

# Econ 4274 Programing Econometrics with R

## Course Information

Instructor: Yangguang (Sunny) Huang

Email: [huangyg@ust.hk](mailto:huangyg@ust.hk)

Class time: Tue 3:00 – 5:50pm (LSK G021)

Office hour: Wed 13:30-15:30 or by appointment (LSK 6075)

Course website: <https://canvas.ust.hk/courses/11846/>

Teaching Assistant: Jeremy To

Email: [ecjeremy@ust.hk](mailto:ecjeremy@ust.hk)

Office hour: Thu 14:00-16:00, Fri 9:00-11:00, or by appointment (LSK 6066)

Required textbook:

*Data Analysis and Graphics Using R* (2010), 3rd Edition, by John Maindonald and John Braun. (MB)

Optional textbook:

*Applied Econometrics with R* (2008) by Achim Zeileis and Christian Kleiber. (ZK)

*Mostly Harmless Econometrics* (2008) by Joshua Angrist and Jorn-Steffen Pischke. (AP)

*Econometrics* (2015) by Bruce Hanse (Hansen) (<http://www.ssc.wisc.edu/~bhansen/econometrics/>)

## Grading

- Problem set 1, 2, and 3, each count 15%

Can be submitted by individual student or by a group with maximum three students. Submission will be through Canvas. Please submit both your answer (as word document or PDF) and your code.

- Midterm exam, 30%

Midterm will be hold during class time. You will have internet access but no communication is allowed. Absence in the midterm exam without prior notifications and reasonable and verifiable justifications will result in zero point.

- Problem set 4, 25%

Student can choose whether or not to do problem set 4 with attempting on fulfilling ECON 4670's paper/project requirement.

If a student chooses not, then can submit it by individual or as a group with maximum three students.

If a student chooses yes for the 4670 option, then must submit it by individual.

- There is no final exam.

## 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)

## Other Information

Academic Integrity and Honesty:

Please read the information on academic integrity carefully and follow the instruction:

<http://www.ust.hk/vpao/ug-guide/integrity/>. You should be familiar with Academic Honor Code and the content on Academic Integrity website.

Learning Environment:

Matured conduct in classroom is the requirement for this course. Distractive behaviors such as use of cell phone, instant messaging and chatting are not tolerated. Violation of this rule will result in significant deduction of points from student's grade. Please refer to following website for the guideline for good learning environment:

[http://www.ust.hk/vpao/conduct/good\\_learning\\_experience.pps](http://www.ust.hk/vpao/conduct/good_learning_experience.pps).

Center for Language Education:

If you have difficulty in English, please seek help at the Center for Language Education:

<http://cle.ust.hk/>

## Outline and Schedule

1. Introduction to R and Programming (2 lectures, Feb. 7<sup>th</sup>, 14<sup>th</sup>)
  - Basic commands
  - Loop and Function
  - Plot
  - Simulation

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

2. Data (1 lectures, Feb. 21<sup>st</sup>)
  - Importing/exporting data
  - Organizing and visualizing data
  - Summary statistics and reporting

Readings: MB 2

### **Problem Set 1**

3. Linear Regression (2 lectures, Feb. 28<sup>th</sup>, Mar. 7<sup>th</sup>)
  - Ordinary least square
  - Hypothesis tests
  - Model specification
  - Reporting estimation results
  - Quantile regression

Readings: MB 4, 5, 6; ZK 3, 4

4. Causal Inference (2 lectures, Mar. 14<sup>th</sup>, 21<sup>st</sup>)
  - Endogeneity and Causality
  - Treatment effect
  - Instrumental variable
  - Difference-in-difference
  - Panel data

Readings: AP 1, 2, 3, 4, 5; Hansen 10, 20

### **Problem Set 2**

**Midterm Exam** (1 lectures, Mar 28<sup>th</sup>, subject to adjustment)

**Start Problem Set 4 during midterm break**

5. Nonlinear Models (3 lectures, Apr. 11<sup>th</sup>, 25<sup>th</sup>, May 2<sup>nd</sup>)
  - Maximum likelihood estimation
  - Generalized method of moments
  - Binary choice, logistic regression, and generalized linear model
  - Standard error and bootstrap
  - Nonparametric estimation

Readings: MB 8; ZK 5, 7, Hansen 11, 12.1, 12.2, 13, 14, 19.1

6. Big data (1 lectures, May 9<sup>th</sup>)
  - High-dimensional data
  - Tree-based classification and regression
  - Lasso

Readings: MB 6.5, 11

### **Problem Set 3**

**Problem Set 4 (final project) is due at final exam period.**

Paper reading list:

- Guadagni, Peter M., and John DC Little. "A Logit Model of Brand Choice Calibrated on Scanner Data." *Marketing Science* 2.3 (1983): 203-238.
- Angrist, Joshua D., and Alan B. Keueger. "Does compulsory school attendance affect schooling and earnings?." *Quarterly Journal of Economics* 106.4 (1991): 979-1014.
- Mankiw, N. G., David Romer, and David Weil. "A Contribution to the Empirics of Economic Growth." *Quarterly Journal of Economics* 107.May (1992).
- Angrist, Joshua D. "Estimating the Labor Market Impact of Voluntary Military Service Using Social Security Data on Military Applicants." *Econometrica* 66.2 (1998): 249-288.
- Acemoglu, Daron, Simon Johnson, and James A. Robinson. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review* 91.5 (2001): 1369-1401.
- Petrin, Amil. "Quantifying the Benefits of New Products: The Case of the Minivan." *Journal of Political Economy* 110.4 (2002).
- Engelberg, Joseph, et al. "Human Capital and the Supply of Religion." *The Review of Economics and Statistics* 98.3 (2016): 415-427.