PSC 202
SYRACUSE UNIVERSITY

INTRODUCTION TO POLITICAL ANALYSIS

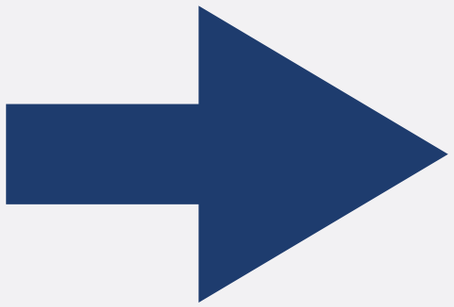
MORE HYPOTHESIS TESTING WITH ONE CONFOUNDER

HOUSEKEEPING

- Problem Set 8 due on Friday

LAST TIME

Partisanship



Support for vaccine mandate

LAST TIME

	Democrats	Not Democrats	Total
Mandate	69% (51)	30% (17)	52% (68)
No Mandate	31% (23)	70% (40)	48% (63)
Total	100% (74)	100% (57)	100% (131)

LAST TIME

	Democrats	Not Democrats	Total
Mandate	69% (51)	30% (17)	52% (68)
No Mandate	31% (23)	70% (40)	48% (63)
Total	100% (74)	100% (57)	100% (131)

39%

CONFOUNDER?

Gender (Z)

W more likely to be Democrats than M

W more supportive of vaccine mandate than M

Partisanship (X)

Vaccine Mandate (Y)

Partisanship by itself has no effect on vaccine mandate attitude

CONTROLLED COMPARISON TABLE

Vaccine Mandate		Female			Male		
		Dem	Non-Dem	Total	Dem	Non-Dem	Total
Mandate							
No Mandate							
Total							

CONTROLLED COMPARISON TABLE

Vaccine Mandate	Female			Male		
	Dem	Non-Dem	Total	Dem	Non-Dem	Total
Mandate	71% (40)	35% (8)	61% (48)			
No Mandate	29% (16)	65% (15)	39% (31)			
Total	100% (56)	100% (23)	100% (79)			

36%

TERMINOLOGY

- Controlled effect: 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 vaccine mandate support (Y) among women (one value of Z)

CONTROLLED COMPARISON TABLE

Vaccine Mandate	Female			Male		
	Dem	Non-Dem	Total	Dem	Non-Dem	Total
	36%			31%		
Mandate	71% (40)	35% (8)	61% (48)	59% (10)	28% (9)	39% (19)
No Mandate	29% (16)	65% (15)	39% (31)	41% (7)	72% (23)	61% (30)
Total	100% (56)	100% (23)	100% (79)	100% (17)	100% (32)	100% (49)

- Partial effect of partisanship, “controlling for” gender

GENDER AND EVALUATION

- So even if we take gender into account, partisanship *still* has effect on attitudes about vaccine mandate
- Among both men and women, Democrats are more likely to support mandate

TERMINOLOGY

- Partial relationship/partial effect: relationship between two variables after taking effect of other variables into account
  - e.g. relation between partisanship and support for vaccine mandate, controlling for gender
  - Partial relationship summarizes the controlled effects

HOW DOES THIS HELP?

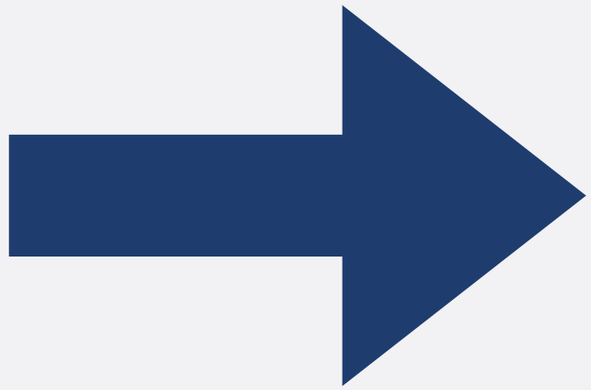
- Is there a credible causal mechanism that connects X to Y?
- Can we rule out the possibility that Y could cause X?
- Is there covariation between X and Y?
- Have we controlled for all confounding variables (Z) that might make the association between X and Y spurious?

