

# Controlled Comparisons and Controlled Relationships

POSC 3410 – Quantitative Methods in Political Science

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## Goals for Today

- *Introduce students to making controlled comparisons and understanding controlled relationships.*
- *Discuss importance of controlling for rival explanations.*
- *Introducing three different types of controlled relationships.*

# A Brief Review

What we have done to this point:

- We have an interest in a relationship between an independent variable and a dependent variable.
- We already know our types of relationships.

## How Do We Get Our Data?

Our standard research design is similar to an **experimental design** with **random assignment**.

- Complete with **test group** and **control group**.

Experiments are typically either **lab experiments** or **field experiments**.

- Lab experiments: greater **internal validity** than **external validity**.
- Field experiments: vice-versa. Think of “get out the vote” experiments here.

# The Problem of Selection

Experimental design with random assignment can lead to proper inference about relationship between  $x$  and  $y$ .

- However, we often deal with observational or event data.
- We must deal with the problem of **selection** all the same.

It could be some third process ( $z$ ) that is responsible for the relationship between  $x$  and  $y$ .

- We account for this by making **controlled comparisons**.

# Types of Controlled Relationships

There are three types of controlled relationships among  $x$ ,  $y$ , and  $z$ .

1. Spurious relationship
2. Additive relationship
3. Interactive relationship

## Partisanship, Gender, and Gun Control

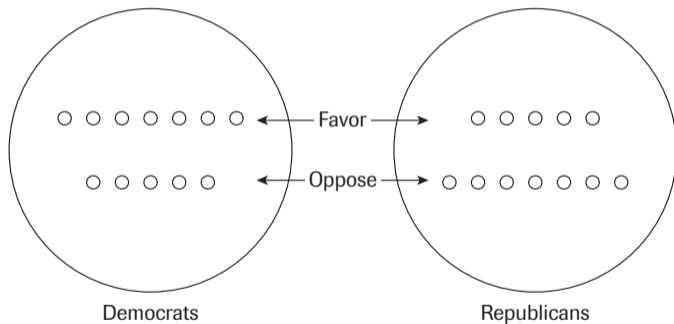
We will use the partisanship, gender, gun control example from your book.

- We already discussed the theory linking partisanship and gun control.
- However, Democrats tend to have more women than men.
  - This is an essential **compositional difference**.

There is good reason to expect gender confounds our partisanship-gun control inference.

# Partisanship and Gun Control

**Figure 4-1** Relationship between Partisanship and Gun Control Opinions (diagram)





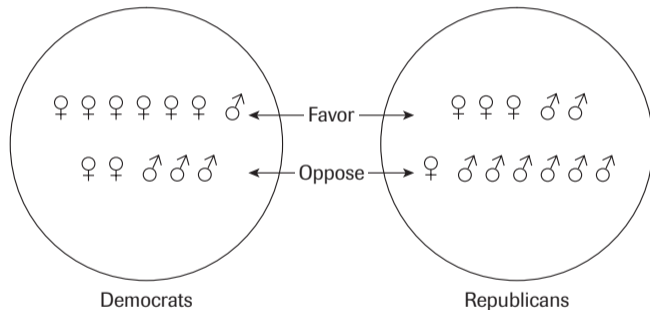
# Partisanship, Gender, and Gun Control

What if we believe gender is responsible for this relationship?

- Figure 4.1 would not let us know.
- Figure 4.2 would let us know in an obvious way.

# Partisanship, Gender, and Gun Control

**Figure 4-2** Spurious Relationship between Partisanship and Gun Control Opinions (diagram)



## Partisanship, Gender, and Gun Control

What is the effect of partisanship on gun control opinions, *controlling* for gender?

- Nine of 12 women favored gun control.
- Six of eight female Dems favored gun control (i.e. 75%)
- Three of four female Republicans favored gun control (i.e. 75%).

Of the men:

- One male Dem favored while three opposed (i.e. 25%).
- Two GOP men favored while six opposed (25%).

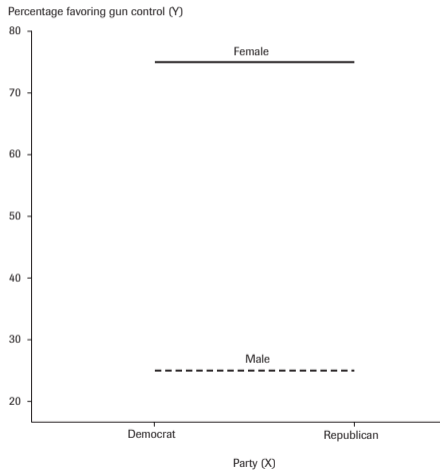
# Partisanship, Gender, and Gun Control

Gender explains everything in this example.

