NATIONAL TAIWAN UNIVERSITY

Department of Finance

ECONOMETRIC THEORY I

and

Departments of Economics and International Business

ECONOMETRIC THEORY III

Prof. C.-M. Kuan **Fall 2013**
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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 are also welcome to take this course. Students in this class are expected to have learned probability theory, multivariate statistics, and linear (matrix) algebra; check R1 (Chapters 1 and 2) and S4 below. Some econometrics courses at the master level are 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. By introducing econometrics in this way, I hope students will be able to learn *how* an econometric method is derived and *why* it works. Depending on the progress of our lectures, some of the topics given in the course outline below may be changed.

The lectures will be in *English*; classroom discussion may be in Mandrin. Students are required to learn at least one programming language, such as R (a free software) or Matlab. A senior student will introduce basic programming in R; some materials about R installation and introduction can be found in the class website below. Do not just copy other students' program for your computation exercises, as learning to program by yourself is an important step for understanding econometrics methods.

Required Reading

[R1] Kuan, C.-M., *Introduction to Econometric Theory*, Lecture Notes and Slides.
https://ceiba.ntu.edu.tw/1021econometrics01 (for economics and IB)
https://ceiba.ntu.edu.tw/1021econometrics02 (for finance)
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.

[S3] Hamilton, J., *Time Series Analysis*, Princeton University Press, 1994.

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

Office Hours: By appointment (3366.1072 or e-mail)

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%).