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)

ZERO-ORDER EFFECT

	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)

16%

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

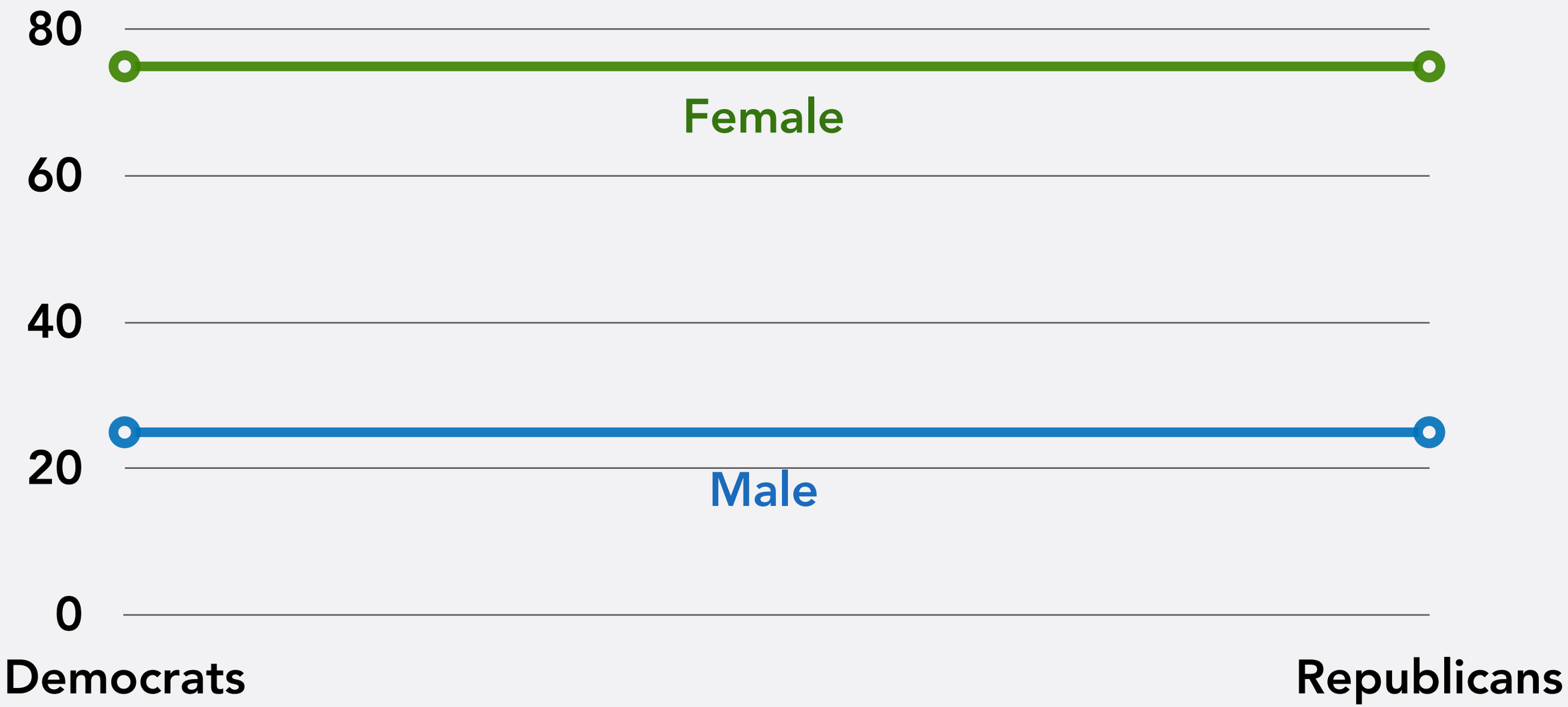
	Female			Male		
	Dem	Rep	Total	Dem	Rep	Total
Stricter Gun Control	75% (6)	75% (3)	75% (9)	25% (1)	25% (2)	25% (3)
Not Stricter Gun	25% (2)	25% (1)	25% (3)	75% (3)	75% (6)	75% (9)
Total	100% (8)	100% (4)	100% (12)	100% (4)	100% (8)	100% (12)

0%

0%

- Partial effect of partisanship, “controlling for” gender

SPURIOUS RELATIONSHIP



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
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)

16%

16%

WHAT WE FIND...

- **Even though women are more likely to support gun control than men...**

WHAT WE FIND...

	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 WE FIND...

- Even though women are more likely to support gun control than men...
- Partisanship still has an independent effect on attitudes among both men and women

