

NATIONAL TAIWAN UNIVERSITY
Department of Finance
ECONOMETRIC THEORY I

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3366.9541

This is the first course in econometric theory for Ph.D. students; well prepared Master students are also welcome to take this course. The prerequisite of this course includes the basic knowledge of linear (matrix) algebra and multivariate statistics; undergraduate econometrics is *not* required, however. Those who are not familiar with these concepts must read my lecture notes: *Elements of Matrix Algebra* and/or the first two chapters of *Introduction to Econometric Theory*; you may also consult related textbooks, e.g., Appendices A and B of Greene (2008).

In this course, I will follow my own lecture notes; other textbooks are assigned as complementary reading. Unlike most econometrics textbooks that are organized according to *models*, my notes are categorized by *theories* or *methods*, such that each theory (method) is readily applied to existing models. What I hope is that, by introducing econometric theory in this way, students will learn not only various models but also *how* an econometric method is derived and *why* it works.

In this course, I will focus on the classical and asymptotic least squares theories. In the asymptotic theory part, some non-conventional methods, including unit-root tests and co-integration, will also be discussed. Depending on the time we have at the end of this semester, I will try to cover two additional methods that are related to the topics in this course: (1) hypothesis testing without a consistent covariance matrix estimator, and (2) bootstrap. The lectures will be in *English*; students may ask questions in Mandarin though. Our homeworks will include *programming* exercises; a TA will introduce basic ideas of programming in R (it is okay if you choose to use matlab or anything similar). Auditors are welcome; yet please be advised that *no* one really learns econometrics without doing homeworks and programming by himself.

Required Reading

1. Kuan, C.-M., *Introduction to Econometric Theory*, Lecture Notes, available at ceiba.ntu.edu.tw/981econometrics or homepage.ntu.edu.tw/~ckuan (please constantly check for new versions).

Supplemental Reading

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

2. Hayashi, F., *Econometrics*, Princeton University Press, 2000 (recommended).
3. Kuan, C.-M., *Elements of Matrix Algebra*, Lecture Notes, also available at ceiba.ntu.edu.tw/981econometrics or homepage.ntu.edu.tw/~ckuan.
4. White, H., *Asymptotic Theory for Econometricians*, revised ed., Academic Press, 1999.

Office Hours: Tuesday 3–5 and by appointment

Course Outline

Part I: Classical and Generalized Least Squares Theory (Chapters 3–4 of Lecture Notes)

- I.1 The Method of Ordinary Least Squares (OLS)
- I.2 Statistical 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 Lecture Notes)

- II.1 Elements of Probability Theory
- II.2 Asymptotic Properties of the OLS Estimator
- II.3 Consistent Estimation of Covariance Matrix
- II.4 Large Sample Tests
- II.5 Autoregression of an $I(1)$ Variable and Unit-Root Tests
- II.6 Tests of Stationarity against $I(1)$
- II.7 Regressions of $I(1)$ Variables and Cointegration

Part III: Additional Topics

- III.1 Hypothesis Testing without a Consistent Covariance Matrix Estimator
- III.2 Bootstrap and Applications

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