EC 708: Advanced Econometrics I
Spring 2019

Instructor: Zhongjun Qu
Time and Location: Monday and Wednesday 10:10–11:25; PSY B37
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Course Overview

The course is designed for first-year Ph.D students in Economics. The primary objective is to provide an introduction to basic econometric theory and methods, hence to provide a foundation for applied research in economics. The material discussed can be thought as a minimum that a well-trained economics Ph.D. should know.

Prerequisite

EC 707 or equivalent. Familiarity with statistics is assumed. We will make extensive use of matrix algebra.

Grading

There will be bi-weekly assignments. The assignments will be graded and reviewed in discussion sections. The students are allowed to collaborate on the problem sets, but must turn in their own copy. The evaluation will be based on problem sets (20%), a midterm exam (30%) and a final exam (50%). The exams will be close book.

Material

I will distribute a set of lecture notes developed by Professor Pierre Perron, supplemented by some notes of my own. Some useful references are:

COURSE OUTLINE

Part 1: The Basic Linear Regression Model

1. Introduction
   (Population and sample, simple random sample, conditional expectation, regression, best (linear) prediction)

2. Geometry of least squares
   (The Frisch-Waugh-Lovell Theorem)

3. The classical linear model (I)
   (Model assumptions, unbiasedness, efficient estimation, Gauss-Markov Theorem, restricted least squares)

4. The classical linear model (II)
   (Normal distribution Theory)

5. The classical linear model (III)
   (Hypothesis testing, t-test, F-test, testing for structural change)

Part 2: Generalized Regression Models

1. Asymptotic distribution theory
   (Consistency of OLS, limiting distribution of OLS, LAD estimation)

   (The principle of MLE, the Cramer-Rao lower bound, asymptotic distribution of the MLE, an information matrix equality, consistent estimates of the information matrix)

3. Maximum likelihood (II): hypothesis testing
   (LR, LM, and Wald)
4. Nonlinear regression
   (Numerical optimization)

5. Estimation with heteroskedasticity and/or autocorrelation
   (GLS, HAC estimation, automatic bandwidth selection, pre-whitening)

6. Instrumental variable estimation
   (Identification, estimation, inference, weak instruments)

7. Multivariate regression
   (SURE system, equivalence between OLS and GLS)

Part 3: Topics

1. Generalized methods of moments
   (Theory of estimation, testing for over-identifying restrictions)

2. Misspecified models: estimation and inference
   (Pseudo true value, the Kullback-Leibler divergence)

3. Simultaneous equation models
   (Full information maximum likelihood)

4. Introduction to time series models
   (ARMA, unit root, cointegration)