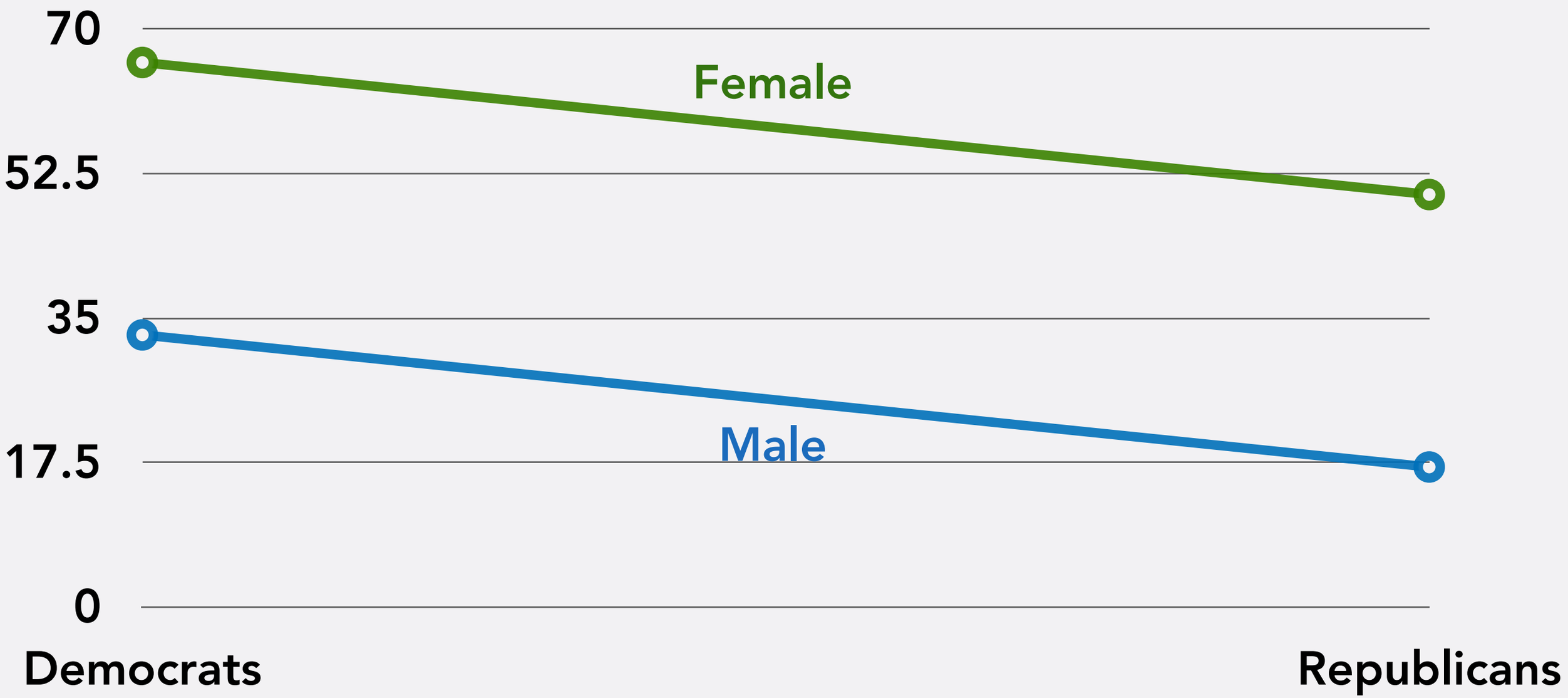
WHAT WE FIND...

	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)

16%

16%

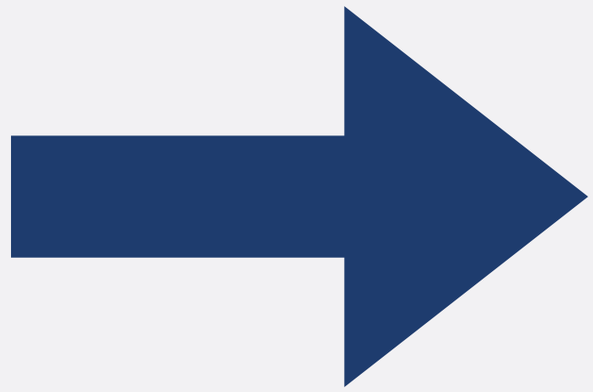
ADDITIVE RELATIONSHIP



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
Stricter Gun Control	57% (4)	50% (2)	55% (6)	60% (3)	38% (3)	46% (6)
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Total	100% (7)	100% (4)	100% (11)	100% (5)	100% (8)	100% (13)

7%

22%

WHAT WE FIND...

- Even though women are more likely to support gun control than men...

WHAT WE FIND...

	Female			Male		
	Dem	Rep	Total	Dem	Rep	Total
Stricter Gun Control	57% (4)	50% (2)	55% (6)	60% (3)	38% (3)	46% (6)
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WHAT WE FIND...

- Even though women are more likely to support gun control than men...
- Partisanship still has an independent effect on attitudes among both men and women

WHAT WE FIND...

