Econometrics (ECON 5300, Spring 2024)

Department of Economics, HKUST

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Lecture schedule and location: Monday & Wednesday 15:00 - 16:50. (LSK Rm 1027)

Course Description:

This course will introduce students to econometrics with rigorous mathematical treatment. It will help students to understand advanced econometric techniques and to conduct state-of-the-art empirical studies. A unified approach will be provided for analyzing linear regression models, simultaneous equation models, panel data models, and time series models.

Prerequisites:

Introductory econometrics, linear algebra, calculus, probability and statistics, or consent of instructor.

Course Web Site: http://canvas.ust.hk

The course content is based on my lecture notes. All teaching materials and problem sets will be posted on Canvas. You should check the course website at least **twice a week** for important announcement such as the homework information.

Computer Software

This course requires computer-based calculation. Students are required to write codes to conduct statistical inference using real data and to conduct Monte Carlo simulations. The teaching will be based on Matlab/Stata/R.

Course Requirements:

Homework (40%):   The course is topic-based. Homework will be assigned for every topic. Students are encouraged to form small study groups. However, each student has to submit his/her own solution in their own writing. Do not copy other people's work, even if they come from your study group. Students must submit their solutions through Canvas. The due dates will be specified in each assignment. **Email or mail submissions will not be accepted.** Late submission including uploading failure will not be accepted without justification. If the submission occurs after the answer is posted, it will receive zero point.

Final exam (60%):   Time and format to be announced.

Class Attendance:

We will not take record of attendance but you are strongly encouraged to attend every lecture.

Exam Policy:

The exam is closed-book. I will provide some formula sheets. There is zero tolerance of cheating. The case of cheating will be reported to the school. We will check your **school ID cards** during exams.

Re-grading Policy:

Contact your TA regarding any grading issue within <u>one week</u> from the time the grade is released.

Academic Integrity and Honesty:

Students are required to comply with the university policy on academic integrity as detailed at

https://registry.hkust.edu.hk/resource-library/academic-integrity

The case of **plagiarism** and **copying** will be reported to the school.

Course Intended Learning Outcomes: Upon completion of the course, you will be able to:

1. Weight the significance of key assumptions used in different econometric models, and explain the relationship between those assumptions and properties of estimators.

2. Design an identification strategy.

3. Derive statistical properties of an estimator.

4. Use Matlab to conduct Monte Carlo simulations to analyze properties of estimators.

5. Construct an appropriate econometric model and use Matlab/Stata/R to analyze a given economic dataset, and then conduct statistical inference and interpret the results.

Reference Textbooks:

Hayashi, Fumio (2000): "Econometrics." Princeton University Press

Greene, William: "Econometric Analysis." Prentice Hall, any edition.

Wooldridge, Jeffrey M.: "Econometric Analysis of Cross Section and Panel Data," The MIT Press. (The 1st edition is downloadable from HKUST library)

Hamilton, J. D. (1994): "Time Series Analysis." Princeton University Press.

Hansen, Bruce. (2022): "Econometrics." Princeton University Press.

Course Outline:

- Regression with control variables
  - Potential outcomes
  - Assumptions that help to map regression to causality: omitted variable bias
  - OLS and the inference
  - About standard errors
- Instrumental variables
  - Two-stage least squares (2SLS)
  - Generalized method of moments (GMM): over-identification test
  - Application to quasi-experiments/natural experiments
  - Local average treatment effects (LATE)
  - Weak IV
- Difference-in-differences
  - The parallel trend assumption
- Regression discontinuity design
  - The quasi- or natural experiment
- Synthetic control
  - Extensions to the idea of difference-in-differences
- Panel data methods
  - Fixed effects
  - Dynamic panel: system and difference GMM
- Limited dependent variable models
  - Linear probability model
  - Maximum likelihood: Probit, Logit, Tobit.
- Vector-autoregression models
  - Impulse responses and dynamic causal analysis
- State space models and Kalman filter
- Regime-switching models
- High-dimensional factor models
  - Principal component analysis
  - Factor augmented VAR
  - High dimensional covariance estimation
  - Panel regression with interactive fixed effects