

Econ 630: Econometrics I

Course info

Instructor:

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

Time: TBD

Place: TBD

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 (forthcoming, Princeton University Press). This is a draft of a textbook, which can be downloaded for free.¹ It is a bit more technical than the level that I want for this course, but it is an excellent book, and I recommend it as a reference, especially if you have previous exposure to graduate-level econometrics or

¹<https://www.ssc.wisc.edu/~bhansen/econometrics/>.

are interested in some of the technical details not covered in Greene's book (also, you can't beat the price).

- *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.² 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.³ In addition, Hansen also has a freely available introduction to probability and statistics.⁴

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).⁵

I will provide you with sample code to help you get started with Stata. I also recommend the following resources to expand your Stata programming abilities:

- German Rodriguez's Stata tutorial is a great place to get started with Stata programming.⁶
- Christopher Baum's article "A little bit of Stata programming goes a long way" is a crash course in more advanced Stata programming techniques.⁷
- Baum's *An Introduction to Stata Programming* (Stata Press, 2nd ed.) is a comprehensive guide to Stata programming.

²Two that I like are *Econometric Theory and Methods* by Davidson and Mackinnon (Oxford University Press) and *Econometrics* by Hayashi (Princeton University Press).

³<https://www.pearson.com/us/higher-education/product/Greene-Appendices-for-Econometric-Analysis-8th-Edition/9780134804576.html>.

⁴<https://www.ssc.wisc.edu/~bhansen/probability/>.

⁵See <https://www.stata.com/order/new/edu/gradplans/student-pricing/>.

⁶<https://data.princeton.edu/stata/>.

⁷<http://fmwww.bc.edu/ec-p/wp612.pdf>.

Although we will focus on Stata in order to keep the course streamlined, I recommend developing some familiarity with additional statistical programs. Another popular application is R, which is open source and can be downloaded for free.⁸ Below are a few resources to help you get started with R, if you are interested:

- German Rodriguez also has an introduction to R.⁹
- “An introduction to R” by Venables, Smith, et al. is available online, and also comes bundled with R.¹⁰
- *R for Data Science* by Wickham (O’Reilly Media) is the de facto reference for modern R techniques, and can be read online for free.¹¹

In general, Stata is a bit easier to use while R is more flexible (they are both quite good, and I use them both for different purposes in my own work). There are also several other statistics and econometrics packages that are popular in specific fields and other disciplines.

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)

⁸<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>).

⁹<https://data.princeton.edu/R>.

¹⁰<https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf>.

¹¹<https://r4ds.had.co.nz>

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