	Female			Male		
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Total	100% (7)	100% (4)	100% (11)	100% (5)	100% (8)	100% (13)

WHAT WE FIND…

- Even though women are more likely to support gun control than men…
- 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	Total	Dem	Rep	Total
Stricter Gun Control	57% (4)	50% (2)	55% (6)	60% (3)	38% (3)	46% (6)
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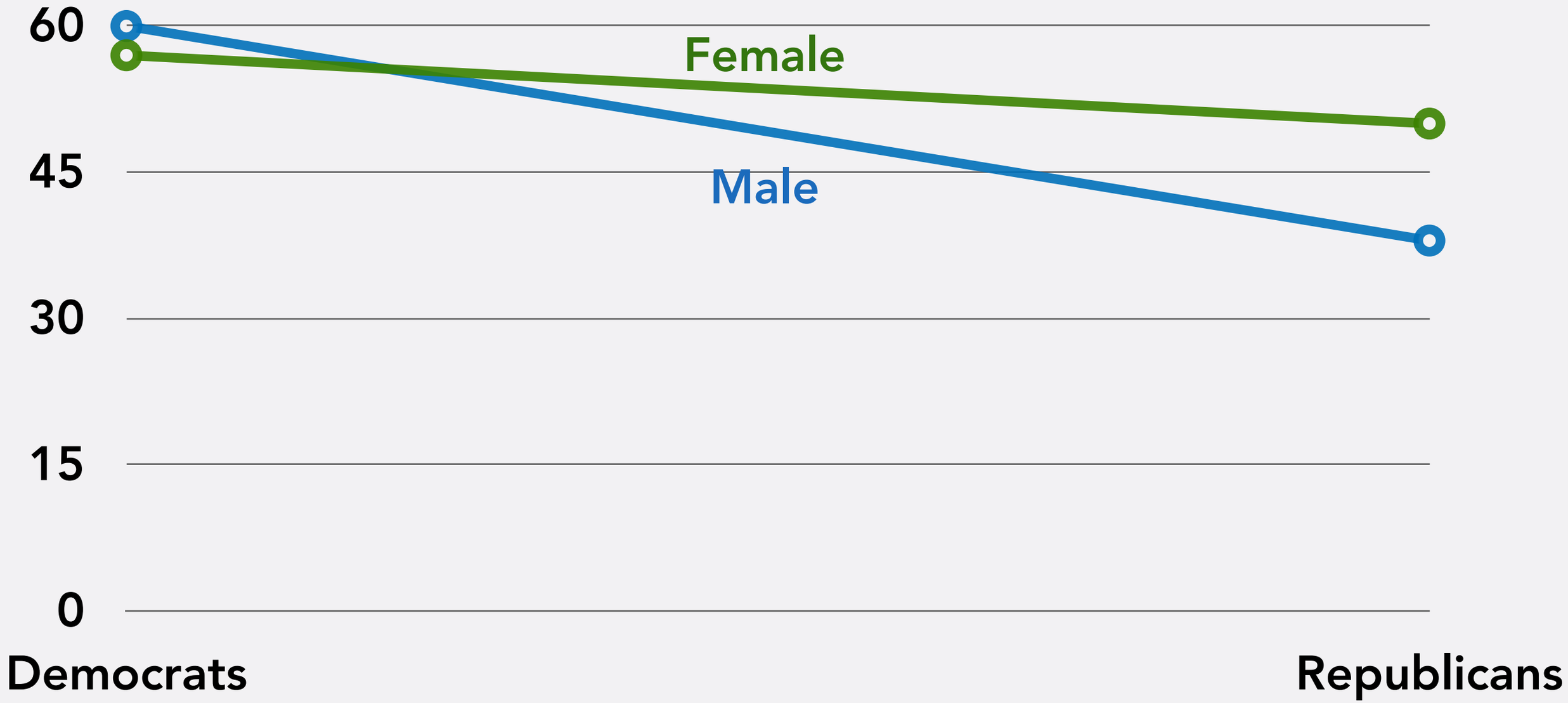
7%

