Fin8037 **Econometrics II**
National Taiwan University **2021/02/17**

YI-TING CHEN

Professor, Department of Finance, National Taiwan University
Tel: 33661080
E-mail: chenyt@ntu.edu.tw

Introduction

Econometrics II is an advanced course following Econometrics I. It covers many important topics in econometrics. These topics are essential not only for theoretical analyses but also for empirical studies.

In Econometrics I, we have discussed the basic principles of model specification, estimation and inference methods in the context of linear regressions. In particular, we have discussed

- how to express the relationship between a dependent variable y and a set of regressors X using a linear regression (which is indeed the baseline setting of parametric econometric models)?
- how to define a sensible parameter of the linear regression for identification (true parameter when the regression is correctly specified vs. the pseudo-true parameter when the regression is misspecified)?
- how to estimate the parameter using real data base the least squares method?
- how to establish the computational properties (the orthogonal condition) and the statistical properties (the unbiasedness, the BLUE, the normality, the t test and the F test) of the LS estimator (under the assumption of conditional normality)?
- how to relax the conditional normality assumption using the asymptotic approach?
- how to establish a simple law of large numbers using the concept of convergence in probability for random samples?
- how to establish a simple central limit theorem using the concept of convergence in distribution for random samples?

- how to establish the asymptotic inference methods for the LS estimator and its transformation based on the law of large numbers, the central limit theorem, the continuous mapping theorem and the delta method?
- how to estimate the parameters under a parameter restriction using the constrained least squares (CLS) method?

In Econometrics II, we plan to introduce a more complete framework of econometric analysis by completing our discussions about the constrained estimation methods and discussing a number of important econometric topics, including hypotheses testing and model selection, bootstrap and its properties, the problem of endogeneity and instrumental-variable (IV) estimation, and the generalized method of moments (GMM). In addition, we plan to introduce a basic framework of time-series analysis. In this part, we plan to discuss the basic types and properties of time-series data, and the linear time-series models for stationary processes. In this course, students may learn important econometric methods and basic principles of time-series analysis for their future empirical or econometric research, and may also enhance their programming skills in R via doing computer homework.

Lectures

1. Introduction
2. Constrained estimation (Ch.8 of Hansen's (2021) textbook)
    - Constrained least squares, exclusion restriction, Hausman equality, Minimum distance (MD) estimator, asymptotic distribution of the MD, asymptotically efficient MD estimator, misspecification and local misspecification.
3. Hypothesis testing and model selection (Ch.9; Ch.28)
    - Hypotheses, type I error, type II error, significance, p-value, Wald test, score test, criterion-based test, testing consistency, asymptotic local power, information criterion, AIC and BIC.
4. Bootstrap (Ch.10)
    - Bootstrap algorithm, bootstrap moments, bootstrap distribution, bootstrap asymptotics, bootstrap consistency, bias correction, bootstrap tests, parametric bootstrap, bootstrap regression, and wild bootstrap. **Asymptotic refinement and Edgeworth expansion.**
5. Endogeneity and IVs (Ch.12)

- Endogenous regressors, identification, two-stage LS (2SLS) and properties, generated regressors, control function, endogeneity tests, overidentification test, weak IVs.

- **Midterm exam. 4/7**

6. GMM (Ch.13)

   - Moment equation models, method of moments, overidentified moment equations, GMM estimator, efficient GMM, overidentification test, conditional moment equation models.

7. Time series data (Ch.14)

   - Stationarity, convergent series, ergodicity, martingale difference, mixing, linear projection, white noise, Wold decomposition, lag operator, unit root.

8. Univariate time-series models (Ch.14)

   - Moving average (MA) processes, autoregressive (AR) processes, ARMA processes, ARIMA processes, time trend, time-series regressions, estimation, asymptotics.

- **Final exam. 6/2**

Requirements

As you will observe, Econometrics II involves more technical details than Econometrics I. It needs more mathematical derivations and computer exercises for simulation. It also means that after learning Econometrics II, your skills for econometric analyses will be greatly enhanced. Regular class attendance is a basic requirement. **Mathematical statistics**, **matrix algebra** and **Econometrics I** are required as background knowledge of this course. Computer homework needs to be done using **R** (`https://www.r-project.org/`).

Textbook & References

Textbook

Hansen, B. E. (**2021**), *Econometrics*, (`https://www.ssc.wisc.edu/~bhansen/econometrics/Econometrics.pdf`) Version: September, 2021.

- Certain sections will be skipped.
- Many chapters will not be discussed.

- However, this does mean that these chapters and topics are not essential. Indeed, topics like non-parametric methods, panel data analysis and program evaluation methods (such as RD and DID) are also important for empirical analysis.
- Nonetheless, with the knowledge of Econometrics I and Econometrics II, it would be much easier to go through these topics in your future studies.

References

1. Hansen, B. E. (2021), *Introduction to Econometrics*, (`https://www.ssc.wisc.edu/~bhansen/probability/Probability.pdf`)

2. Hamilton, J. (1994), *Time Series Analysis*, Princeton University Press.

3. White, H. (2001), *Asymptotic Theory for Econometricians*, Academic Press.

Grade

- Midterm (40%), Final (40%), **Homework** (20%).
- Welcome to contact me for econometrics but NOT for grade.

Office Hours

- Before and **after** the classes
- By appointment
- Asks for TA's help