Fin8036 & ECON7026 **Econometrics I**
National Taiwan University **2018**

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Introduction

Econometrics is a research discipline that aims at bridging economics and data or statistical analysis. Modern economic studies are inseparable from econometric analysis for evaluating existing economic theories, motivating new theories or finding empirical evidence. In this course, we will introduce basic concepts, principles and methods of econometrics in specifying, estimating and testing empirical models. Our discussions will be mainly established in the context of linear regressions. We will also introduce the first-order asymptotic method which is essential for statistical inference. Important econometric issues, such as the problem of endogeneity, the instrumental variables (IV) and the generalized method of moments (GMM) will also be introduced. In this course, students may learn basic econometric principles and methods for their future research, and may also learn programming skills in R via doing computer homework.

Lectures

1. Introduction (9/13, 2018)
2. Linear regression
    - Conditional moments, Law of iterated expectations, conditional expectation function, best prediction, linear regression, dummy variables, best linear predictor, partition of regressors, omitted variable bias, linear projection, causal effect.
3. Least square estimation
    - Ordinary least square (OLS) estimator, computational properties, algebraic properties, projection & orthogonal projection matrices, R^2, residual regression, Frisch-Waugh-Lovell theorem, leave-one-out OLS estimator.

4. Classical linear regression I

    - First & second moments of the OLS estimator, Gauss-Markov theorem, heteroskedasticity, generalized least squares (GLS) estimator, covariance matrix and its estimation, goodness-of-fit measures.

5. Classical linear regression II

    - Properties of normality, Gaussian maximum likelihood estimator (MLE), distribution of the OLS estimator, confidence interval, t statistic, F statistic, information matrix equality, Crámer-Rao lower bound.

- Midterm exam. (11/8, 2018)

6. Large sample theory I

    - Limits, concepts of convergence, law of large numbers, central limit theorem, continuous mapping theorem, delta method, stochastic order.

7. Large sample theory II

    - Consistency of the OLS estimator, asymptotic normality of the OLS estimator, asymptotic covariance matrix and its estimation, parameter transformation, asymptotic standard error, t statistic, Wald statistic, asymptotic confidence interval.

8. Endogeneity & Instrumental variables

    - Examples of endogeneity, IV, identification, two-stage LS estimation, control-function approach, asymptotic distribution of the IV estimator.

9. Generalized method of moments

    - Moment models, just-identified vs. over-identified restrictions (MM vs. GMM), GMM estimator, asymptotic distribution of the GMM estimator, efficient GMM, over-identification test, conditional moment restrictions.

- Final exam. (1/10, 2019)

Requirements

Regular class attendance is a basic requirement. Mathematical statistics and matrix algebra are required as background knowledge of this course. The "Introduction to Quantitative Methods"(ECON7009), offered by the Department of Economics, is a useful short course on related topics and is recommended. Computer homework needs to be done using R (`https://www.r-project.org/`).

Textbook & References

Textbook

Hansen, B. E. (**2017**) *Econometrics*, (`https://www.ssc.wisc.edu/~bhansen/econometrics/Econometrics2017.pdf`)

References

1. Hansen, B. E. (**2018**), *Econometrics*, (`https://www.ssc.wisc.edu/~bhansen/econometrics/`)
2. White, H. (2001), *Asymptotic Theory for Econometricians*, Academic Press.
3. Hamilton, J (1994), *Time Series Analysis*, Princeton University Press.
4. Davidson, R. and J. G. MacKinnon(1993), *Estimation and Inference in Econometrics*, Oxford University Press.

Grade

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

$$\text{your grade} = f_{\text{rule}}(\text{your inputs}, \text{your } \varepsilon).$$