Why Study Econometrics?

Econometrics gives you the opportunity to claim:

- I can predict the sales of our product if we lower our price by $1 per unit.
- I can statistically test whether advertising increase sales.
- Product **B** is our main competitor.
- I can predict the sales of our product if we lower our price by $1 per unit and our competitor **B** lowers their price by 50 cents.

What is Econometrics?

- Econometrics is the unification of economic theory, statistics and mathematics. (R Frish: **http://goo.gl/E4qtn6**)
- Econometrics bridges the gap between being a “student of economics” and the “practice of economics” as an “applied economist.”

Econometrics answer “how much” type questions, e.g.:

- What is the relationship between advertising and sales?
- How much advertising space should my company purchase?
- How should I optimal allocate a limited advertising budget between television and internet spending?

The Econometric Model (1)

An econometric model consists of a systematic part and unpredictable component e that we call a random error.

$1)\ \ Q = f(P_1, P_2, INC)$

$2)\ \ Q = f(P_1, P_2, INC) + e$

$3)\ \ Q(P_1, P_2, INC) = \beta_1 + \beta_2 P_1 + \beta_3 P_2 + \beta_4 INC$

$4)\ \ Q = \beta_1 + \beta_2 P_1 + \beta_3 P_2 + \beta_4 INC + e$

$5)\ \ E(Q|P_1, P_2, INC) = \beta_1 + \beta_2 P_1 + \beta_3 P_2 + \beta_4 INC$

where $Q =$ quantity demanded, $P_1 =$ own-price, $P_2 =$ substitute-price, $INC =$ income and f is a general functional form.

The Econometric Model (2)

- The coefficients β_1, β_2, β_3, β_4, are unknown parameters of the model that we estimate using economic data and a specified statistical algorithm.
- The functional form represents a hypothesis about the relationship between the variables.
- In any particular problem, one challenge is to determine a functional form that is compatible with economic theory and the data.
- The random component represents a “noise” component, which obscures our understanding of the relationship among variables, and which we represent using *e* - a random error.

Use the econometric model for Statistical Inference

- Estimate economic parameters, such as marginal effects and elasticities.
- Predict economic outcomes.
- Test economic hypotheses, e.g., is television advertising better than internet ads for increasing sales?

What type of real processes generate data?

- Economists and other social scientists work in a complex world in which data on variables are “observed” and rarely obtained from controlled experiments.
- This makes the task of learning about economic relationships, and testing economic theories from data very difficult.

Data may be collected at various levels of aggregation:

- Micro (individual)
- Macro (aggregated).
- Data may also represent a flow or a stock:
  – Flow: measured over a period of time.
  – Stock: measured at a particular point in time.
- Data may be quantitative or qualitative:
  – Quantitative: expressed as numbers.
  – Qualitative: expressed as an “either/or” label.

Time-series Data

- “Time-series” is data collected over discrete intervals of time.
- The key feature of time-series data is that the same economic quantity is recorded at a regular time interval.
- E.g. daily data on the exchange rate between USD and NOK

Importance of Tidy Data in Data Science/Econometrics

1. **Consistency**: Provides a standardized data structure.
2. **Efficiency**: Streamlines analysis and visualization tools.
3. **Data Wrangling**: Simplifies data transformations and manipulations.
4. **Reproducibility**: Ensures research can be easily repeated.
5. **Error Detection**: Standard structure makes anomalies evident.
6. **Joining Datasets**: Easier combination of multiple data sources.
7. **Communication**: Enhances clarity for collaborators and stakeholders.
8. **Exploration**: Facilitates effective exploratory data analysis.

The Research Process

- Use economic theory to think about the problem (**http://freakonomics.com/**).
- Develop a working economic model leading to an econometric model.
- Obtain sample data and choose a desirable method of statistical analysis based on initial assumptions and an understanding of how the data were collected.
- Estimate the unknown parameters with the help of a statistical software package, make predictions, and test hypotheses.
- Perform model diagnostics to check the validity of model assumptions.
- Analyze, evaluate and discuss the economic consequences and the implications of the empirical results.

Error ×