

# **ECON 4320: Advanced Econometric Techniques and Applications**

**Spring 2025**

**Professor Hanna Wang**

**Lectures:** 1:45-3:14 Mondays and Wednesdays in PCPSE 200

**Office Hours:** H. Wang: 1.15-2.15pm Tuesdays (or by appt.) in office 615 in PCPSE.

Keunsang Song (TA): 9.30 to 11.30am Fridays in PCPSE 500.

## **Prerequisites**

ECON 1, 2, 101, 102, 103, ECON 104 Math 104 and Math 114 (Calculus). Additional coursework in linear algebra and statistics is also very helpful for this course.

If you are missing some of the prerequisites but think you may have taken other classes that prepared you for this class, then please talk to me about it.

## **Course Description**

This course introduces undergraduate students to advanced topics in econometrics, with an emphasis on modeling and estimation methods used in microeconomic applications. The course begins with some review of material from the first econometrics course using matrix algebra notation, including the OLS model with and without heteroskedasticity, errors in variables, and instrumental variables.

We then cover methods for handling discrete variables (binary logit, binary probit, multinomial logit) and limited dependent variables, including maximum likelihood estimators. We will also learn various techniques for program evaluation such as matching, difference-in-difference and regression discontinuity. Along with the methods, we will consider many policy-relevant applications, including modeling behaviors such as the decision to go to college, to get married, or to work, marketing applications where we predict the demand for goods based on their characteristics, and some applications in evaluating the effects of treatments and social programs.

As part of the course, students will also be required to write programs in the language R. This programming language is widely used to analyze data (in academic and nonacademic settings). R can be obtained for free from the web site <http://www.r-project.org/>.

Students will be required to write R programs for the purpose of implementing the econometric methods discussed in class and analyzing some datasets. This course satisfies the university's quantitative data analysis requirement.

If you have a strong preference for using another programming language, such as python or Matlab, contact me to see if this can be accommodated. However, SAS and Stata and SPSS do not have enough programming features to be able to do all the problem sets.

## **Readings**

The main text for the course are Prof. Todd's course notes available on Canvas. A reference book in econometrics that is helpful for the course is *Econometric Analysis* by William Greene. However, we will not closely follow any text and the purchase of a textbook is not required. Exams will be based almost entirely on material covered in class, so regular class attendance is critical for success. I may occasionally take attendance and class attendance will be taken into account if a final grade is borderline.

## **Grading**

Four problem sets: 28%

Two midterms: 40%

Final exam: 32%

Problem sets will be worth 100 points each. Group work on problem sets is permitted, although each student needs to hand in a separate assignment. The assignments should be given to your TA by email for grading. There will be a 10 point penalty for problem sets that are turned in up to a week late. Work is not accepted if more than a week late.

## **Key Dates**

Midterm #1: February 24 (Wed)

Spring break: March 10-14

Midterm #2: April 7 (Monday)

Last day of Classes: April 30 (Wednesday)

Final Exam: Will be held on the date assigned by the university, but it has not been announced yet.

Due dates for problem sets will be announced in class.

## **Other information**

I strive to make the course accessible to students from diverse backgrounds, including FIGLI students, LBGTQ students, and students from different racial/ethnic backgrounds. All students who are interested in economics and in learning econometrics should feel very welcome in this class. If you experience any issues in attending this class that make you feel uncomfortable, please tell me.

We will use Canvas for class discussion. The system is designed to let you get help fast and efficiently from classmates, the TA, and myself. I encourage you to post your questions on Canvas and to interact there with other students in the class.

## ***Economics Department Course policies***

***Academic integrity.*** It is your responsibility to be familiar with the University's Code of Academic Integrity, and to abide by its rules. You can find the Economics Department's policy on academic integrity on the department's website:

Academic integrity is a very important part of student life, and the Department of Economics takes it seriously [ . . . ] Students who are suspected of committing infractions will be reported to the Office of Student Conduct [ . . . ] The Department reserves the right to undertake procedures that would catch breaches of academic integrity, should any arise.

***Exam attendance policy.*** The Economics Department's policy on exam attendance applies. You can find it at: <https://economics.sas.upenn.edu/undergraduate/course-information/course-policies>

Attendance at midterm or final exams is mandatory, there are only a few valid excuses for missing an exam. They are:

- Three exams scheduled within one calendar day (for final exams ONLY!) This policy of three exams does not count for midterm exams given during class time.
- An exam is given outside of the regular class schedule and the timing conflicts with another class in which the student is enrolled.
- Observance of a university-recognized religious holiday.
- UPENN Business that takes you away from campus. This includes, for example, athletic events in which you are actively participating. In such cases, you need to make arrangements with me ahead of the exam date to take the exam at another time (preferably earlier than the schedule date).
- An illness/health emergency.
- A death in your family.
- Documented disabilities that allow you to take the exam under other circumstances.

Examples of reasons that are not valid for missing an exam are:

- Job internships/ interviews
- Beginning fall or spring break early or returning after a scheduled exam
- End of semester early flights
- Take home exams
- Any other reason you would prefer not to be at the university when the exam is scheduled. Students are responsible for making sure, at the beginning of the term, that they can attend the exams. Registering for a course means that you certify that you will be present for the exam (unless one of the explicitly stated exceptions above arises.) Students who arrive late to an exam will generally be required to hand in their exam at the same time as other students.

***Regrade of exams and problem sets*** may be requested, if you find a clear and compelling error in the way your exam was graded. The procedure for requesting a regrade is to submit a one-page typed petition detailing the supposed grading error. No regrade request will be accepted for exams that are written in pencil and/or look altered. In addition, note the following economics department's policies on grading requests: Errors in grading arising from illegible or garbled answers are not subject to correction. [Your answers must be legible. Answers that I and/or the grader cannot read or understand, regardless whether it is due to poor hand-writing, grammar or anything else, will be deemed wrong.] Students should not approach either the instructor or the TA with an oral request before making their written request. Requests should be focused on the specific

error and should be made within a week of the work being returned. The entire graded work (problem set or examination) should be resubmitted; there is no guarantee that grades will rise as, statistically, positive and negative errors in grading are equally likely. If the request arises because you think different students have been graded differently, all the affected students should submit their work as a group (and may all be regraded).

***Sharing class material.*** Course documents—including problem sets, practice exams, exams, and their respective solutions—are to be used exclusively by students enrolled in this course, and are not to be shared with people outside of this class. Regardless of whether documents are physically distributed in class or posted on the course site, any re-posting online (including on any course material sharing website) is prohibited.