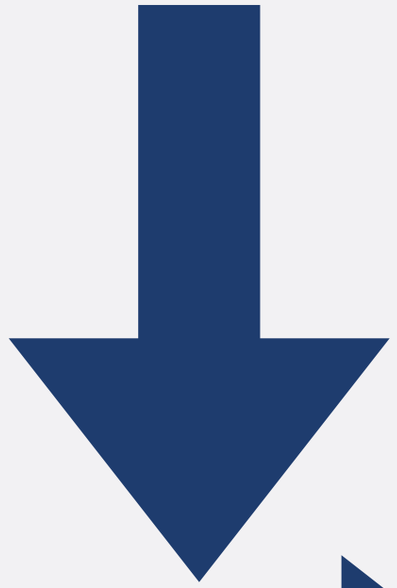
22%

INTERACTIVE RELATIONSHIP

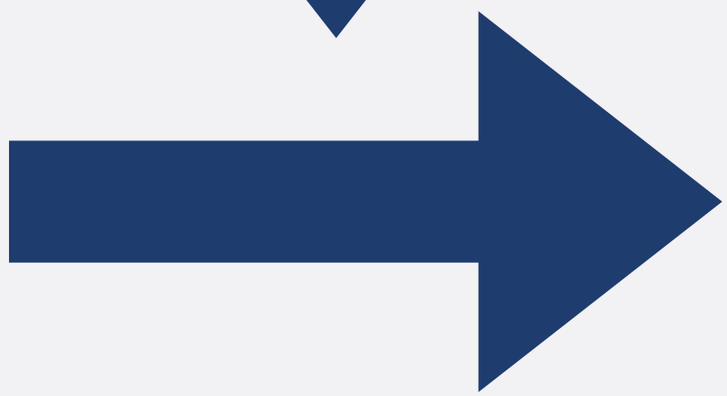


INTERACTIVE RELATIONSHIP

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

Vaccine Mandate	Female			Male		
	Dem	Non-Dem	Total	Dem	Non-Dem	Total
	36%			31%		
Mandate	71% (40)	35% (8)	61% (48)	59% (10)	28% (9)	39% (19)
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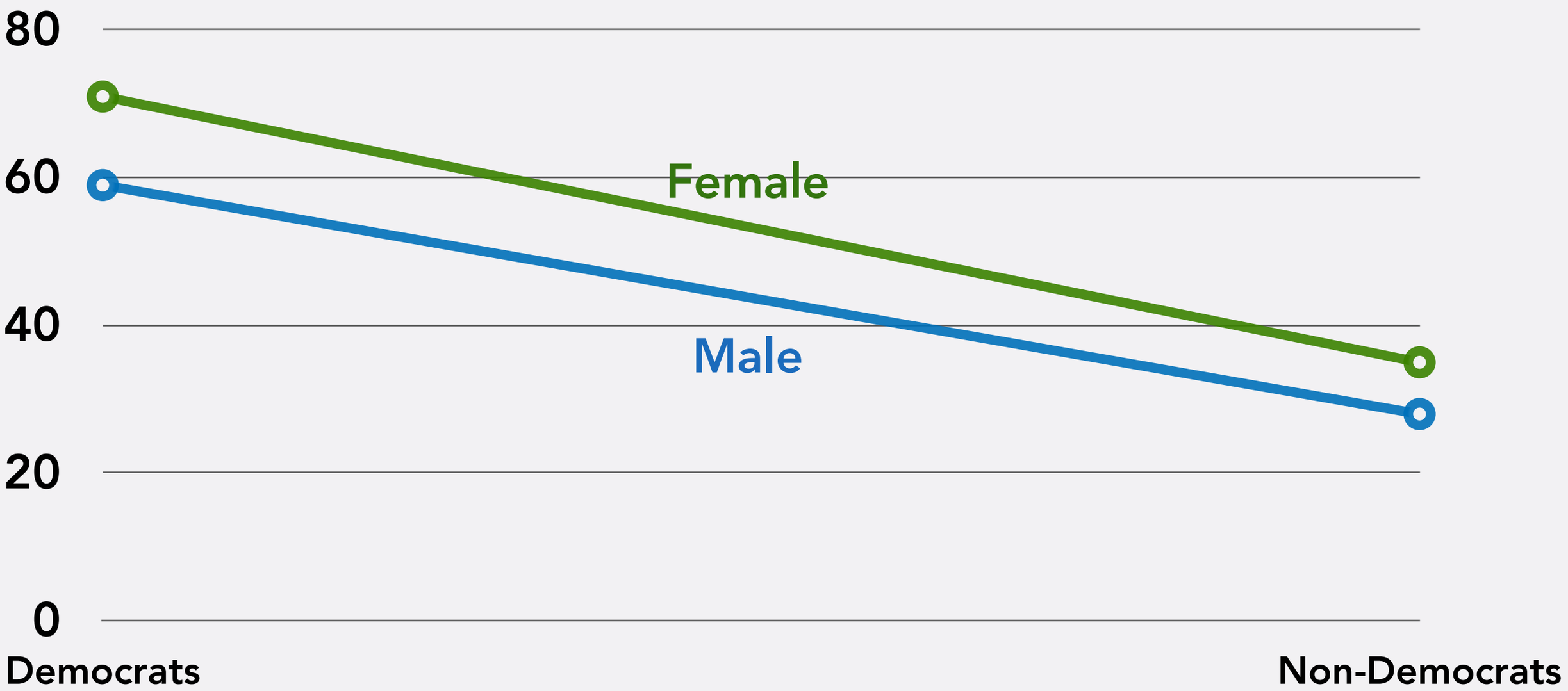
   - No? ⇒ *interactive* relationship

