

# ECON4274 Programing Econometrics with R

Hong Kong University of Science and Technology  
Department of Economics

## Course Information

This course puts statistical theory and econometric methods into practice by working with data and cases. ECON3334 is the prerequisite. 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 tables and write report for empirical studies. The main objective is to help students develop skills in working with data to support a better business decision or analysis.

This is an advanced level course and requires a significant amount of time and commitment. The learning curve of programming can be 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.

Instructor: Yangguang (Sunny) HUANG

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

Lecture time: Tuesday Thursday 9:00-10:20 at LSK1033

**Please bring your laptop to all lectures and exams.**

Office hours: Tuesday Thursday 10:30-11:30.

- Face-to-face at LSK6075

- Zoom (2067854429, <https://hkust.zoom.us/j/2067854429>)

Teaching assistant: Jeremy TO

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

Tutorial time: Tuesday 18:00-18:50 at LTK

Office hours: TBD

Grading:

1. Five problem sets, each count 8%, total 40%  
Can be submitted by individual student or by group with maximum two members. (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. Two exams, each count 20%, total 40%  
Exams will be conducted during lecture time. Absence in an exam without a prior notification and a reasonable and verifiable justification will result in zero point.
3. Final project, 20%  
See details in the final project requirement.

The final course grade will be given by the University guideline (<http://qa.ust.hk/aos/distribution.html>).  
Student conduct and academic integrity (<http://acadreg.ust.hk/generalreg.html>).

## School Intended Learning Outcomes (SILO)

(<https://bmundergrad.hkust.edu.hk/academics/academic-programs/learning-outcomes>)

1. Understand the logic, scientific basis, and critical thinking of economic analyses. Solve business problems using appropriate quantitative and analytical techniques. (SILO 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. (SILO 4).
3. Collaborating effectively with your team members to answer questions in homework (SILO 3).
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. (SILO 1).
5. Be lifelong users of economic analysis and econometric or statistical software. (SILO 3).

## Course Materials

### Books:

1. *Econometrics* (2019) by Bruce Hanse (Hansen)  
(<http://www.ssc.wisc.edu/~bhansen/econometrics/>)
2. *Mostly Harmless Econometrics* (2008) by Joshua Angrist and Jorn-Steffen Pischke (Harmless)
3. *Discrete Choice Methods with Simulation* (2003) by Kenneth Train (Train)  
(<https://eml.berkeley.edu/books/choice2.html>)
4. *Data Analysis and Graphics Using R* (2010), by John Maindonald and John Braun.  
(<http://maths-people.anu.edu.au/~johnm/r-book/daagur3.html>)
5. *Applied Econometrics with R* (2008) by Achim Zeileis and Christian Kleiber.

### Papers:

1. David, H., Alan Manning, and Christopher L. Smith. "The Contribution of the Minimum Wage to US Wage Inequality Over Three Decades: a Reassessment." *American Economic Journal: Applied Economics* (2016).
2. Card, David, and Alan B. Krueger. "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania." *American Economic Review* (1994).
3. Angrist, Joshua D., and Alan B. Krueger. "Does Compulsory School Attendance Affect Schooling and Earnings?" *Quarterly Journal of Economics* (1991).
4. Acemoglu, Daron, Simon Johnson, and James A. Robinson. "The Colonial Origins of Comparative Development: An Empirical Investigation." *American Economic Review* (2001).
5. Islam, Nazrul. "Growth Empirics: A Panel Data Approach." *Quarterly Journal of Economics* (1995).
6. Acemoglu, Daron, et al. "Democracy Does Cause Growth." *Journal of Political Economy* (2019).
7. Jaffee, Adam B. "Building Program Evaluation into the Design of Public Research Support Programs." *Oxford Review of Economic Policy* 18 (2002).
8. Wallsten, Scott J. "The Effects of Government-industry R&D Programs on Private R&D: the Case of the Small Business Innovation Research program." *RAND Journal of Economics* (2000).
9. Chemmanur, Thomas J., Elena Loutskina, and Xuan Tian. "Corporate Venture Capital, Value Creation, and Innovation." *Review of Financial Studies* (2014): 2434-2473.
10. \*Howell, Sabrina T. "Financing Innovation: Evidence from R&D Grants." *American Economic Review* (2017)

11. \*Branstetter, Lee G., and Mariko Sakakibara. "When do Research Consortia Work Well and Why? Evidence from Japanese Panel Data." *American Economic Review* 92.1 (2002).
12. Shum, Matthew. "Estimating Demand in Discrete-Choice Differentiated Product Markets". (<http://people.hss.caltech.edu/~mshum/gradio/china1.pdf>)

## Outline and Schedule

### **Module 1. R Programming bootcamp** (4 lectures)

- Basic commands
- Matrix algebra
- Function
- Loop
- Plot
- Solving mathematical problem by numerical method

Readings: Hansen Appendix A

### **Module 2. Estimation and statistical properties** (4 lectures)

- Ordinary least square (OLS)
- Monte-Carlo simulation
- Statistical properties (unbiasedness, consistency, standard error, hypothesis test...)
- Bootstrap
- Maximum likelihood estimation (MLE)

Readings: Hansen 3, 4

### **Exam 1** (1 lectures)

### **Module 3. Linear regression in practice** (5 lectures)

- Importing and exporting data
- Organizing and visualizing data
- Summary statistic table
- Linear regression
- Understanding and reporting estimation results
- Model specification

Readings: Hansen 5, 7

**Module 4. Causal inference** (5 lectures)

- Endogeneity and causality
- Treatment effect
- Difference-in-difference (DID)
- Instrumental variable (IV)
- Panel data
- \*Regression discontinuity
- \*Propensity score matching

Readings: Harmless 1, 2, 3, 4, 5; Hansen 12, 16

**Exam 2** (1 lectures)

**Module 5. Selected Topics** (3 lecture)

- Limited dependent variable
- Discrete choice and multinomial logit
- Nonparametric estimation
- Writing empirical papers

Readings: Train 1, 2, 3, 4, 13; Hansen 18

**Final project is due at the end of the final exam period.**