Advanced Econometrics I

Spring 2013 (4th module) – Syllabus

Instructor: SungBin Sohn

Class: Mondays and Thursdays 10:10-12 pm in C105
Office Hours: Wednesdays 10-11:45am or by appointment at C324

Email: sungbin.sohn@phbs.pku.edu.cn

Grading: Homework/Attendance 30%, Midterm 30%, Final exam 40%
Teaching Assistant: TBA

Course Description:

This is a graduate level course in econometrics. Econometrics is statistical analysis of economic and financial data. It is widely applied to estimate economic relationship, test economic theory and evaluate government and business policies. It has also been applied to management, marketing, sociology, etc. This course helps students use and understand regression, explore the economic intuition of regression analysis, and introduces students some widely used econometric models.

The course begins with brief reviews of probability distributions and limit theorems. Then, it studies the classical linear regression model (CLRM) focusing on the least squares estimator. The course further studies the cases in which main assumptions in the CLRM are violated. Other estimation methods such as the maximum likelihood and the generalized method of moments are also covered. If time permits, some special topics (e.g., panel data, qualitative dependent variable, etc.) will be studied. The course emphasis is rather theoretical than empirical.

There is no designated textbook for the course, but the following book could be useful (you are not required to read it):

William H. Greene (2003), *Econometric Analysis*, Prentice Hall

Prerequisites:

(General) Probability and statistics; Linear algebra
(Course) Mathematics; Applied econometrics

Requirements:

Requirements for the course include attending lectures, several problem sets, a midterm exam and a final exam. I take roll several times randomly throughout the module. Each time you're absent, your course score will be deducted by 1 point unless you obtain my pre-approval. Some of the assignments may contain computational exercises. You are encouraged to work in groups. However, you must turn in an individual solution. Plagiarism is strictly punished. Late submission is unacceptable and will not be graded.

Email policies:

I strongly encourage you to ask questions during lectures and office hours. If you have special needs to reach me outside the lectures or office hours, however, you may email me. I will try to respond to your email in two business days. If you don't get my response within two business days, please send me a reminder email. When you email me, please prefix the subject header [AE] in order to make your email too conspicuous to miss it.

Course Outline and References:

The schedule of topics could be updated as the course evolves.

1. Probability distributions

- 1.1. The normal distribution
- 1.2. The chi-squared (χ^2) distribution
- 1.3. The *t* distribution & the *F* distribution

2. Limit theorems

- 2.1. Convergence
- 2.2. Law of large number (LLN)
- 2.3. Central limit theorem (CLT)
- 2.4. Slutsky's theorem
- 2.5. Delta method

3. Classical linear regression model

- 3.1. Standard assumptions of classical linear regression model
- 3.2. Least squares estimator (LSE)
- 3.3. Properties of OLS estimator
- 3.4. Gauss-Markov theorem
- 3.5. Estimator of σ^2
- 3.6. Distribution of β & σ^2
- 3.7. Wald test
- 3.8. Goodness of fit
- 3.9. Confidence interval of β
- 3.10. Prediction
- 3.11. Confidence interval of *y*

4. Departure from assumptions in classical linear regression model

- 4.1. Heteroskedasticity
  - 4.1.1. Introduction
  - 4.1.2. Detection
  - 4.1.3. Generalized least squares (GLS) estimator
- 4.2. Serial correlation
  - 4.2.1. Introduction
  - 4.2.2. Detection
  - 4.2.3. GLS estimator
- 4.3. Multicollinearity
  - 4.3.1. Introduction
  - 4.3.2. Detection and suggested solutions

5. Other estimation methods

- 5.1. Maximum likelihood estimator (MLE)
- 5.2. Generalized method of moments estimator (GMME)

6 Special topics

- 6.1. Measurement error
- 6.2. Misspecification problem
- 6.3. Panel data
- 6.4. Qualitative dependent variable
- 6.5. Truncated or censored data