

Econ 630: Econometrics I

Course info

Instructor:

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OH: By appointment (on Zoom or in my office)

Time: TR, 230-345

Place: Longstreet 110

URL: <http://blackboard.olemiss.edu>

Overview

This is a graduate-level introduction to the theory and application of econometrics. The purpose of this course is twofold. First, it is an introduction to the *theory* of econometrics. The theory that you will learn in this class will help you understand why econometric techniques work the way they do. Our focus in this course will be on the linear regression model (and least squares and instrumental variables estimation of that model). Within this framework, we will discuss how econometric models can be constructed, how they can be estimated, and how hypotheses about them can be tested. The linear model is only a small subset of the vast field of econometrics, albeit an incredibly useful subset. The theory that you will learn in this course will also prepare you for further coursework in econometrics, as well as provide you with the background that you need to learn new techniques on your own.

Second, this course is an introduction to the *practice* of econometrics. You will learn how to implement econometric estimators, and how to apply econometric theory to answer questions in empirical economics. We will discuss challenges that arise in econometric applications, and how those challenges can be avoided or solved. Thus, this course will also prepare you to use econometrics in your own research.

Texts

The official textbook for the course will be *Econometric Analysis* by Greene (Pearson, 8th ed.) This is a solid introduction to and reference for econometrics at the level of this course (and somewhat higher levels). Feel free to get an edition as old as the 5th to save a little bit of money on a hard copy.

The course will also draw on several other excellent textbooks, including

- *Econometric Analysis of Cross Section and Panel Data* by Wooldridge (MIT Press, 2nd ed.). This book is actually more appropriate for the sequel to this course. However, it does overlap with the present course, and I like it more than Greene for some topics.
- *Econometrics* by Hansen (Princeton University Press). This is a comprehensive and modern econometrics text. It is a bit more technical in places than the level that I want for this course, but it is an excellent text, and I recommend it as a supplement or

reference, especially if you have previous exposure to graduate-level econometrics or are interested in some of the technical details not covered in Greene's book.

- *Mostly Harmless Econometrics: An Empiricist's Companion* by Angrist and Pischke (Princeton University Press). This is a fantastic introduction to the econometrics of causal inference, with an emphasis on applications. We will draw on it only lightly in this class, but I highly recommend getting a copy.
- *Introductory Econometrics: A Modern Approach* by Wooldridge (Cengage, any edition). This is primarily an undergraduate/master's level text that covers the same material as this course, with more intuition and less mathematical baggage. It is a great supplement to the more technical texts.

You are not required to purchase any of these textbooks, but they may be helpful for this course, other courses, or your research. There are also many other good econometrics texts at the same level as those listed above.¹ Feel free to use any book you like as a reference.

Mathematical background

Your statistics textbook should be an adequate reference for the mathematical background for this course. The appendices to Greene, which can be downloaded for free, also provide a nice review of the probability, statistics, and other mathematical background (calculus and matrix algebra) that we will use.²

Software

An important component of your work in this course will consist of implementing the methods that we discuss on a computer. The official software package for this course will be Stata. StataCorp offers competitive pricing on six-month, one-year, and perpetual student licenses (let me know if you have any difficulty obtaining a license, and I will either help you obtain one or make arrangements for you to use alternative software).³

Although we will focus on Stata in order to keep the course streamlined, I recommend developing some familiarity additional statistical programs, and will try my best to accommodate you if have a strong preference for another statistical package. Another popular application is R, which is open source and can be downloaded for free.⁴ In general, I find that Stata is a bit more user friendly and R is a bit more flexible; I like both and use each for different purposes in my own work.

I will provide you with some help getting started with Stata. In addition, I maintain a list of resources to help you learn both Stata and R on my website.⁵

¹Two that I like are *Econometric Theory and Methods* by Davidson and Mackinnon (Oxford University Press) and *Econometrics* by Hayashi (Princeton University Press).

²<https://www.pearson.com/us/higher-education/product/Greene-Appendices-for-Econometric-Analysis-8th-Edition/9780134804576.html>.

³See <https://www.stata.com/order/new/edu/gradplans/student-pricing/>.

⁴<https://www.r-project.org> (you may also be interested in the RStudio development environment for R, which is free for non-commercial use, and available at <https://www.rstudio.com>).

⁵See <https://jrgcmu.github.io/resources.html>.

Assessment

Your grade in this course will be based on your performance on several problem sets, worth a total of 50% of your grade, and two exams, each worth 25% of your grade.

Course policies

Attendance. Attendance is mandatory. It's also a good way to learn the material.

Accommodations. If you require any accommodations (such as extra time, a different testing environment, etc.), please let me know as soon as possible. For more information on the University's policies regarding such accommodations, see <http://sds.olemiss.edu>.

Collaboration and plagiarism. All of the work that you submit for this course must be your own; any violation of this standard constitutes plagiarism. Any student found plagiarizing once will fail the assignment or exam; any student found twice will fail the course.

Outline and readings

1. Introduction
2. The linear regression model (Greene, ch. 2)
3. Least squares algebra and estimation (Greene, ch. 3.1-3.3, 3.5-3.6)
4. The statistical properties of least squares (Greene, ch. 4.1-4.6, 4.9.1; Wooldridge, ch. 4.2.1-4.2.2, 4.3.1)
5. Hypothesis testing (Greene, ch. 4.7.1, 5.1-5.5).
6. Functional form, specification, and an introduction to treatment effect estimation (Greene, ch. 6.1, 6.2.1-6.2.5, 6.3.1, 6.4.2, 6.5)
7. Heteroskedasticity, generalized least squares, and weighted least squares (Greene, ch. 9; Wooldridge, ch. 4.2.3)
8. Endogeneity, instrumental variables and two-stage least squares (Greene ch. 8.1-8.3, 8.4.1, 8.6-8.7, Wooldridge, ch. 5.1-5.2)

Additional topics (if time permits)

9. Panel data (Greene, ch. 11.1-11.4; Wooldridge ch. 10.1-10.3, 10.5)
10. A closer look at treatment effect estimation (more on differences in differences and instrumental variables, Greene ch. 8.5; Wooldridge ch. 21.1-21.5)

Tentative schedule

Midterm: TBD

Final: TBD