Introduction to Econometrics

Class 3

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* This lecture note is written based on Professor Chang Sik Kim's lecture notes.

What is Econometrics?

- Literal interpretation: **Econo + Metrics = Economic Measurement**

- Purpose: Econometrics gives empirical content to a priori reasoning in economics $\implies$ Economic Theory + Mathematical Tools + Statistical Tools

- Major areas of concern

  - *Estimating* economic relationships

  - *Testing hypotheses* involving economic behaviors

  - *Forecasting* the behavior of economic variables

Econometric Methodology

1. Statement of **economic theory** (or conjecture)

2. Specification of **economic model**

3. Specification of **econometric model**

4. Collection of **data**

5. **Estimation** of the econometric model

6. **Hypothesis testing**

7. **Prediction** (or forecasting)

Example: Marginal Propensity to Consume

1. Economic Theory

- Keynes: *"The fundamental psychological law . . . is that men [women] are disposed, as a rule and on average, to <u>increase their consumption as their income increases, but not as much as the increase in their income.</u>"*

- The above statement means:

$$0 < \text{MPC} < 1$$

2. Economic Model

- Consumption Function

$$Y = \alpha + \beta X, \quad 0 < \beta < 1$$

  where Y is consumption, X is income.

- Parameters: α (intercept), β (slope)

3. Econometric Model

- Model:

$$Y_i = \alpha + \beta X_i + e_i$$

where e_i is error (or disturbance) term which represents all the factors (besides X_i) that affect Y_i (e.g. family size, ages, religion, etc.).

- The above one is "**Linear regression model**":

  - Y_i: Dependent (Explained) variable, Regressand

  - X_i: Independent (or Explanatory) variable, Regressor

  - Objective: How can we explain the behavior of the dependent variable using that of the independent variable(s)?

Example: Marginal Propensity to Consume [cont'd]

4. Data

- Data: Y_i (personal consumption expenditure), X_i (GDP) for the U.S., 1980-1991, in billion dollars

- Different types of data

  - **Time series data**: measurements at different points in time (daily, weekly, monthly, quarterly, annually, etc.)

    - stock price, GDP, unemployment rate, CPI

  - **Cross-sectional data**: measurements at a given point in time

    - surveys on consumer expenditure, opinion polls

  - **Panel data**: time series + cross-sectional data, measurements at different points in time on the same cross-sectional units

    - census data (1980-2015)

Example: Marginal Propensity to Consume [cont'd]

5. Estimation

- Estimated model:

$$\hat{Y}_i = -231.8 + 0.7194 X_i$$

  where $\hat{Y}_i$ is a fitted value of consumption.

- Interpretation: One dollar increase in income will lead, *on average*, to increase of about 72 cents in consumption.

6. Hypothesis Testing

- Hypothesis:

$$0 < \beta < 1$$

- Question: Is 0.7194 statistically less than 1 and greater than 0? $\implies$ Requires statistical methodology.

7. Forecasting

- Question: What will be the consumer expenditure in 2010, if the GDP in 2010 is expected to be \$20,000 (billions)?

- Answer:

$$\hat{Y}_{2010} = -231.8 + 0.7194 \times 20,000$$
$$= 14,156$$