

EC220 Introduction to Econometrics

Dr Canh T. Dang

Lecture Notes

Cedric Tan

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1 Introduction to Econometrics: Michaelmas Term

The initial focus of MT is applied econometrics, particularly causal questions such as "what-if" questions. Mislabelling causality as correlation can be a critical error that people make when analysing data. The course intends to teach you how to analyse data and answer economic questions using "econometrics" and data.

Examples of what-ifs are below:

- What happens to a country if it withdraws from a trade agreement?
- What is the effect of parents' education on children's education?
- What is the impact on your health if you go to a hospital?

1.1 Causality

A causes B: A contributes (or influences) to the occurrence of event B. The *cause* A is partly responsible for the *effect* B, and the effect B is partly dependent on the cause A. A can be necessary for the occurrence of B, but A can simply lead to fluctuations in B, this is still a causal relationship.

So we can take two definitions for causality:

- A is a necessary condition for B to occur
- A can cause fluctuations in B

Labels are also necessary for the structure of causation:

- Event A is called Treatment
- Event B is called the Outcome
- A third variable that causes the two events to happen is called a Confounder

We can have reverse causality - A causes B but also B causes A. An example would be *Umbrellas* and *Rain* where bringing umbrellas is caused by the possibility of rain. Sometimes timing helps to establish causality - as *Rain* happens before *Umbrellas*, *Umbrellas* cannot cause *Rain*.

Reasons that A and B are correlated:

1. A causes B (direct causation)
2. B causes A (reverse causation)
3. A and B are consequences of a common cause but do not cause each other (confounder)
4. A causes B and B causes A (bidirectional causation)
5. A causes C which then causes B (indirect causation)
6. No connection between A and B, the correlation is pure coincidence

All statistical techniques only establish associations, causation requires interpretation.

Correlation: the extent to which A and B tend to decrease and increase at the same time.

Causation can occur without correlation, here is an example for medicine:

Illness (A) can cause death (B), but nowadays healthcare (C) can eliminate the correlation between common illness and death.

1.2 Why Causality?

This is the economist's comparative advantage, the ability to infer causality from correlation.

Examples of causality are listed below with classifications like the above.

- Direct Causation:
- Reverse Causation:
- Confounder Problem:
- Bidirectional Causation:
- Indirect Causation
- Pure Coincidence: