

Lecture 4: Meaning and nature of econometrics; exact and econometric relationships

Econometrics ■ Unit I: Introduction and generalized least squares

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Previous lecture

Lecture 3: Variance of OLS; estimating σ^2 ; the Gauss–Markov theorem; a numerical example.

Today

- Meaning and nature of econometrics
 - Exact and econometric relationships
 - Theoretical and applied econometrics

The word *econometrics* means “economic measurement”. Econometrics uses economic theory, mathematics and statistical methods together in order to give numerical values to economic relationships and to test them with data.

Each of the three components has a different job.

- **Economic theory** tells us which variables are related and in which direction. For example, the theory of consumption says that consumption rises when income rises.
- **Mathematics** writes this relationship as an equation, for example $C = \beta_0 + \beta_1 Y$.
- **Statistics** estimates β_0 and β_1 from data, measures how reliable the estimates are, and tests hypotheses about them.

Econometrics joins all three

None of these alone is econometrics.

- Economic theory gives no numbers.
- Mathematical economics writes exact equations but does not confront them with data.
- Economic statistics collects and presents data but does not estimate relationships.

Econometrics joins all three.

A mathematical (exact) consumption function is

$$C_i = \beta_0 + \beta_1 Y_i.$$

- It says that all households with the same income Y_i have exactly the same consumption C_i .
- Real data never behave like this. Two households with the same income usually consume different amounts.

The econometric model therefore adds a random disturbance ε_i :

$$C_i = \beta_0 + \beta_1 Y_i + \varepsilon_i.$$

Why a disturbance term?

The disturbance represents everything that affects consumption but is not written in the equation. The main reasons for including it are:

1. **Omitted variables.** Family size, age, wealth and habits also affect consumption.
2. **Randomness of human behaviour.** People do not react identically to the same income.
3. **Errors of measurement.** Income and consumption are measured with errors in surveys.
4. **Wrong functional form.** The true relation may not be exactly a straight line.

The average relationship

If $E(\varepsilon_i) = 0$, then on average

$$E(C_i) = \beta_0 + \beta_1 Y_i.$$

So β_1 is the change in average consumption when income increases by one unit. In economics it is called the *marginal propensity to consume*.

Example 1.1 (Reading an estimated equation)

Suppose income and consumption are measured in thousand rupees per month and the estimated equation is $\hat{C} = 4 + 0.72Y$.

- For a household with income $Y = 30$, the estimated average consumption is $4 + 0.72 \times 30 = 4 + 21.6 = 25.6$ thousand rupees.
- When income rises by one thousand rupees, average consumption rises by 0.72 thousand rupees, that is, by 720 rupees.

- *Theoretical econometrics* develops methods of estimation and testing and studies their properties, for example unbiasedness and efficiency.
- *Applied econometrics* uses these methods to study particular economic problems, such as the demand for wheat or the effect of interest rates on investment.

This course is mainly about theoretical econometrics, illustrated by small applied examples.

Practice

- Exercises 1.1 and 1.2 (Exercises and Solutions booklet).

Next lecture

Lecture 5: Types of data; sources and quality of data.