

# EE 425 Econometrics I

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Semester 1, 2013

In this course, we will study applications of statistical and economic theories in analyzing economic data. This includes parameter estimation using the ordinary least squares (OLS) technique and hypothesis testing.

The course covers single and multiple regressions. It also discusses problems encountered by OLS, including autocorrelation, heteroskedasticity, multi-collinearity, specification error, and stochastic regressors. Other estimation techniques such as generalized least squares (GLS), maximum likelihood estimation (MLE) and the use of computer application in practice will also be covered.

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# Introduction and Motivation

## 1 What is econometrics?

Statistical method for estimating economic relationships, testing economic theories, and evaluating an implementing government and business policies (Wooldridge, 2009)

- Estimating economic relationships – How much discount would a hotel have to give in order to achieve full occupancy? (Price vs. Demand), How many cars would be sold if the car tax is reduced by half? (Tax vs. Consumption), etc.
- Testing economic theories – For example, is true that the demand curve is always downward sloping? Is it true that firms always maximize profits? (See Levitt, 2006)<sup>1</sup>, etc.
- Evaluating and implementing government policies – Does universal health care (e.g. 30 baht program) help decrease mortality rate? Which method is more effective in convincing rural students to come to school, free lunch or subsidy to the parents?
- Evaluating and implementing business policies – Should firm pay the manager a fixed salary or a variable compensation in order to achieve the highest profit? Are part-time workers more productive than full-time workers? etc.

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<sup>1</sup>Levitt, S. D. (2006). "An Economist Sells Bagels: A Case Study in Profit Maximization." National Bureau of Economic Research (NBER) Working Paper 12152.

4 1. Introduction and Motivation

- In econometrics, we believe that there are actually "true" answer(s) to the above questions.
  - Econometricians collect data (sample data) and use the sample data to answer the questions.
  - Econometric methods help justify that the answers that we get from analyzing the sample is comparable to the "true" answers.
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### 1.1 Steps in Empirical Economics Analysis

- – Empirical -> data and numbers.
  1. Form a question, define the population of interest.
  2. In some cases, construct an economic model.

$$y = f(x_1, x_2, x_3, x_4)$$

where  $y$  denotes the number of days/week that a student (in rural Thailand) would go to school,  $x_1$  denotes the availability of school lunch,  $x_2$  denotes the provision of subsidies to parents,  $x_3$  denotes parents' income,  $x_4$  denotes parents' occupation.

3. If the analysis is based on a real economic model, one has to adapt it in such a way they can perform econometrics analysis.
4. In many cases, one bypasses 2. and 3., and construct an econometric model right away
5. Let the "Number of days a student goes to school" =  $y$

$$y = \beta_0 + \beta_1 \text{lunch} + \beta_2 \text{subsidies} + \beta_3 \text{parents\_inc.} + \beta_4 \text{parents\_occ.}$$


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## 2 Types of economic data

- Data is usually a "subset" of the population of interest. For example, some students in the village of interest.
- Cross-sectional data – More than 1 individual, households, cities, villages. But 1 time period.
- Let the "Number of days a student goes to school" =  $y$

Student no.	$y$	lunch	subsidies	parents_inc.	parents_occ.
1	5	1	1	3,000	farmer
2	2	0	1	4,500	hair-dresser
3	3	0	0	6,000	farmer
4	4	0	1	3,500	driver

- Time-series data – 1 individual, households, cities, villages. More than 1 time period.

Student no.	Time	$y$	lunch	subsidies	parents_inc.	parents_occ.
1	1/02/10	5	1	1	3,000	farmer
1	2/02/10	5	0	1	3,000	farmer
1	3/02/10	3	0	0	3,000	farmer
1	4/02/10	2	0	0	3,000	farmer

- Panel or Longitudinal data – Several individual, households, cities, villages. More than 1 time period.

Student no.	Time	$y$	lunch	subsidies	parents_inc.	parents_occ.
1	1/02/10	5	1	1	3,000	farmer
1	2/02/10	5	0	1	3,000	farmer
2	1/02/10	2	0	0	4,500	hair-dresser
2	2/02/10	4	0	1	4,500	hair-dresser
...	...	...	...	...	...	...
4	2/02/10	3	0	1	3,500	driver

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