

GV103: Introduction to International Relations

Dr. Philip Arena

Statistical Analysis

Introduction

- Three goals for this lecture
 - ① Introduce some more terms and concepts
 - ② Show you how to identify **patterns of association**
 - ③ Discuss the difference between **correlation** and **causation**

Terminology I

Dependent Variable

The outcomes we seek to explain. Generically denoted y .

Independent Variable

Factors we believe **might** be **causally** responsible for variation in the dependent variable. Generically denoted x .

Terminology II

Pattern of Association

Systematic **covariation** between two variables.

Correlation

A linear or monotonic pattern of association.

Causation

Particular form of association where x **directly** (though perhaps **probabilistically**) impacts y , but not vice versa.

Identifying Patterns of Association

- Pattern b/w binary x & y best established by comparing
 - how often y occurs when x is present (\uparrow indicates **pos** assoc)
 - how often y occurs when x absent (\uparrow indicates **neg** assoc)
- Ex: As of 2001, at least one bilateral war had been fought by
 - $\approx 0.95\%$ of directly contiguous dyads
 - $\approx 0.01\%$ of non-contiguous dyads
- Pattern b/w continuous x & y best established by comparing
 - Average change in y as x increases by one unit
 - **Positive** association if $y \uparrow$ as $x \uparrow$
 - **Negative** association if $y \downarrow$ as $x \uparrow$
- Ex: In 2001
 - \uparrow 100 miles b/w capitol cities associated w/ \downarrow \$ 9.6 m trade

Interpreting Regression Results

- Tables of results from regression models look like this

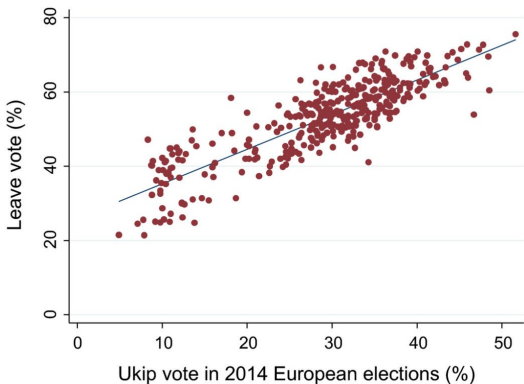
	Model 1	Model 2
X ₁	+*	-*
X ₂	-	
X ₃		+*

Example: Military Spending Per Capita

- Observations: all country-years from 1946 to 2007
- y : military expenditures per capita
- x s: energy consumption per capita, time blocs

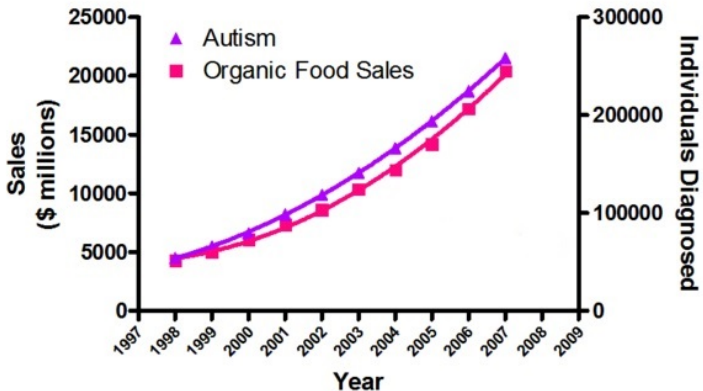
	Model 1	Model 2
Energy consumption	+*	+*
1946–1955	–*	
1956–1965	–*	
1966–1975	–*	
1976–1985	+*	
1986–1995	+*	

Example: EU Referendum



Correlation \rightarrow Causation

The real cause of increasing autism prevalence?



Sources: Organic Trade Association, 2011 Organic Industry Survey; U.S. Department of Education, Office of Special Education Programs, Data Analysis System (DANS), OMB# 1820-0043; *Children with Disabilities Receiving Special Education Under Part B of the Individuals with Disabilities Education Act

Absence of Correlation \nrightarrow Absence of Causation

- Suppose 120 civil wars occur over some time period
- 60 end in a fragile peace, pr new war $\frac{2}{3}$
- 60 end with more definitive resolution, pr new war $\frac{1}{3}$
- Suppose peacekeeping is always *partially* effective
- Let $pr(war|PKO, fragile) = \frac{1}{2}pr(war|no\ PKO, fragile)$ and $pr(war|PKO, definitive) = \frac{1}{4}pr(war|no\ PKO, definitive)$
- Suppose $PKO=1$ for all fragile cases, $PKO=0$ for definitive
- We'll observe 20 wars with PKOs, 20 without

Dealing with the Problem

- Must always worry about $y \leftarrow z \rightarrow x$
- Laboratory **experiments** allow us to rule this out
- Rarely an option when studying international politics
- In depth analysis of specific cases can help, as can various advanced statistical techniques
- Causal interpretation particularly unwarranted if
 - No strong theory indicates $x \rightarrow y$
 - Strong theory indicates $y \leftarrow z \rightarrow x$, $x \nrightarrow y$