Relationships Between Two Variables: Chapter 10: Cross-Tabulation

1. Constructing a Bivariate Table
2. Chi Square
3. Elaboration
   - Spurious relationships
   - Intervening relationships
   - Conditional Relationships

Introduction

- **Bivariate Analysis:** A statistical method designed to detect and describe the relationship between two variables (typically independent and dependent variables).
- **Cross-Tabulation:** A technique for analyzing the relationship between two variables that have been organized in a table.

Constructing a Bivariate Table

- ***Column variable:*** A variable whose categories are the columns of a bivariate table (usually the independent variable).
- ***Row variable:*** A variable whose categories are the rows of a bivariate table (usually the dependent variable).
- ***Marginals:*** The row and column totals in a bivariate table.

Absolute Frequencies

Support for Abortion by Job Security

		Job Security: Can Find Job Easy	Can Not Find Job Easy	Row Total
Support for Abortion	Yes	24	25	49
	No	20	26	46
Column Total		44	51	95

Constructing a Bivariate Table:

Percentages Can Be Computed in Different Ways:

1. ***Column*** **Percentages:** column totals as base
2. ***Row*** **Percentages:** row totals as base

Column Percentages

Support for Abortion by Job Security

Abortion	Can Find Job Easy	Can Not Find Job Easy	Row Total
Yes	24	25	49
(% w/in job security)	55%	49%	52%
No	20	26	46
(% w/in job security)	45%	51%	48%
Column Total	44	51	95
(% w/in job security)	100%	100%	100%

Row Percentages

Support for Abortion by Job Security

Abortion	Can Find Job Easy	Can Not Find Job Easy	Row Total
Yes	24	25	49
(% within abortion)	49%	51%	100%
No	20	26	46
(% within abortion)	43%	57%	100%
Column Total	44	51	95
(% within abortion)	46%	54%	100%

Row and Column Percentages

Support for Abortion by Job Security

Abortion	Can Find Job Easy	Can Not Find Job Easy	Row Total
Yes	24	25	49
(% w/in job security)	55%	49%	52%
(% within abortion)	49%	51%	100%
No	20	26	46
(% w/in job security)	45%	51%	48%
(% within abortion)	43%	57%	100%
Column Total	44	51	95
(% w/in job security)	100%	100%	100%
(% within abortion)	46%	54%	100%

Characteristics of a Bivariate Relationship

1. What are the **dependent** and **independent** variables?
2. Does there appear to be a **relationship**?
3. How **strong** is it?
4. What is the **direction** of the relationship?

Does there appear to be a relationship?

Chi Square is a statistical technique designed to test for significant relationships between two variables.

How does Chi Square Work?

First, it examines the two variables and their marginal totals.

Next, it creates a new table using the marginal totals and fills in the columns and rows (the middle of the table) with what you would expect to find if there is no relationship between the two variables.

Finally, it compares this "table of no relationship" to the actually table (that is the actual row and column numbers)

The more similar the actual table is to the table of no relationship the less likely that the two variables are related.

Direction of the Relationship

- ***Positive relationship***: A bivariate relationship between two variables measured at the ordinal level or higher in which the variables vary in the **same direction**.
- ***Negative relationship***: A bivariate relationship between two variables measured at the ordinal level or higher in which the variables vary in **opposite directions**.

A Positive Relationship
(as class goes up "health" goes up)

Table 6.8 **Health Condition by Social Class: A Positive Relationship**

HEALTH	CLASS: Low	Middle	High
Poor	39%	12%	9%
Fair	36%	45%	28%
Good	25%	43%	63%
Total	100%	100%	100%
(N)	(39)	(254)	(202)

Source: General Social Survey, 1987 to 1992.

A Negative Relationship
(as "class" goes up "traumas" go down)

Table 6.9 **Frequency of Trauma by Social Class: A Negative Relationship**

TRAUMA	CLASS: Low	Middle	High
0	31%	41%	48%
1	22%	42%	20%
2+	47%	17%	32%
Total	100%	100%	100%
(N)	(48)	(220)	(180)

Source: General Social Survey, 1987 to 1992.

More Examples

Which are likely to be positive relationships and which negative relationships?

