

Course info

Instructor:

John Gardner

jrgardne@olemiss.edu

318 Odom

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

Time:

Place:

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 material in this class is drawn from a number of sources, including:

Greene, *Econometric Analysis* (Pearson, 8th ed.)

Wooldridge, *Introductory Econometrics: A Modern Approach* (Pearson, 8th ed.)

Hansen, *Econometrics* (Princeton University Press)

Wooldridge, *Econometric Analysis of Cross Section and Panel Data* (MIT Press, 2nd ed.)

Angrist and Pischke, *Mostly Harmless Econometrics: An Empiricist's Companion* (Princeton University Press)

If you want one good, general reference, I recommend Greene, which covers all of the material in this class (and more) with a good mix of motivation, technical detail and examples. If you want a treatment that offers more intuition and discussion and less technical baggage, I strongly recommend getting a copy of Wooldridge's introductory text. Hansen provides a comprehensive and modern introduction, including more technical detail and advanced material than we will cover

in this course. Wooldridge's *Econometric Analysis* is one of the main references for the sequel to this course, but I prefer Wooldridge's coverage of some of the topics that overlap with this course. Angrist and Pischke is an introduction to the econometrics of causal inference that provides extensions and alternative perspectives on the material in this course, with a focus on applications; I highly recommend getting a copy (and reading it). Feel free to use any book you like as a reference, and to use older editions to save money.¹

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 For more details on calculus and matrix algebra, I recommend *Mathematics for Economists* by Simon and Blume (Norton).

Software

An important component of your work in this course will consist of implementing the methods that we discuss on a computer. I will officially support two software packages: Stata and R, and you can use whichever you prefer. In general, Stata is more user friendly, while R is more flexible. On the other hand, Stata is also fairly expensive, while R is open source.³ I recommend trying both of them out (personally, I tend to use Stata for “standard” tasks and R for “custom” tasks). I will try to accommodate you if you want to use a different programming language, but I won't be able to provide much technical guidance, and may ask you to switch to Stata or R if you run into problems.

I will provide you with some help getting started with Stata and R. In addition, I maintain a list of resources to help you learn both packages on my website.⁴

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.

¹Two other texts 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/> for information on obtaining a student license.

⁴See <https://jrgcmu.github.io/resources.html>.

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:

Final: