Syllabus

Ec141 - Econometric Analysis, Spring 2019

Course Description

This course provides a (sophisticated) introduction to identification, estimation and inference methods commonly used in economics. Both underlying theory and practical application will be emphasized. In addition to linear regression analysis, the method of instrumental variables and basic methods of panel data analysis will be introduced.

Instructor: Bryan Graham, 665 Evans Hall, email: `bgraham@econ.berkeley.edu`

Time and Location: Tuesday and Thursday, 11:00AM to 12:30PM, Wurster 102

Office Hours: Thursdays 2 to 3:40PM (sign up online here).

Graduate Student Instructor: Seongjoo Min, e-mail: sjmin711@berkeley.edu

Prerequisites: Economics 100A-100B or 101A-101B or equivalent; Statistics 20, 21, 25, or 131A, or equivalent; and Mathematics 53 and 54, or equivalent. Linear/matrix algebra will be used freely in this course..

Course Webpage: This syllabus, and other instructional materials, can be found (or will be made available) on GitHub in the following repository

https://github.com/bryangraham/Ec_141

The GSI may make additional resources available on bCourses.

Textbook: There is no mandatory text. Material will be delivered primarily through lecture and assigned papers. *Good note taking is essential for successful performance in the class.* There are several books, entirely optional, which you may find as useful supplements to your course notes.

1. Goldberger, Arthur S. (1991). *A Course in Econometrics*. Cambridge, MA: Harvard University Press.

2. Wooldridge, Jeffrey M. (2016). *Introductory Econometrics: A Modern Approach.* Boston: Cengage Learning.

3. Stock, James H. and Watson, Mark W. (2015). *Introduction to Econometrics.* Boston: Pearson.

None of these books is required. The Goldberger (1991) text is now rather dated, but students have found the first thirteen chapters useful in the past. The Wooldridge (2016) and Stock & Watson (2015) books are standard undergraduate textbooks in econometrics and both have good coverage of the topics we will study this semester; however I will not "lecture" form either of these books. These are expensive books to purchase new. If you do elect to buy a book I suggest seeking out used and/or older editions.

Additional books which you may find helpful include Wasserman (2004) and Mitzenmacher & Upfal (2005). These are somewhat more technical.

Virtual Meetings: There will be no physical class meetings on February 5th and 7th. Lecture will instead be delivered online using the Zoom video-conferencing software. This will occur during the scheduled class meeting time. I will attempt to record the virtual lecture so that students can watch it at other times as well. Information on how to join the virtual class will be provided later.

Grading: Grades for for the class will equal a weighted average of homework (40%), midterm performance (50%) and scribing work (10%). There will be two in class midterm examinations; the first will be on March 7th, 2019 and the second on May 2nd, 2019. Each midterm exam is graded on a scale from 0 to 100. I will only retain your highest midterm grade. Students that take both midterms (and get comparable/serious grades on both) will receive an additional bonus to their midterm grade component of 10 points. Consequently the highest available midterm aggregate is 110.

There will be 5 homework assignments. Homeworks are due at 5PM on the assigned due date (the GSI may elect to make small modifications to all things homework related). Homeworks are graded on a ten point scale with one point off per day late. You are free, indeed encouraged, to work in groups but each student must submit an individual write-up and accompanying Jupyter Notebook (when required; see below). Your lowest homework grade will be dropped, with the average of the remaining scores counting toward your final grade. There will be no 'make-up' midterms. I will add 5 points to homework aggregates for students who make serious efforts to complete all five problem sets (concretely this means that students may amass up to 45 homework points). The due dates for the five problem sets are:

Problem Set	**Due Date**
1	February 5th
2	February 26th
3	March 19th
4	April 9th
5	May 7th

Since there is no assigned textbook for the class, good note-taking is essential. To help everyone in this area each lecture will be assigned a few scribes. Scribes will take detailed notes during lecture and then type up their notes (in LaTex), making minor corrections and adding supplemental details/material as they feel needed (e.g., from the course readings). These typed notes will be made available to everyone in the class (likely via bCourses). This will be a group assignment and graded on a scale of 1 to 10.

Computation: All computational work should be completed in Python. Python is a widely used general purpose programming language with good functionality for scientific computing. There are lots of ways of accessing Python. We will use https://datahub.berkeley.edu for computation. More information will be provided in section on how to access and use this platform. For those wishing to manage a Python environment on their personal computer, the Anaconda distribution, which is available for download at

[https://www.anaconda.com/distribution/]

is a convenient way to get started. Some basic tutorials on installing and using Python, with a focus on economic applications, can be found online at `http://quant-econ.net`.