1. **The relationship between studying and grades**
2. **The relationship between partying and grades**
3. **The relationship between "amount of sleep" and grades**
4. **The relationship between "color of shoes" and grades**

Elaboration

- **Elaboration** is a process designed to further explore a bivariate relationship; it involves the introduction of "control" variables.
- A **control variable** is an additional variable considered in a bivariate relationship. The variable is "controlled for" when we take into account the effects of an independent variable on a dependent variable.

Example of a relationship between two variables prior to considering a third variable
(that is, prior to elaboration)

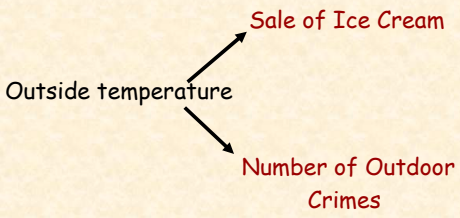
Sale of Ice Cream

(two variables appear related, when one goes up the other goes up)

↓

Number of Outdoor Crimes

Example of a third (control) variable causing a "spurious" relationship
(elaboration considers additional variables)



Three Goals of Elaboration

(that is, three ways that a third variable may be causing two variables to appear related when they are not)

1. Elaboration allows us to test for a "spurious" relationship

Testing for a spurious relationship

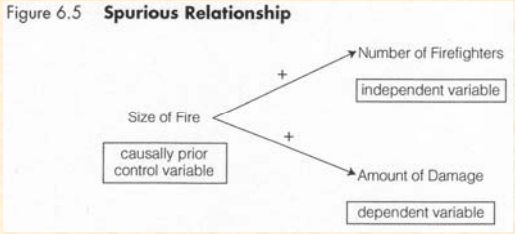
- A **Direct causal relationship** is a relationship between two variables that cannot be accounted for by other variables. It is a "nonspurious" relationship.
- A **Spurious relationship** is a relationship in which both the IV and DV are influenced by a third variable. The IV and DV are not causally linked, although it might appear so if one was unaware of the third variable.
- The relationship between the IV and DV is said to be "explained away" by the third or "control" variable.

Example of a Bivariate Relationship that is probably spurious:

# of Firefighters and Property Damage

Number of Firefighters ⟶ **Property Damage**
(IV) **(DV)**

Figure 6.5 **Spurious Relationship**



What is another example of a spurious relationship?

What is the dependent and independent variable and what is the "control" variable that is causing the spurious relationship?

2. Elaboration can test for an intervening relationship

- ***Intervening relationship:*** a relationship in which the control variable intervenes between the independent and dependent variables.
- ***Intervening variable:*** a control variable that follows an independent variable but precedes the dependent variable in a causal sequence.

Intervening Relationship: Examination of two variables prior to considering a third "intervening" variable

of "job" hours worked → Grades
(independent variable) (dependent variable)

Intervening Relationship: Examination of an intervening variable between two other variables

of job hours worked → Fewer Hours Studying → Grades
(IV) (Intervening Variable) (DV)

What is another example of an intervening relationship?

What is the dependent and independent variable and what is the "control" variable that is intervening between the two variables?

3. Elaboration tests for Conditional Relationships

- ***Conditional relationship:*** a relationship in which the control variable's effect on the dependent variable depends on (or is conditional on) the category of the control variable.
- The relationship between the independent and dependent variables will change according to the different conditions (or categories) of the control variable.

Example of a relationship between two variables prior to considering a "conditional" (or control) variable

of Dolls owned → Hours spent Playing with Dolls

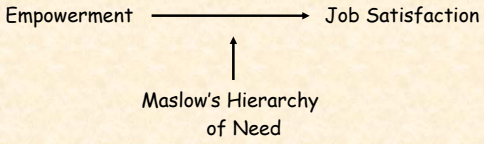
Example of a Conditional Relationship

of Dolls owned → Hours spent Playing with Dolls

↑

Sex of Child
(two categories: male and female)

Another Example of a Conditional Relationships



Maslow's Hierarchy of Need

(categories range from basic "physical" needs to "self actualization" and "esteem" needs)

Review: Three Goals of Elaboration

1. Elaboration allows us to test for **spurious relationships**
2. Elaboration clarifies the causal sequence of bivariate relationships by introducing variables hypothesized to **intervene** between the IV and DV.
3. Elaboration specifies the different **conditions** under which the original bivariate relationship might hold.