NATIONAL TAIWAN UNIVERSITY

Department of Finance

ECONOMETRIC THEORY I

and

Departments of Economics and International Business

ECONOMETRIC THEORY III

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This is the first course in econometric theory for Ph.D. students; well prepared Master students are also welcome to take this course. This course requires knowledge of probability theory, multivariate statistics, and linear (matrix) algebra; econometrics at master level is *not* a prerequisite, however. In this course, I will follow my own lecture notes and cover various least-squares theories and quasi-maximum likelihood theory. Unlike most econometrics textbooks that are organized according to *models*, my notes are arranged by *theories* (*methods*), with applications to various models. Some textbooks (R2 and R3 below) provide more thorough treatment of these topics. What I hope is that, by introducing econometric theory in this way, students will learn *how* an econometric method is derived and *why* it works.

The lectures will be in *English*; classroom discussion may be in Mandrin if so desired. Students are also required to be familiar with at least one programming language, such as R or Matlab. A senior student will introduce basic programming in R in the beginning lectures; some basic materials about R installation and introduction can be found in the class website (see below).

Required Reading

R1. Kuan, C.-M., *Introduction to Econometric Theory*, Slides and Notes, available at:
https://ceiba.ntu.edu.tw/1001econometrics (for finance students)
https://ceiba.ntu.edu.tw/1001econometric3 (for economics and IB students)
homepage.ntu.edu.tw/~ckuan

R2. White, H., *Asymptotic Theory for Econometricians*, revised ed., Academic Press, 1999.

R3. White, H., *Estimation, Inference and Specification Analysis*, Cambridge University Press, 1994.

Supplemental Reading

S1. Davidson, R. and J. G. MacKinnon, *Estimation and Inference in Econometrics*, Oxford University Press, 1993.

S2. Greene, W. H., *Econometric Analysis*, 6th ed., Pearson Prentice Hall, 2008.

S4. Kuan, C.-M., *Elements of Matrix Algebra*, Lecture Notes.

Office Hours: Tuesday 4–6 or by appointment (3366.1072)

Course Outline

Part I: Review of Classical and Generalized Least Squares Theory (Chapters 3–4 of R1; S2; S4)

- I.1 The Method of Ordinary Least Squares (OLS)
- I.2 Properties of the OLS Estimator
- I.3 Hypothesis Testing
- I.4 Limitation of the Classical Conditions
- I.5 The Method of Generalized Least Squares (GLS)
- I.6 Heteroskedasticity and Serial Correlation

Part II: Asymptotic Least Squares Theory (Chapters 5–7 of R1; R2; R3)

- II.1 Elements of Probability Theory
- II.2 Asymptotic Properties of the OLS Estimator
- II.3 Consistent Estimation of Asymptotic Covariance Matrix
- II.4 Large Sample Tests

Part III: Nonlinear Least Squares (NLS) Theory (Chapter 8 of R1; S1)

- III.1 Nonlinear Specifications
- III.2 NLS Estimator
- III.3 Asymptotic Properties of the NLS Estimator
- III.4 Large Sample Tests

Part IV: Quasi-Maximum Likelihood (QML) Theory (Chapters 9–10 of R1; R3; S3)

- IV.1 Kullback-Leibler Information Criterion
- IV.2 Asymptotic Properties of the QML Estimator
- IV.3 Information Matrix Equality
- IV.4 Large Sample Tests – Nested Models
- IV.5 Large Sample Tests – Non-Nested Models
- IV.7 Applications: ARMA Models
- IV.8 Applications: Volatility Models

Grading: One midterm (40%), one final (45%), Homework (15%).