

Causal Data Analysis

Introduction

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Professors

- Álmos Telegdy: lectures (with lots of interaction - that is my hope)
- László Tórkés: seminar I (applications in **R**)
- Xiaoru Lin: seminar II (**R** programming)

Evaluation

- Short empirical paper (30%)
 - Students work in pairs
 - Outline (question, data, method – 1 Dec.)
 - Short written analysis (app. 5 pages – 15 Dec.)
- Midterm exam (35% – 24 Nov.)
 - Theory and R programming
- Second exam (35% – 15 Dec.)
 - Theory and R programming

To pass the course, you must have at least 50 percent in each assignment

Prerequisites, textbook

- The course is based on OLS regression analysis
- Textbook: Gábor Békés – Gábor Kézdi (2021). Data Analysis for Business Economics and Policy. US: Cambridge University Press, Part IV

Aim of the course

- 1 How can we derive causal conjectures from data?
- 2 Econometric methods which let us make causal statements
- 3 More on "everyday" methods (= those which can be used in most circumstances). Advanced methods also mentioned so you can read the literature
- 4 Emphasis on understanding how to do causal analysis and how to interpret the results, less on statistical features

Topic covered

- A framework for causal analysis (Ch. 19)
- Experiments (Ch. 20)
- Regressions with matching (Ch. 21)
- Difference-in-differences (Ch. 22)
- Panel data regressions (Ch. 23)
- Synthetic controls and event studies (Ch. 24)
- Regression discontinuity
- Instrumental variables

Causal data analysis

What we do? \Rightarrow run regressions

$$y_i = \beta_0 + \beta x_i + \epsilon_i \quad (1)$$

What is our goal?

- Under what **conditions** can we say that the relation between x and y is causal?
- What is the **meaning** of β ?

OLS = correlation

- So far: statistical connections
- This course: under what conditions can we declare that one variable causes the other variable's variation?
- Causal questions
 - Does the consumption of alcohol cause lung cancer?
 - The the death of the increase the chance of death of the other spouse (The widowhood effect)?
 - Do export subsidies increase productivity improvement?

Why not obvious?

We study causal data analysis, to avoid the *Post hoc, ergo propter hoc* – *after it, therefore because of it* type mistakes

A correlated with B

- Maybe both A and B were caused by something else
 - both spouses died in an accident
- Maybe B causes A
 - productive firms start exporting
- Maybe C causes A, but C correlated with B
 - alcohol consumption correlated with smoking which causes lung cancer

The optimization behavior of agents can make all kinds of correlations in the data

Complete endogeneity: The King's orders

"It is contrary to etiquette to yawn in the presence of a king," the monarch said to him.

"I forbid you to do so."

"I can't help it. I can't stop myself," replied the little prince [...]

"Ah, then," the king said. "I order you to yawn. [...] Come, now! Yawn again! It is an order."

"That frightens me . . . I cannot, any more . . ." murmured the little prince, now completely abashed.

"Hum! Hum!" replied the king. "Then I – I order you sometimes to yawn and sometimes to – " He sputtered a little, and seemed vexed.

For what the king fundamentally insisted upon was that his authority should be respected. He tolerated no disobedience. He was an absolute monarch. But, because he was a very good man, he made his orders reasonable.

Antoine de Saint-Exupéry: The Little Prince

Why are causal relations important?

Policy decisions based on correlations may be very costly

Example: effect of privatization on employment

- Simple correlation: -47%

Problems with the simple correlation

- What is the effect of the business environment?
 - In the 90s most firms decreased their size → downward bias
- Maybe privatized firms are different from those which stayed under state ownership
 - Politicians are willing to privatize the good companies → upward bias

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If we attenuate these biases, the estimated effect becomes -1,7%.

Correlation not causation



Central Bank interventions

- Good times coming: decrease the money supply
- Recession expected: buy bonds, increase liquidity

Is countercyclical monetary policy effective? An OLS regression would suggest it is not.
⇒ Whatever the Central Bank does, the economy behaves the same way.

Contemplation about reverse causality



Correlation and Causality

Correlation is not causality, but we can observe only correlation

→ a regression coefficient measures correlation

But we can say more

- If we see evidence of correlation, it's because...
 - ...there is actual causality
 - ...there is no direct causality, something in the background is going on
 - ...it's just randomness, and really, no correlation

Our goal: under what assumptions can we say that a regression coefficient quantifies a causal effect?

We can **never** say that there is causality. All we can do is to make as simple as possible assumptions under which there is causality.

What do you need for good analysis?

1 Good question

- Sometimes you get it from your boss, sometimes you go for it

2 Hypotheses

- What are agent's motivations?
- what is the institutional framework?

3 Data

- *"In God we trust. All others must bring data."* (W. Edwards Deming statistician)

5 Method

- Under what conditions can we view a correlation to be causal?

6 Writing: write down your analysis such that it is understandable and honest

- *Lies, damned lies, and statistics* – true to the extent that with a bad methodology one can derive anything from the data

Admin
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Correlation is not causality
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Causal data analysis
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Final warning

Final warning

