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, with some textbooks assigned as complementary reading. Unlike most econometrics textbooks that are organized according to models, my notes are arranged by theories (methods), with applications to various models. 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 Mandarin if so desired. Students are also required to be familiar with at least one programming language. 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). You may choose to program in MATLAB or other languages.

Required Reading

R1. Kuan, C.-M., Introduction to Econometric Theory, Slides and Notes, available at:
   ceiba.ntu.edu.tw/991econometrics (for finance students)
   ceiba.ntu.edu.tw/991econometrics3 (for economics and IB students)
   homepage.ntu.edu.tw/~ckuan


Supplemental Reading


**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)

**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 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:** 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%).