Would also be ok to conclude interactive

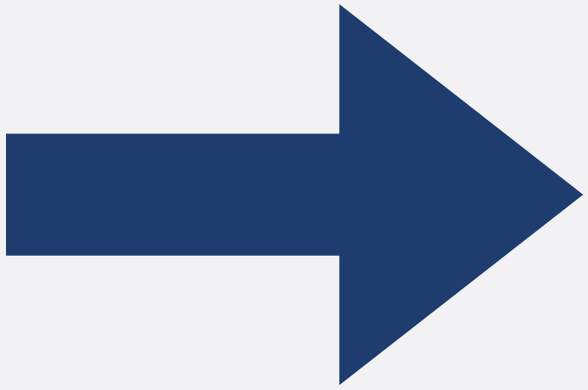
ADDITIVE RELATIONSHIP



ADDITIVE RELATIONSHIP

Gender (Z)

Partisanship (X)



Vaccine Mandate (Y)

- Both partisanship *and* gender determine Y

EXERCISE

	Female			Male		
	Car	No Car	Total	Car	No Car	Total
Support Highway	(3)	(1)	(4)	(2)	(1)	(3)
Oppose Highway	(1)	(3)	(4)	(2)	(3)	(5)
Total	(4)	(4)	(8)	(4)	(4)	(8)

EXERCISE

	Female			Male		
	Car	No Car	Total	Car	No Car	Total
Support Highway	75% (3)	25% (1)	50% (4)	50% (2)	25% (1)	37.5% (3)
Oppose Highway	25% (1)	75% (3)	50% (4)	50% (2)	75% (3)	62.5% (5)
Total	100% (4)	100% (4)	100% (8)	100% (4)	100% (4)	100% (8)

EXERCISE

	Female			Male		
	Car	No Car	Total	Car	No Car	Total
	50%			25%		
Support Highway	75% (3)	25% (1)	50% (4)	50% (2)	25% (1)	37.5% (3)
Oppose Highway	25% (1)	75% (3)	50% (4)	50% (2)	75% (3)	62.5% (5)
Total	100% (4)	100% (4)	100% (8)	100% (4)	100% (4)	100% (8)

