NATIONAL TAIWAN UNIVERSITY

Department of Finance

ECONOMETRIC THEORY I

and

Departments of Economics and International Business

ECONOMETRIC THEORY III

Prof. C.-M. Kuan **Fall 2014**
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This is the first course in econometric theory for Ph.D. students; master students and undergraduates with proper mathematics and statistics background (e.g., probability theory, multivariate statistics, and matrix algebra) are welcome to take this course. Please check R1 (Chapters 1 and 2 of Lectures Notes) and S3 below for related background information. Some basic econometrics knowledge is a plus but *not* required.

In this course, I will follow my own lecture notes and cover the least-squares theory 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 different models. More detailed treatment of these theories can be found in R2 and R3 below. By introducing econometrics in this way, I hope students can understand *how* an econometric method is derived and *why* it works.

The lectures will be in *English*; classroom discussion may be in Mandrin. Students are required to learn a programming language, such as R (a free software) 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*, Lecture Notes and Slides.
https://ceiba.ntu.edu.tw/1031econometrics02 (for finance students)
https://ceiba.ntu.edu.tw/1031econometrics01 (for economics and IB students)

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

[S2] Hamilton, J., *Time Series Analysis*, Princeton University Press, 1994.

[S3] Kuan, C.-M., *Elements of Matrix Algebra*, Lecture Notes.

Office Hours: By appointment (3366.1072)

Course Outline

Part I: Classical 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)

Part II: Asymptotic Least Squares Theory (Chapters 5–7 of R1; R2; R3; S1)

- 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
- II.5 Digression: Bootstrap

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

- III.1 Nonlinear Specifications
- III.2 NLS Estimator

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.6 Applications: Microeconometric models
- IV.7 Applications: ARMA Models
- IV.8 Applications: Volatility Models

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