

## **Econometrics: A Mathematical Approach**

Syllabus: Version 1 (August 29, 2018)

Instructor:	Mikkel Plagborg-Møller mikkelpm@princeton.edu
Lectures:	Mon/Wed 1.30–2.50pm Julis Romo Rabinowitz Building (JRRB) A17
Office hours	Mon/Wed 3.00–4.00pm, JRRB 282 Please book appointment slots on WASE: <a href="http://wase.princeton.edu">http://wase.princeton.edu</a>
Precepts (tentative):	Wed 3.30–4.20pm, JRRB A87 Wed 7.30–8.20pm, JRRB A87 Thu 10.00–10.50am, JRRB 198
Assistants-in-Instruction:	Charis Katsiardis and Christian Wolf
Undergrad Course Assistants:	Bulut Cakmak and Gabriel Swagel
Web page:	<a href="http://blackboard.princeton.edu">http://blackboard.princeton.edu</a>

**Description.** This course is an introduction to econometrics. Econometrics is a sub-discipline of statistics that provides methods for inferring economic structure from data. This course has two goals. The first goal is to give you means to evaluate an econometric analysis critically and logically. Second, you should be able to analyze a data set methodically and comprehensively using the tools of econometrics.

**Prerequisites.** ECO 100, ECO 101, ECO 202 (or ORF 245), MAT 175 + elementary matrix algebra such as matrix addition, subtraction, multiplication and inversion. MAT 201 and 202 recommended, but not required.

## **Readings.**

Required texts:

- Stock and Watson, *Introduction to Econometrics*. Pearson; 3rd edition updated. We will cover most of the first 14 chapters, as well as chapters 17 and 18. If time permits, we will also cover parts of chapters 15 and 16.

Lecture slides will be posted on the course website before each lecture. You are strongly encouraged to read along in the Stock & Watson textbook as well. It is especially useful to read the empirical examples in the book.

## **Requirements/grading.**

Final exam: 50%.

- There will be a three-hour closed-book final exam (to be scheduled by the Office of the Registrar).

In-class tests: 25%.

- There will be two in-class tests, each 75 minutes and closed-book. They are tentatively scheduled for October 17 and December 5. The average score on these tests will count toward 25% of your final grade. The in-class tests are required. If you miss any of these tests, then the final will be reweighted appropriately, provided that this is endorsed by the relevant dean.

Problem sets: 25%.

- There will be a number of problem sets (approximately one per week, except in weeks with an in-class test), which will count toward 25% of your final grade. You may work with other students on the problem sets, but the answers you submit must represent your own understanding of the solutions. Direct copying is not permitted and will be treated as cheating. We will only accept late submission of problem sets due to (i) a documented illness or (ii) a major event that cannot be rescheduled and that you let us know about well before the deadline. However, we will ignore the two lowest problem set grades.

We reserve the right to subtract points for sloppy exposition, including unreadable code or poor document structure. If you find a grading error, please resubmit your problem set or test along with a one-paragraph explanation. Re-grading will be done by the Instructor or Assistant-in-Instruction. We reserve the right to re-grade the entire problem set.

**Computer work.** Computer work is an integral part of econometrics, and the problems that will be assigned assume general computer literacy. Lectures, precepts, and problem sets will emphasize use of the software package Stata, but you may use other equivalent software packages for problem sets if you wish.

### **Timing of events.**

- Problem sets will generally be posted Wednesdays and will be due in class the following Wednesday. Graded problem sets will be returned in precept.
- Precepts will start the first week. The first precept will be used to introduce Stata and review basic matrix algebra.
- The in-class tests are tentatively scheduled for October 17 and December 5.
- The final exam will be scheduled by the Office of the Registrar.

**Code of conduct.** All course activities, including class meetings and homework assignments, are subject to the university’s academic code and code of conduct as detailed in the “Rights, Rules, Responsibilities” publication.

**Accommodations for students with disabilities.** Students must register with the Office of Disability Services (ODS) ([ods@princeton.edu](mailto:ods@princeton.edu); 258-8840) for disability verification and determination of eligibility for reasonable academic accommodations. Requests for academic accommodations for this course need to be made at the beginning of the semester, or as soon as possible for newly approved students, and again at least two weeks in advance of any needed accommodations in order to make arrangements to implement the accommodations. Please make an appointment to meet with the instructor in order to maintain confidentiality in addressing your needs. No accommodations will be given without authorization from ODS, or without advance notice.

**Course outline.** The following outline is preliminary and may change without warning.

1. What is econometrics and why is it useful? (Stock and Watson, chapter 1).
2. Linear regression.
  - i) Regression with one regressor (Stock and Watson, chapters 4–5 and 17).
  - ii) General case (Stock and Watson, chapters 6–8 and 18.1–18.6).
  - iii) Assessing studies based on regression (chapter 9).
3. Panel data (Stock and Watson, chapter 10).
4. Binary choice (Stock and Watson, chapter 11).
5. Instrumental variables (Stock and Watson, chapters 12 and 18.7).
6. Experiments and quasi-experiments (Stock and Watson, chapter 13).
7. Introduction to time series (Stock and Watson, chapter 14, and possibly chapters 15–16 if time permits).

We will review probability and statistics (Stock and Watson, chapters 2–3) as needed along the way. The relevant topics include:

- Random variables, probability distributions, and densities. Expectations. Multivariate distributions, conditional distributions, and independence. Special distributions: Bernoulli, normal, chi-squared, F, and T.
- Large sample theory.
- Estimators and their properties. Confidence intervals and hypothesis testing.