

Advanced Econometrics I

Module 2, 2025

Course Information

Instructor: Jizhou Liu

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Office Hour: TBD

Teaching Assistant:

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Classes:

Lectures: Mon & Thur 8:30-10:20

Venue: PHBS Building, Room TBD

Course Website:

If any.

1. Course Description

1.1 Context

Course overview:

This course is designed for advanced Master's students, focusing on cross-sectional techniques and the foundational methods of modern econometrics, such as least squares estimation, the maximum likelihood method and regression discontinuity design.

Prerequisites:

Students are expected to have a solid undergraduate-level understanding of calculus, matrix algebra, and probability theory.

1.2 Textbooks and Reading Materials

Main Textbook:

Russell Davidson and James G. MacKinnon (2004). *Econometric Theory and Methods*. New York: Oxford University Press.

This advanced Master's-/graduate-level text encourages readers to think beyond the standard theorem-proof approach, with an emphasis on the geometric intuition behind algebraic results. While the course will not strictly follow the textbook, it is a valuable reference throughout.

Thanks to an agreement with Oxford University Press, this book is **freely available for download** as a PDF:

[Davidson and MacKinnon -- Econometric Theory and Methods](#). Read or download: [Econometric Theory and Methods](#).

The website also includes:

- Data sets for textbook exercises
- Corrections from various printings
- Solutions to selected (starred) exercises

Students are encouraged to explore online resources provided by the publisher. Additional handouts will be distributed as needed to supplement the textbook. Students are expected to review them regularly.

2. Learning Outcomes

2.1 Intended Learning Outcomes

Learning Goals	Objectives	Assessment (YES with details or NO)
1. Our graduates will be effective communicators.	1.1. Our students will produce quality business and research-oriented documents.	Yes
	1.2. Students are able to professionally present their ideas and also logically explain and defend their argument.	Yes
2. Our graduates will be skilled in team work and leadership.	2.1. Students will be able to lead and participate in group for projects, discussion, and presentation.	Yes
	2.2. Students will be able to apply leadership theories and related skills.	Yes
3. Our graduates will be trained in ethics.	3.1. In a case setting, students will use appropriate techniques to analyze business problems and identify the ethical aspects, provide a solution and defend it.	Yes
	3.2. Our students will practice ethics in the duration of the program.	Yes
4. Our graduates will have a global perspective.	4.1. Students will have an international exposure.	Yes
5. Our graduates will be skilled in problem-solving and critical thinking.	5.1. Our students will have a good understanding of fundamental theories in their fields.	Yes
	5.2. Our students will be prepared to face problems in various business settings and find solutions.	Yes
	5.3. Our students will demonstrate competency in critical thinking.	Yes

2.2 Course specific objectives

1. To help applied economic researchers understand commonly used econometric techniques in academic journals
2. To help Master's students build a strong technical foundation for applying to PhD programs
3. To provide knowledge of econometric methods for analyzing economic data
4. To offer hands-on experience with data analysis using statistical software

2.3 Assessment/Grading Details

Assessment Methods	Brief Description (Optional)	Weight
A1. In-class & forum participation	Attendance & discussions	10%
A2. Assignments	Effort and accuracy	10%
A3. Midterm exam	Effort and accuracy	40%
A4. Final exam	Effort and accuracy	40%
	Total	100%

2.4 Academic Honesty and Plagiarism

It is important for a student's effort and credit to be recognized through class assessment. Credits earned for a student work due to efforts done by others are clearly unfair. Deliberate dishonesty is considered academic misconducts, which include plagiarism; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; or altering, forging, or misusing a University academic record; or fabricating or falsifying of data, research procedures, or data analysis.

All assessments are subject to academic misconduct check. Misconduct check may include reproducing the assessment, providing a copy to another member of faculty, and/or communicate a copy of this assignment to the PHBS Discipline Committee. A suspected plagiarized document/assignment submitted to a plagiarism checking service may be kept in its database for future reference purpose.

Where violation is suspected, penalties will be implemented. The penalties for academic misconduct may include: deduction of honour points, a mark of zero on the assessment, a fail grade for the whole course, and reference of the matter to the Peking University Registrar.

AI tools requirements:

Using AI tools to complete assignments or assessments without the approval of the course instructor will be regarded as an act of academic dishonesty. Depending on the severity of the situation, penalties will be implemented in accordance with the provisions of the Peking University Graduate Student Handbook.

For more information of plagiarism, please refer to *PHBS Student Handbook*.

3. Topics, Teaching and Assessment Schedule

Week 1: Introduction (DM Chapter 1)

- Introduction to the course and the subject of econometrics
- Review of basic linear algebra, matrices, and multivariate statistics
- Motivation for Ordinary Least Squares (OLS)

Week 2: The Geometry of Linear Regression (DM Chapter 2)

- Identification and omitted variable bias
- Estimation and geometric interpretation
- The Frisch-Waugh-Lovell Theorem

Week 3: Statistical Properties of Ordinary Least Squares (DM Chapter 3)

- Finite-sample properties and the Gauss–Markov Theorem
- Measures of goodness of fit
- Convergence concepts and Asymptotic Theory

Week 4: Hypothesis Testing in Linear Regression Models (DM Chapter 4)

- Inference and large-sample tests
- Multiple hypothesis testing
- Dummy variables and model selection

Week 5: Instrumental Variables Estimation (DM Chapter 8)

- Causes of endogeneity
- IV and Two-Stage Least Squares (2SLS) estimation
- Tests with instrumental variables
- Weak instruments and overidentification

Week 6: Endogeneity and Instrumental Variables (continued)

Week 7: Nonlinear Models and General Estimation Frameworks (DM Chapters 6, 9, 10)

- Method of Moments estimators
- Nonlinear models: nonlinear regression, Maximum Likelihood Estimation (MLE)
- Testing using the Likelihood Ratio, Wald, and Lagrange Multiplier tests (the "trinity")

Week 8: Discrete Choice and Limited Dependent Variable Models (DM Chapter 11)

- Binary choice models: Probit and Logit
- Multinomial choice models
- Ordered and count data models
- Censoring, truncation, and Tobit models
- Sample selection models

Week 9: Regression Discontinuity Design

4. Miscellaneous

TBD