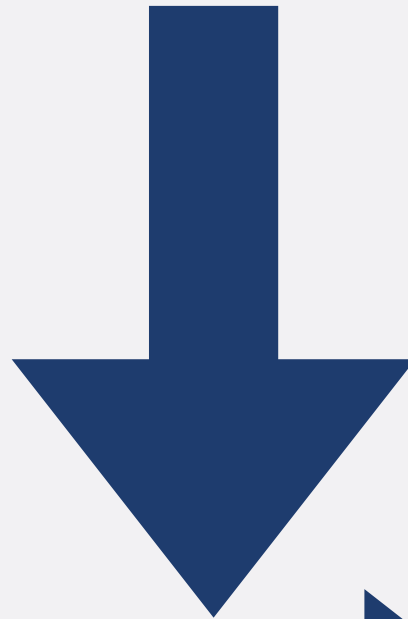
Sleep (X)   GPA
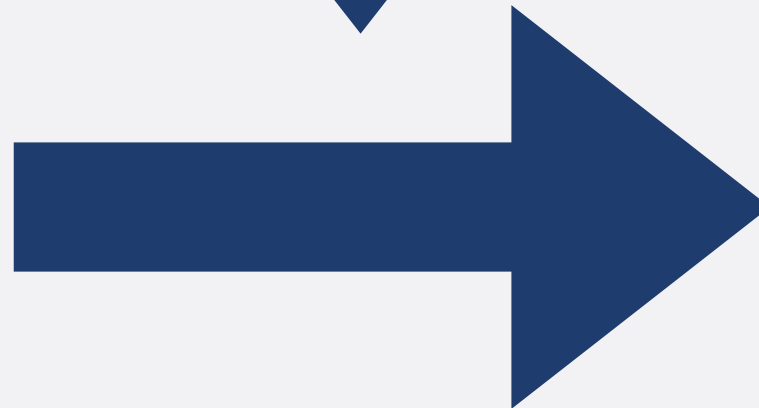
- Number of classes determines how much sleep affects GPA
  - Sleep matters quite a bit among students who take 6 or more classes
  - Sleep doesn't matter as much for students who take 5 or fewer classes

A REAL-WORLD EXAMPLE

- **2020 Presidential election: Joe Biden (D) vs. Donald Trump (R)**
- **Hypothesis: People with a college degree were more likely to vote for Joe Biden than people without a college degree**
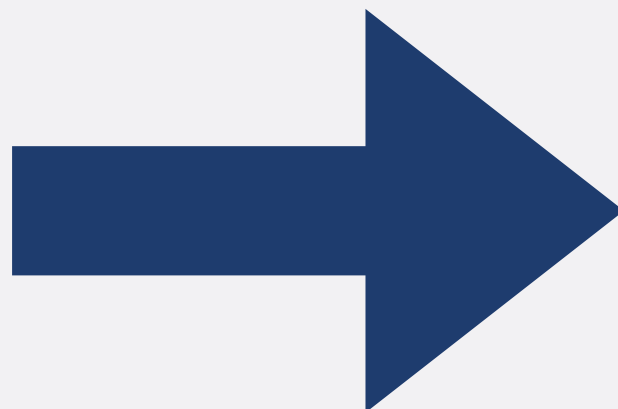
Education (X) → **Voting for Biden (Y)**

A REAL-WORLD EXAMPLE

The New York Times

National Exit Polls: How Different Groups Voted

Donald Trump

Joseph R. Biden Jr.

What is your level of education?

	Donald Trump	Joseph R. Biden Jr.
College graduate 41% of voters	43	55
No college degree 59%	50	48
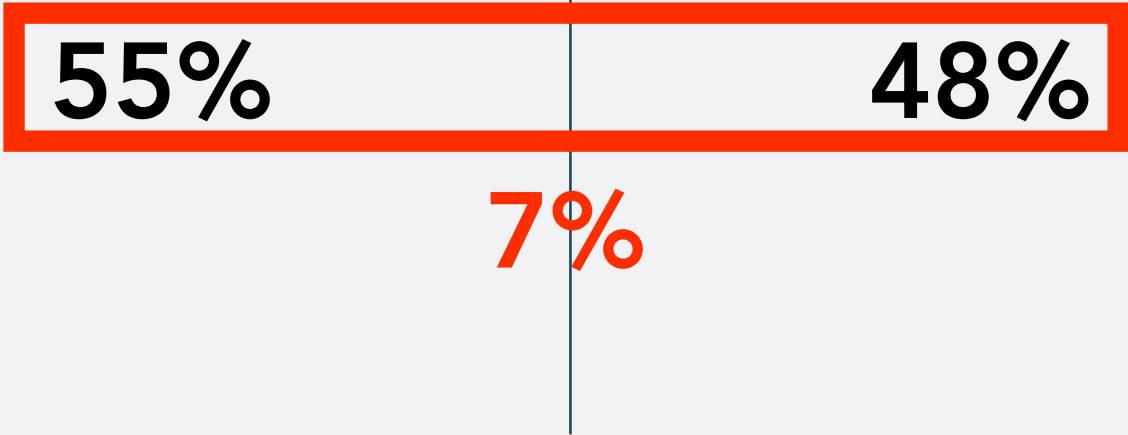
VOTING FOR BIDEN

