Econ 4284 Econometrics for Cross-Section and Panel Data (4 Credits)

Department of Economics, HKUST

Fall 2021

All the content provided in this syllabus is subject to further updates depending on the pandemic situation in Hong Kong and the development of social distancing policy of the Hong Kong government.

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Office Hours: Wed 11 am-noon (or by appointment)
Class Hour and Venue: Tue & Thu 09:00 am-10:20 am, Rm 5583, Lift 29-30
TA: TBA
Tutorials: Tue 03:00 pm-03:50 pm, Rm 1007, LSK

Course Description

This course provides students with advanced econometric tools for analyzing cross-sectional and panel data. These tools are widely used in academia, business, finance, policy-making and other related fields. The course focuses on econometric causal inference. It begins with a review of linear regression. Then the course covers the potential outcome framework, randomized controlled trial, random forest, instrumental variable method, regression continuity design, fixed effects, difference-in-difference, and limited dependent variables. R will be used for computer-based calculations.

Course Intended Learning Outcomes (Course ILO)

On completion of the course, you will be able to:

1. Understand popular methods in econometrics to conduct causal inference.
2. Apply basic asymptotic theory to analyze and evaluate different econometric method.
3. Use appropriate methods to conduct empirical analysis.
4. Use software to analyze a given economic data and interpret the results.

Prerequisites

Introduction to Econometrics (Econ 3334).

Course Materials

- **Textbook**. Stock, James and Mark Watson. *Introduction to Econometrics* (4th edition), Pearson. We will also use materials from the companion website: https://media.pearsoncmg.com/intl/ge/2019/cws/ge_stock_econometrics_4/.
  - I reserved a few copies in the library. Ebook is also available from the library's website, although it only allows four concurrent users to access.
  - Some problem sets are from the required textbook. You may use its previous editions, **but you are responsible to make sure that your solutions are based on the 4th edition**.
- **Recommended**. Angrist, Joshua and Jörn-Steffen Pischke. *Mostly Harmless Econometrics: An Empiricist's Companion* (any edition), Princeton.
  - This book provides a large number of empirical examples for several methods we cover in class.
- **Slides, problem sets, and other materials**. All these course related materials will be posted on **Canvas** (http://canvas.ust.hk). You should check Canvas at least twice per week for announcements and postings.

Computer Packages

- R will be used to apply the econometric tools to data. R is both a programming language and a software environment for statistical computing, which is free and open-source. To get started, you will need to install two pieces of software:
  1. R: https://www.r-project.org/.
  2. RStudio: https://rstudio.com/. You have to install R first. RStudio is only an interface making it easier for you to interact with R.
- You may use other software/packages (Stata, MATLAB, Python, Julia, etc.) for psetting. But they will not be taught in class.

Teaching and Learning Activities

Lectures

- Following the current university's guidelines, the default teaching mode is **in-person on campus**. If every enrolled students are physically in Hong Kong, no live Zoom session will be offered for remote attendance. If at least one student does not physically stay in Hong Kong after the add-drop period because of travel restrictions, live Zoom sessions will

be offered in **mixed-mode lite**, which features limited interactions with students attending online. The teaching mode is subject to change if the University changes its policies during the semester.

- Please make sure to attend all lectures. Not all the topics in the textbook will be covered, and the ones I cover in the lectures will be the focuses of the exams. I will post slides before the lectures on Canvas.

Tutorials

Tutorial sessions are NOT weekly. The TA will make an announcement via Canvas before each session. No tutorial sessions in the first week.

Assessment

Problem Sets (15%)

- There will be three problem sets during the semester. Each problem set shares a weight of 5% towards the final grade. The problem sets will involve both theoretical and empirical work. You may discuss the questions and work in groups, **but you must submit your own solutions**.
- The problem sets will be posted in Canvas. You have to submit your solutions through **Canvas** by the due date and time. **Submissions by emails or to the department mailboxes will NOT be accepted. Only PDF/JPG/JPEG/HEIC files will be allowed.**

Midterm (35%)

- **Date and time (tentative): Oct. 21 (Thu), in class.**

Final (50%)

- Date and time: TBA.
- The final will be cumulative, covering all the course materials including those covered by the midterm.

Econ 4670 (0%)

- This course **does not** require a research paper, so it cannot automatically help you pass Econ 4670. However, interested students may choose a course-related topic and write a research paper under the instructor's supervision to fulfill the requirement of Econ 4670 (see http://www.bm.ust.hk/econ/programs-n-courses/ug-programs/econ4670 for details). The deadline for this submission will be in mid-January 2022. Students who wish to pursue this option should inform the instructor *no later than Friday Oct. 15*. Further details will be provided to interested students after this date.

Policies on Exams and Problem Set Submission

- Proctored midterm and final exams will be held **on campus** for all students, except those who cannot be in Hong Kong. For those students, we will have a simulaneous online exam with Zoom proctoring with the same set of questions. More details will be announced before the exams.
- There will be no make-up exam for the midterm. If you miss the midterm, you will receive a zero. The only exception is a verifiable medical reason, in which case the weight of the midterm will be moved to the final exam. If you miss the final, you will receive an "F" (fail) for the course. The only exception is that you apply for a make-up exam and get approved by the University (https://arr.ust.hk/reg/em/em_std_reg/reg_makeup.html). Only in that case a make-up final would be arranged.
- There is zero tolerance of cheating. If you are caught cheating, you will receive a zero for the course. The case will be reported to both the department and the school levels.
- Late submission of the problem sets, including uploading failure due to using a different file format other than instructed, will not be accepted unless you have a verifiable medical reason.
- Re-grading must be completed within **one week** from the time the grade of a problem set or an exam is released. Please contact the TA regarding re-grading.

Academic Integrity and Honesty

Students are required to comply with the university policy on academic integrity found http://ugadmin.ust.hk/integrity/student-1.html

Tentative Schedule

The schedule is tentative and subject to change as the semester progresses.

Module 1. Introduction

- Classes: Sept. 2 (Thu).

Module 2. Review of Linear Regression

- Classes: Sept. 7 (Tue), Sept. 9 (Thu), Sept. 14 (Tue).

Module 3. Basics about Causal Inference

- Classes: Sept. 16 (Thu).

Module 4. RCT and Machine Learning

- Classes: Sept. 21 (Tue), Sept. 23 (Thu), Sept. 28 (Tue).

Module 5. Instrumental Variable

- Classes: Sept. 30 (Thu), Oct. 5 (Tue), Oct. 7 (Thu), Oct. 12 (Tue).

Midterm Review

- Class: Oct. 19 (Tue).

Midterm Exam

- **Oct. 21 (Thu), in class.**
- Covers Modules 1-5.

Module 6. Regression Discontinuity Design

- Classes: Oct. 26 (Tue), Oct. 28 (Thu), Nov. 2 (Tue).

Module 7. Panel Data

- Classes: Nov. 4 (Thu), Nov. 9 (Tue), Nov. 11 (Thu).

Module 8. Difference-in-Difference

- Classes: Nov. 16 (Tue).

Module 9. Limited Dependent Variable and MLE

- Classes: Nov. 18 (Thu), Nov. 23 (Tue), Nov. 25 (Thu).

Final Review

- Class: Nov. 30 (Tue).