Syllabus
ECON 883.05: Special Topics in Econometrics (Econometrics III, First Half)
Fall 2015

Instructor: Jia Li, Economics Department, Social Science Building 237 (228G in the new DFE center after 8/25), E-mail: jl410@duke.edu

Time and Location: T, Th 10:05 - 11:20, Social Science 113
Office Hours: Monday 2:00 - 4:00.

This module is designed for Ph.D. students in economics who have finished the first-year graduate econometrics sequence and will pursue theoretical and/or applied econometrics as their dissertation topics.

This module has two parts. In the first part (about 70%) of this module, we will cover the classical asymptotic theory for M-estimation. The main focus is the estimation and inference for econometric models with finite dimensional parameters based on possibly dependent data. Examples include ordinary least square, generalized methods of moments (GMM), (quasi) maximum likelihood, quantile regression, etc. We will cover the strategy and technical tools with almost complete mathematical rigor. The technical training in this part should facilitate further studies on topical courses in microeconometrics, standard time-series econometrics, and/or high-frequency financial econometrics.

Lecture notes are available on this website. We sometimes talk about more advanced topics on board during lectures.

The second part (about 30%) of the module is more topical and varies across years (which partly reflects the instructor's most recent interest). This year we shall cast the classical moment-based inference into the setting of high-frequency financial econometrics using occupational measures. As a preparation, we also discuss in detail the M-estimation using convex, but possibly nonsmooth loss functions.

Grading: There will be 3 assignments and a final exam. You can form study groups (up to 3 people/group) and coauthor the assignments; there is no penalty on coauthorship. The final exam will be in class, open book/note/papers. They will count toward the grade in the first half as follows.

Assignments	60%
Exam	40%

Books

This course is mainly based on lecture notes. Relevant reference include the following.

[DP] *A user's Guide to Measure Theoretic Probability.* D Pollard.
[AS] *Asymptotic Statistics.* A. W. van der Vaart.
[JD] *Stochastic Limit Theory.* J. Davidson.
[JP] *Discretization of Processes.* Jean Jacod and Philip Protter.

Handbook of Econometrics:
[NM] *Large Sample Estimation and Hypothesis Testing.* W. K. Newey and D. McFadden.
[JW] *Estimation and Inference for Dependent Processes.* J. M. Wooldridge.
[DA] *Empirical Process Methods in Econometrics.* D. Andrews.

Syllabus

1. Review of probability theory
    - Probability, random variables, expectation
    - Stochastic convergence, uniform integrability
    - Stochastic process, random element, metric space

- Weak convergence, almost sure representation
- LLN and CLT for independent data.
- Readings: Lecture notes, [DP] (Ch2), [AS] (Ch2)

2. M-estimation: consistency

   - The standard results
   - Examples: OLS, NLLS, QR, MLE, GMM
   - Identification and uniform convergence
   - Readings: [NM] (Sec 2), [VW] (Ch 3.2)

3. Uniform convergence and stochastic equicontinuity

   - The equivalence result
   - Proving stochastic equicontinuity
   - Applications
   - Readings: [JD] (Ch 21)

4. Asymptotic normality of M-estimation and GMM (The smooth case)

   - Basic results
   - Sequential estimation
   - Efficiency
   - Testing
   - Readings: [NM] (Sec 3,4,5,6,9)

5. Limit theorems for dependent data: LLN and CLT

   - Dependence (Stationary ergodicity, Martingale, Mixing, Mixingale)
   - LLN
   - CLT
   - Readings: [JD] (Ch 19, 24)

6. M-estimation for dependent data

   - Basic Results
   - MLE
   - QMLE
   - GMM
   - Readings: [JW]

7. Long-run variance estimation

   - Spectral density and long run variance
   - ARMA models
   - Nonparametric estimation
   - Inconsistent long run variance estimation
   - Readings: Newey-West (1987), Andrews (1991)

8. Topic 1: Convexity and nonsmoothness

9. Topic 2: High-frequency M-estimation