EXERCISE

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

REMEMBER VARIABLE LEVELS

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

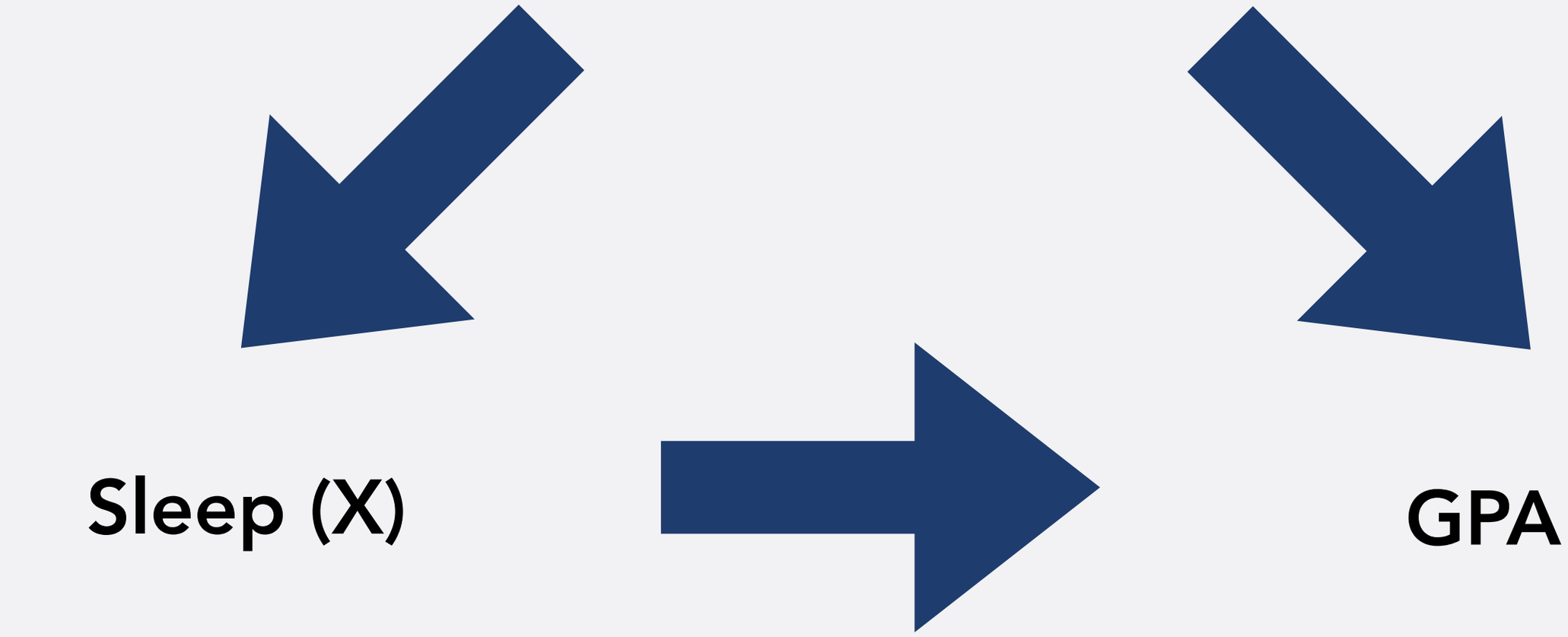
ZERO-ORDER RELATIONSHIP

	How much sleep?	
	More Than 7 Hours/Night	7 Or Fewer Hours/Night
Average Gpa	3.61	3.45
	(55)	(78)

0.16

- Frequency in parentheses

GPA



- Spurious? Additive? Interactive?

ZERO-ORDER RELATIONSHIP

	5 Or Fewer Classes		6 Or More Classes	
Sleep	More Than 7 Hours/Night	7 Or Fewer Hours/Night	More Than 7 Hours/Night	7 Or Fewer Hours/Night
Average Gpa	3.53 (40)	3.45 (53)	3.62 (17)	3.45 (27)

- 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

	5 Or Fewer Classes		6 Or More Classes	
Sleep	More Than 7 Hours/Night	7 Or Fewer Hours/Night	More Than 7 Hours/Night	7 Or Fewer Hours/Night
Average Gpa	3.53 (40)	3.45 (53)	3.62 (17)	3.45 (27)
	0.08		0.17	

- 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

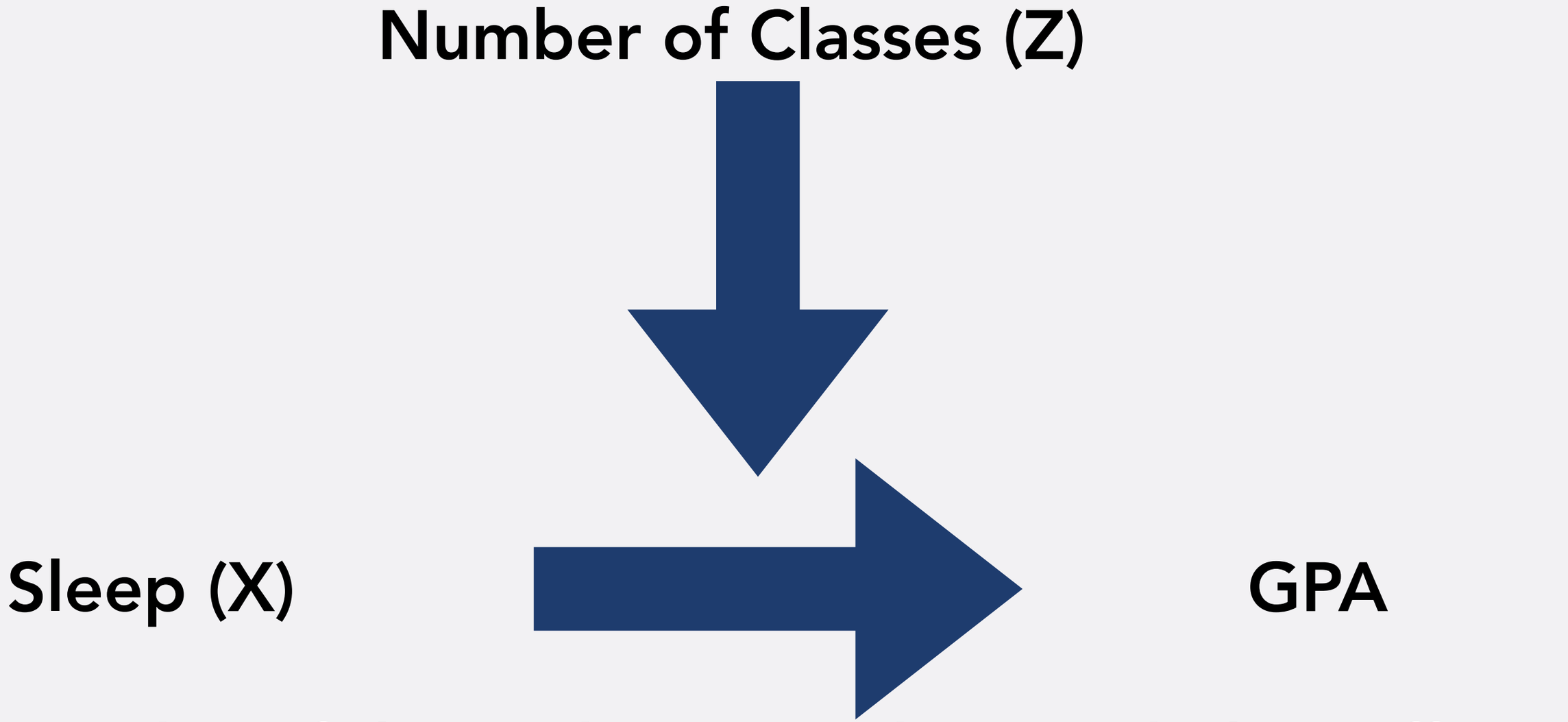
	5 Or Fewer Classes		6 Or More Classes	
Sleep	More Than 7 Hours/Night	7 Or Fewer Hours/Night	More Than 7 Hours/Night	7 Or Fewer Hours/Night
Average Gpa	3.53 (40)	3.45 (53)	3.62 (17)	3.45 (27)
	0.08		0.17	

