Lecture 1: Economic Questions and Data

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1 What is Econometrics about?

1.1 Definition of Econometrics

Econometricians may give different definitions of Econometrics from their own perspective.

Stock and Watson (2015) define Econometrics as

> At a broad level, econometrics is the science and art of using economic theory and statistical techniques to analyze economic data.

1.2 The objective of Econometrics

Frisch (1933) set the objectives of Econometrics as follows,

> (Econometrics's) main objective shall be to promote studies that aim at a unification of the theoretical-quantitative and the empirical-quantitative approach to economic problems and that are penetrated by constructive and rigorous thinking similar to that which has come to dominate the natural sciences. ..... Experience has shown that each of these three viewpoints, that of statistics, economic theory, and mathematics, is a necessary, but not by itself a sufficient, condition for a real understanding of the quantitative relations in modern economic life. It is the unification of all three that is powerful. And it is this unification that constitutes econometrics.

2 Economic Questions We Examine

2.1 Four practical questions

Question 1 does reducing class size improve elementary school education?

Question 2 is there racial discrimination in the market for home loan?

Question 3 how much do cigarette taxes reduce smoking?

Question 4 what will the rate of inflation be next year?

2.2 How does an econometrician formulate such questions?

Ideally, an econometrician would design his/her econometric modeling by the following steps

1. Establish a theoretical model to qualitatively describe how X could cause Y, holding other factors constant. From the theoretical model, put forward some hypotheses to validate the theory.
2. Find actual data to measure the variables in the theory
3. Set up an empirical model to test the theoretical model, using available data.
4. Choose a suitable estimation method to estimate the empirical model.
5. Perform some hypothesis tests and model specification test to validate the estimation results.
6. Based on the estimation and test results, determine whether the theory is internally and externally valid.

3 Causal Effects and Idealized Experiments

The success of an econometric analysis relies on whether the causal effects between X and Y can be accurately identified, excluding the influences of other factors.

3.1 Randomized controlled experiment

Controlled experiment

Control group (no treatment) versus treatment group (with treatment)

Randomized experiment

the treamtment is assigned randomly

Advantages and disadvantages

Advantages eliminate the possibility of a systematic relationship that could blur the causal effects of the treatment

Disadvantages it is difficult to implement, especially for social science

4 Data Sources and Types

4.1 TODO Experimental versus observational data

4.2 Cross-sectional data

- heights of all 30 students in a class
- total population of each province in China in 2014

4.3 Time series data

- stock price of Company A by hour over the last month
- consumer price index of China by month from 1990 to 2014

4.4 Panel data

- annual wage of a fixed group of respondents in a survey conducted by a statistic agency in 1990, 1995, 2000, 2005, and 2010
- GDP per capita of each country in Asia from 1990 to 2014