

An Introduction to Econometrics

Chapter 1

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Chapter 1:
An Introduction to Econometrics

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1.1 Why Study Econometrics?

- Fills a gap between being "a student of economics" and being "a practicing economist"
- Lets you tell your employer:
 - "I can predict the sales of your product."
 - "I can estimate the effect on your sales if your competition lowers its price by \$1 per unit."
 - "I can test whether your new ad campaign is actually increasing your sales."
- Helps you develop "intuition" about how things work and is invaluable if you go to graduate school

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1.2 What Is Econometrics About?

Econometrics is about how we can use theory and data from economics, business and the social sciences, along with tools from statistics, to answer "how much" type questions.

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1.2 What Is Econometrics About?

- $CONSUMPTION = f(INCOME)$
- $Q^d = f(P, P^s, P^e, INC)$
- $Q^s = f(P, P^e, P^f)$

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1.2.1 Some Examples

- A city council ponders the question of how much violent crime will be reduced if an additional million dollars is spent putting uniformed police on the street.
- U.S. Presidential candidate Clinton questions how many additional California voters will support her if she spends an additional million dollars in advertising in that state.
- The owner of a local Pizza Hut franchise must decide how much advertising space to purchase in the local newspaper, and thus must estimate the relationship between advertising and sales.
- Louisiana State University must estimate how much enrollment will fall if tuition is raised by \$100 per semester, and thus whether its revenue from tuition will rise or fall.

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1.2.1 Some Examples

- The CEO of Proctor & Gamble must estimate how much demand there will be in ten years for the detergent Tide, and how much to invest in new plant and equipment.
- A real estate developer must predict by how much population and income will increase to the south of Baton Rouge, Louisiana, over the next few years, and if it will be profitable to begin construction of a new strip-mall.
- You must decide how much of your savings will go into a stock fund and how much into the money market. This requires you to make predictions of the level of economic activity, the rate of inflation and interest rates over your planning horizon.
- A public transportation council in Melbourne, Australia must decide how an increase in fares for public transportation (trams, trains and buses) will affect the number of travelers who switch to car or bike, and the effect of this switch on revenue going to public transportation.

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1.3 The Econometric Model

- An econometric model consists of a systematic part and a random error
- $Q^d = f(P, P^s, P^c, INC) + e$
- $f(P, P^s, P^c, INC) = \beta_1 + \beta_2 P + \beta_3 P^s + \beta_4 P^c + \beta_5 INC$
- $Q^d = \beta_1 + \beta_2 P + \beta_3 P^s + \beta_4 P^c + \beta_5 INC + e$

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1.4 How Do We Obtain Data?

- 1.4.1. Experimental Data
- 1.4.2. Nonexperimental Data
 - *time-series form*—data collected over discrete intervals of time—for example, the annual price of wheat in the US from 1880 to 2007, or the daily price of General Electric stock from 1980 to 2007.
 - *cross-section form*—data collected over sample units in a particular time period—for example, income by counties in California during 2006, or high school graduation rates by state in 2006.
 - *panel data form*—data that follow individual micro-units over time. For example, the U.S. Department of Education has several on-going surveys, in which the same students are tracked over time, from the time they are in the 8th grade until their mid-twenties.

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1.4.2 Nonexperimental Data

- Various levels of aggregation:
 - *Micro* - data collected on individual economic decision making units such as individuals, households or firms.
 - *Macro* - data resulting from a pooling or aggregating over individuals, households or firms at the local, state or national levels.
- Flow or stock:
 - *Flow* - outcome measures over a period of time, such as the consumption of gasoline during the last quarter of 2006.
 - *Stock* - outcome measured at a particular point in time, such as the quantity of crude oil held by Exxon in its U.S. storage tanks on April 1, 2006, or the asset value of the Wells Fargo Bank on July 1, 2007.
- Quantitative or qualitative:
 - *Quantitative* - outcomes such as prices or income that may be expressed as numbers or some transformation of them, such as real prices or per capita income.
 - *Qualitative* - outcomes that are of an "either-or" situation. For example, a consumer either did or did not make a purchase of a particular good, or a person either is or is not married.

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1.5 Statistical Inference

The ways in which statistical inference are carried out include:

- Estimating economic parameters, such as elasticities, using econometric methods.
- Predicting economic outcomes, such as the enrollment in 2-year colleges in the U.S. for the next 10 years.
- Testing economic hypotheses, such as the question of whether newspaper advertising is better than store displays for increasing sales.

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1.6 A Research Format

1. Find an interesting problem or question.
2. Build an economic model and list the questions (hypotheses) of interest.
3. Build an econometric model. Choose a functional form and make some assumptions about the nature of the error term.
4. Obtain sample data and choose a method of statistical analysis.
5. Estimate the unknown parameters using a statistical software package. Perform hypothesis tests and make predictions.
6. Perform model diagnostics to check the validity of assumptions.
7. Analyze and evaluate the economic consequences and the implications of the empirical results. What remaining questions might be answered?

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