Race/Ethnicity (Z)

Education (X)

Voting for Biden (Y)
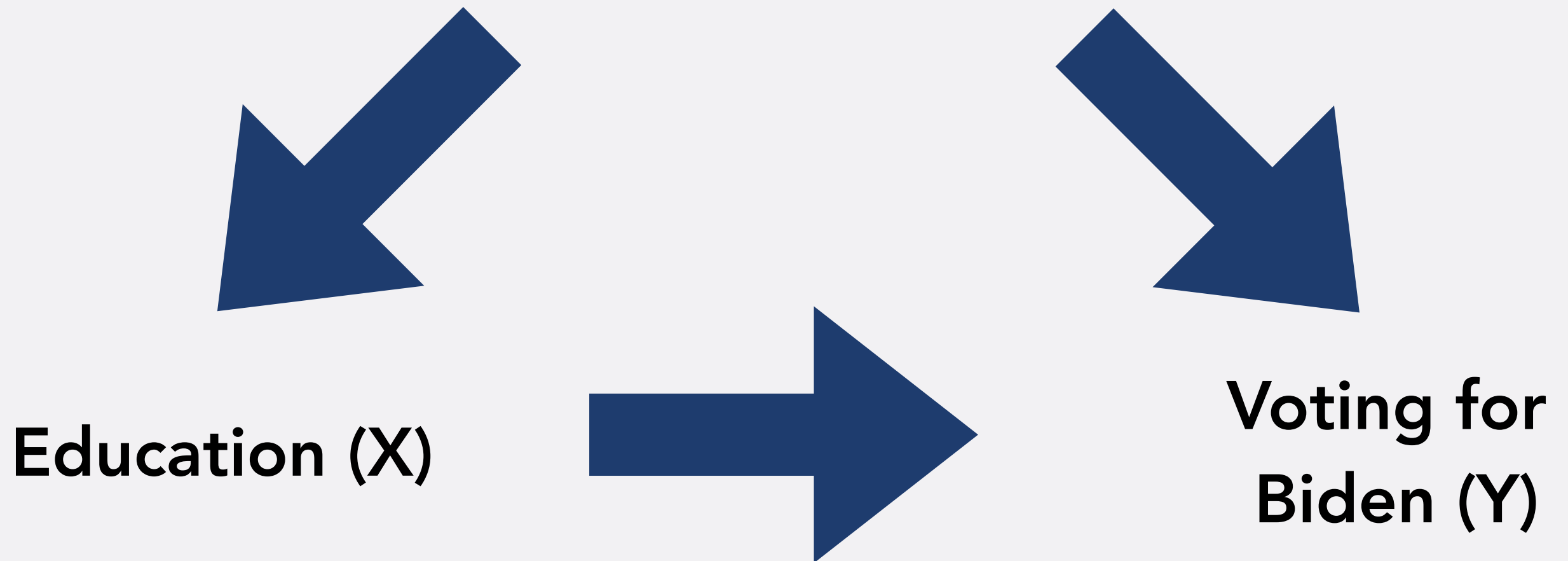
- Is relation between X and Y spurious? Additive? Interactive?

RACE AND EDUCATION

Donald Trump

Joseph R. Biden Jr.

What is your race and education level?

	Donald Trump	Joseph R. Biden Jr.
White college graduate 32% of voters	48	51
White noncollege graduate 35%	67	32
Nonwhite college graduate 10%	27	70
Nonwhite noncollege graduate 24%	26	72

CONTROLLED EFFECTS

	White		Nonwhite	
Education	College	No College	College	No College
Biden Vote Share	51%	32%	70%	72%
	19%		-2%	

HOW CAN WE TELL WHICH ONE?

1. Are all controlled effects zero or very close to zero?
    - Yes? ⇒ relationship between x and y is spurious
    - No? ⇒ either additive or interactive

2. Are all controlled effects approximately the same size?
    - Yes? ⇒ additive relationship
    - No? ⇒ interactive relationship

AFTER THE BREAK

- How to do controlled effects in a linear regression
- What to do if there is more than one confounder?