- Formally: the effect of  $x$  on  $y$  is **spurious** to  $z$ .

# Partisanship, Gender, and Gun Control

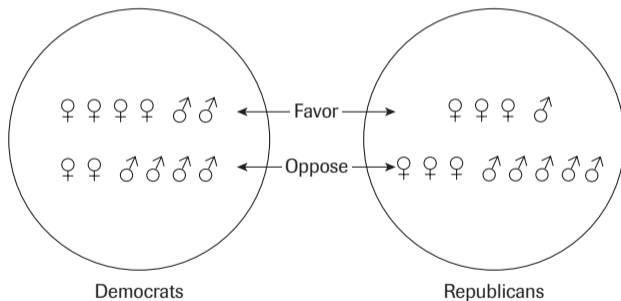
**Figure 4-3** Spurious Relationship between Partisanship and Gun Control Opinions (line chart)



# Partisanship, Gender, and Gun Control

Consider this arrangement.

**Figure 4-4** Additive Relationships between Partisanship and Gun Control Opinions (diagram)



# Partisanship, Gender, and Gun Control

Among the women:

- Four of six Democrats favor gun control (66.6%).
- Three of six Republicans favor gun control (50%).

Among the men:

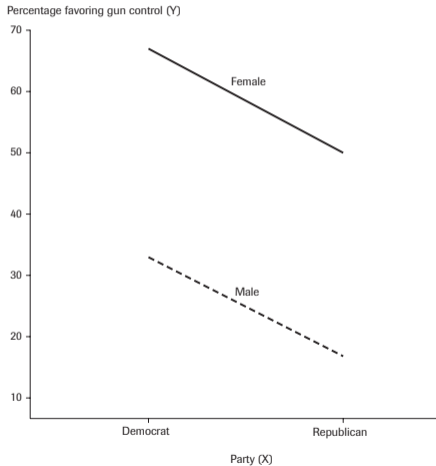
- Two of six Democrats favor gun control (33.3%)
- One in six GOP men favor gun control (16.6%).

This is an **additive relationship**.

- $x$  and  $z$  affect  $y$  independently.

# Partisanship, Gender, and Gun Control

**Figure 4-5** Additive Relationships between Partisanship, Gender, and Gun Control Opinions (line chart)





# Interactive Relationships

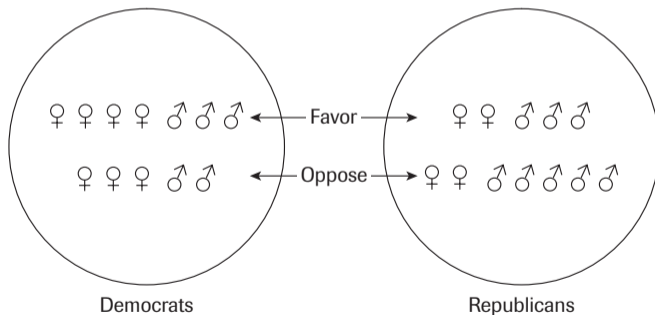
**Interactive relationships** are more difficult to fully describe.

- Simply:  $x$  and  $z$  act in concert to affect  $y$
- Put another way: the effect of  $x$  on  $y$  depends on the value of  $z$ .

# Partisanship, Gender, and Gun Control

Consider this arrangement.

**Figure 4-7** Interaction Relationships between Partisanship, Gun Control Opinions, and Gender (diagram)



# Partisanship, Gender, and Gun Control

Among the women:

- Four of seven Democrats favor gun control (57.1%)
- Two of four Republicans favor gun control (50%).

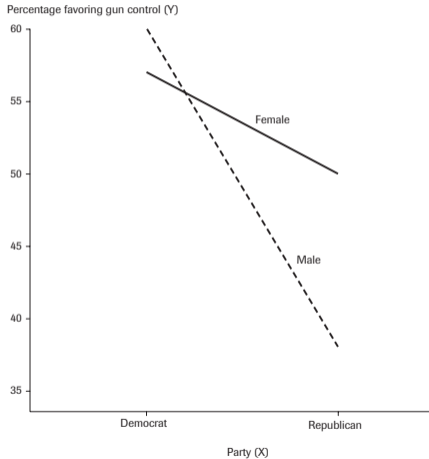
Among the men:

- Three of five Democrats favor gun control (60%).
- Three of eight Republicans favor gun control (37.8%).

Put another way: the effect of partisanship is strong for men, less for women.

# Partisanship, Gender, and Gun Control

**Figure 4-8** Interaction Relationships between Partisanship, Gun Control Opinions, and Gender (line chart)



## Conclusion

- Experiments with random assignment are the gold standard for inference.
- Barring that: no bivariate relationship without control is sufficient for inference.
- There are three types of controlled relationships worth knowing in multivariate analysis.

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