- 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

INTERACTIVE RELATIONSHIP



- 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?

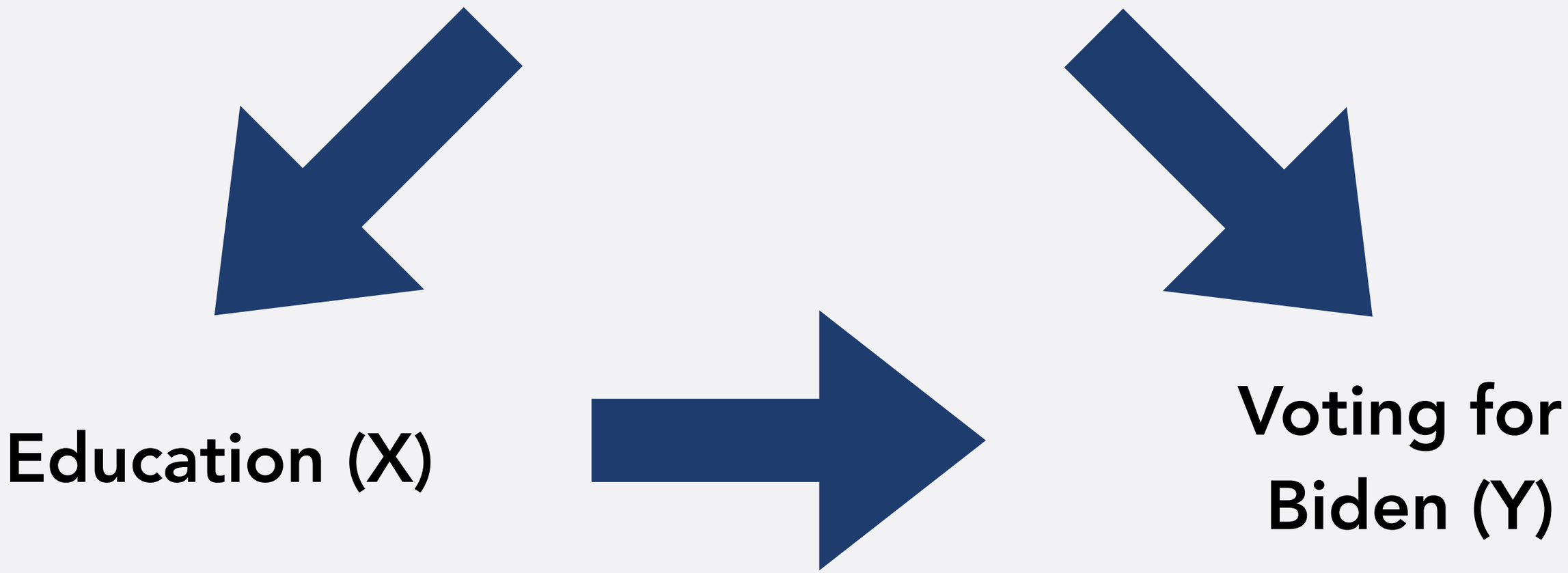
College graduate 41% of voters	43	55
No college degree 59%	50	48

ZERO-ORDER RELATIONSHIP

	Education	
	College Degree	No College Degree
Biden Vote Share	55%	48%

7%

VOTING FOR BIDEN



- 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?

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

VOTING FOR BIDEN

Race/Ethnicity (Z)

Education (X)

Voting for Biden (Y)

- Education matters a lot among white voters
- Education does not matter among nonwhite voters

NEXT TIME

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