Good books for learning Python, with some coverage of statistical applications, are Guttag (2013), VanderPlas (2017), and McKinney (2017). These books are available online via http://oskicat.berkeley.edu/. Any code I provide will execute properly in Python 3.6, which is (close to) the latest Python release. There are a large number of useful resources available for learning Python on campus (including classes at the D-Lab).

While issues of computation may arise from time to time during lecture, I will not teach Python programming. *This is something you will need to learn outside of class* (although help will be provided in section). I do not expect this to be easy. I ask that those students with strong backgrounds in technical computing to assist classmates with less experience. Problem sets will be more fun if you all work together and assist each other.

Extensions: Extensions for assignments will not be granted. The penalty for lateness is relatively minor and I also drop the lowest homework grade.

Accommodations: Any students requiring academic accommodations should request a 'Letter of Accommodation' from the Disabled Students Program at http://dsp.berkeley.edu/ *immediately*. I will make a good faith effort to accommodate any special needs conditional on certification. Please plan well in advance as I may not be able accommodate last minute requests.

Academic Integrity: Please read the Center for Student Conduct's statement on Academic Integrity at http://sa.berkeley.edu/conduct/integrity. I take issues of intellectual honest *very* seriously.

Cooperation: I remember my undergraduate studies as a period of immense intellectual excitement, punctuated by periods of equally intense frustration and stress. My classmates were an important source of intellectual support and encouragement. *Please be open to helping one another learn the material.* Don't be afraid to ask classmates for help and, if asked for help, be generous and gracious in providing it. Everyone will learn more in this class if they work together. You are not rivals in this class.

E-mail and office hours: I prefer to avoid having substantive communications by e-mail. Please limit e-mail use to short yes/no queries. I am unlikely to read or respond to a long/complex e-mail. Do feel free to chat with me immediately before class. For longer questions please make use of my office hours. This is time specifically allocated for your use; please come by! I look forward to getting to know all of you. You can sign-up for office hour slots online here.

Course Outline

Date	Topic	Readings/Notes
Tu 1/22	Probability Review 1 of 2	Events & probability
Th 1/24	Probability Review 2 of 3	Random variables & Expectations
Tu 1/29	Statistical Evidence	
Th 1/31	Experiments 1 of 2	A/B Testing
Tu 2/5 (*)	Experiments 1 of 2	Power calculations; Bloom (1995)
Th 2/7 (*)	Observational Studies 1 of 3	Potential outcomes; Holland (1986)
Tu 2/12	Observational Studies 2 of 3	Propensity score; Rosenbaum & Rubin (1983)
Th 2/14	Observational Studies 3 of 3	Covariate adjustment; Rosenbaum (1987), McEwan et al. (2015)
Tu 2/19	Least squares 1 of 4	Projection theorem
Th 2/21	Least squares 2 of 4	Long, short & auxiliary regression; Card & Krueger (1996)
Tu 2/26	Least squares 3 of 4	Least Squares; Nerlove (1963), Case & Paxson (2008)
Th 2/28	Least squares 4 of 4	Large sample properties of least squares
Tu 3/5	Review and catch-up	
Th 3/7	Midterm 1 of 2	
Tu 3/12	Instrumental Variables 1 of 4	Introduction; Card (1995), Benjamin (1995)
Th 3/14	Instrumental Variables 2 of 4	Heterogeneity; Angrist et al. (1996)
Tu 3/19	Instrumental Variables 3 of 4	Supply & demand; Angrist et al. (2000)
Th 3/21	Instrumental Variables 4 of 4	Production functions; Griliches & Mairesse (1998)
Tu 3/26	No Class	Spring Break
Th 3/28	No Class	Spring Break
Tu 4/2	Panel Data 1 of 4	Static models; Jakubson (1991)
Th 4/4	Panel Data 2 of 4	Spillovers; Jaffe (1986), Bloom et al. (2013)
Tu 4/9	Panel Data 3 of 4	Production functions; Griliches & Mairesse (1998)
Th 4/11	No Class (tentative)	
Tu 4/16	Panel Data 4 of 4	Production functions; Blundell & Bond (2000), de Loecker (2013)
Th 4/18	Survival Analysis 1 of 3	Efron & Hastie (2016, Chs. 8 - 9)
Tu 4/23	Survival Analysis 2 of 3	Ashenfelter & Card (2002)
Th 4/25	Survival Analysis 3 of 3	
Tu 4/30	Review & catch-up	
Th 5/2	Midterm 2 of 2	

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