Econ 4274 Programming Econometrics with R

Course Information

Instructor: Yangguang (Sunny) Huang
Email: huangyg@ust.hk
Class time: Wed 12:00 - 14:50 (LSK G021)
Office hour: Thur 14:00 – 16:00 or by appointment (LSK 6075)
Course website: https://canvas.ust.hk/courses/11846/

Teaching Assistant:
Email:
Office hour:

Books:
4. Econometrics (2015) by Bruce Hanse (Hansen)
   (http://www.ssc.wisc.edu/~bhansen/econometrics/)
5. Discrete Choice Methods with Simulation (2003) by Kenneth Train (Train)

Papers:
   (http://people.hss.caltech.edu/~mshum/gradio/china1.pdf)
Grading

1. Four problem sets (15%+15%+15%+10%)
   Can be submitted by individual student or by a group with maximum three students. (Grouping can be changed across problem sets.) Submission will be through Canvas. Please submit both your answer (as word document or PDF) and your code.

2. In-class exam, 25%
   This in-class exam test for core material of this course. You will have internet access but no communication is allowed. Absence in an exam without a prior notification and a reasonable and verifiable justification will result in zero point for that part.

3. Final project, 20%
   Students can choose whether or not to do the final project with attempting on fulfilling ECON 4670's paper/project requirement.
   If a student chooses no, then can submit it by individual or as a group with maximum three.
   If a student chooses yes for the 4670 option, then must submit it by individual.

Learning Goal

This course puts statistical theory and econometric method into practice by working with data and cases. Students are required to write their own program with R for summary statistics, data visualization, estimation, and hypothesis testing. The students are also trained to produce table and write report for empirical study. The main objective is to help students develop skills in working with data to support a better business decision or analysis.

**Warning:** This is an advanced level course and require significant amount of time and commitment. The learning curve of programming is very steep. Students are assumed to have reasonable knowledge of Econometrics, Calculus, Probability, Statistics, and Linear Algebra. TA and instructor are not responsible to help line-by-line debugging of student’s code.

Per Program Intended Learning Objective (PILO) for BSc in Economics and Finance, after completing this course, students will
1. Understand the logic, scientific basis, and critical thinking of economic analyses. Solve business problems using appropriate quantitative and analytical techniques. (PILO 1)
2. Analyze qualitatively and quantitatively basic economic and financial problems. Apply economic knowledge to practical situations and make sound economic and finance decisions. Have a solid foundation for postgraduate studies. (PILO 4)
3. Work with others effectively and responsibly. (PILO 5)
4. Graduates will be effective users of information technology in business applications. Demonstrate proficiency in using IT applications in business and management. Use econometric or statistical software to deal with databases and conduct empirical analysis. (PILO 7)
5. Be lifelong users of economic analysis and econometric or statistical software. (PILO 9)
Outline and Schedule

1. Introduction to R Programming (3 lectures, Feb. 7th, 14th, 21st)
   - Basic commands
   - Matrix algebra
   - Loop and function
   - Plot
   - Monte-Carlo simulation
   - Ordinary least square

   Readings: MB 1, 3.3; ZK 1, 2; Hansen 4, Appendix A, B; paper 1, 2

2. Data (1 lecture, Feb. 28th)
   - Importing/exporting data
   - Organizing and visualizing data
   - Reporting summary statistics in table

   Readings: MB 2

Problem Set 1

3. Linear Regression (2 lectures, Mar. 7th, 14th)
   - Hypothesis tests
   - Model specification and diagnostic
   - Reporting estimation results in table

   Readings: MB 4, 5, 6; ZK 3, 4; Hansen 9, 10

4. Causal Inference (2 lectures, Mar. 21st, 28th)
   - Endogeneity and Causality
   - Treatment effect
   - Instrumental variable
   - Difference-in-difference
   - Panel data

   Readings: AP 1, 2, 3, 4, 5; Hansen 11, 21; paper 3, 4, 5, 6, 7

Problem Set 2

Start final project during midterm break!
5. Limited dependent variable and maximum likelihood estimation (1 lecture, Apr. 11th)
   - Binary outcome: Logit and Probit
   - Maximum likelihood estimation (MLE)
   - Multinomial outcome
   - Generalized linear model

Readings: MB 8; ZK 5; Hansen 5, 20; Train 1-4

6. Discrete choice model and generalized method of moments (2 lectures, Apr. 18th)
   - Generalized method of moments (GMM)
   - Discrete choice model
   - BLP demand estimation

Readings: Train 13; Hansen 12; paper 8, 9, 10

**Problem Set 3**

**In-class Exam** (1 lectures, Apr. 25th, subject to adjustment)

7. Topics (1 lecture, May 2nd)
   - Standard error and bootstrap
   - Nonparametric estimation
   - Quantile regression

Readings: Hansen 14, 15

8. Big data (1 lecture, May 9th)
   - High-dimensional data and Lasso
   - Tree-based classification and regression

Readings: MB 6.5, 11

**Problem Set 4**

**Final project** is due in final exam period. (There is no final exam.)

**Other Information**

Learning Environment ([http://www.ust.hk/vpaaو/conduct/good_learning_experience.pps](http://www.ust.hk/vpaaو/conduct/good_learning_experience.pps))
Center for Language Education ([http://cle.ust.hk/](http://cle.ust.hk/))
Math Support Center ([https://www.math.ust.hk/~support/](https://www.math.ust.hk/~support/))