Economics 5243

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Hours Wednesday mornings

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1 Purpose

The objective of this course is for you to become knowledgeable users of the linear regression model. The topics include the estimation and specification of the linear regression model, imposition and testing of exact linear parameter restrictions, confidence intervals, estimation of nonlinear models, and an introduction to generalized least squares.

In order to become functionally literate in applied econometrics, it is also necessary for you to learn some of the basics of econometric theory. The basic tools of econometric theory will help to slow the rate of depreciation of your hard-earned econometric human capital. It is well worth your time to learn these tools now, especially if you intend to do any empirical work in the future.

2 Textbooks

Required

William H. Greene. Econometric Analysis. Prentice-Hall. $\geq$ 6th edition.

Most of our lectures and class assignments will come from Greene's book. Pieces of the lectures will also come from Davidson and MacKinnon's Econometric Theory and Methods.

Most of the material covered in class is available in either book, though you may have to use the index to find the specific topic.

Recommended

Lee C. Adkins, *Monte Carlo Experiments Using gretl: A Primer*, http://www.learneconometrics.com/pdf/MCgretl.pdf.

Lee C. Adkins, *Using gretl for Principles of Econometrics*, e-book. 2011. Available from http://www.learneconometrics.com/gretl/.

3 Prerequisites

This course requires you to work with probability, statistics, calculus, matrix algebra, and to write computer programs (as well as learn econometrics). If you have any doubts about whether your experience is sufficient, please talk to me about it. At a minimum, I assume that you know the basics of differential calculus, matrix algebra, probability theory, and how to use a Windows based microcomputer. If you have any doubts about whether your experience is sufficient, please talk to me about it.

4 Course Outline

1 Review of Regression Models

- 1.1 Introduction
- 1.2 Distributions, Densities, and Moments
- 1.3 The Specification of Regression Models
- 1.4 Matrix Algebra
- 1.5 Method-of-Moments Estimation

2 The Geometry of Linear Regression

- 2.1 The Geometry of Vector Spaces
- 2.2 The Geometry of OLS Estimation
- 2.3 The Frisch-Waugh-Lovell Theorem

7.4 Heteroskedasticity

7.5 Autoregressive and Moving-Average Processes

7.6 Testing for Serial Correlation

7.7 Estimating Models with Autoregressive Errors

7.8 Specification Testing and Serial Correlation

5 Computer Assignments and Homework

You can't expect to learn as much without doing some homework. The problem is, my capacity to grade it is limited, especially given the unusually large enrollment in this class and in Econometrics II this spring. So, the homework operates on the honor system for the most part. I will assign homework and expect you to do it. **I will collect it in sets 2 or 3 times during the semester. I'll give you a few days notice before calling for it.** I will evaluate it based on it's degree of completeness, organization (how easy it is for me to figure out what you've done and whether it is correct), and originality (how similar is it to classmates and to previous year's work). I'll evaluate a sample for correctness. If you wish to have a copy of this, then make a duplicate before you turn it in. I will not return it to you. I'd rather see you try to do it and fail than to copy someone else's work and get it right. Remember that. Also, when you turn in an assignment, turn in a copy of the computer code you used to get your results.

Some of the homework consists of algebraic puzzles, and for these I want to see how you do without my help (fairly common in statistics). This helps me to gauge your aptitude for further study in econometrics. Other assignments are purely empirical in nature and I am certainly willing to discuss these almost anytime, preferably in class so that I don't have to say the same thing 25 separate times. These are important for your progress as an applied social scientist.

The other type of assignment will involve a small amount of applied regression analysis or a simulation based on simple regressions. For this you should use gretl. I will provide further instructions on how to get started with gretl and doing simulations with it later in the course. You are responsible for learning to use the software. To help, there are at least two excellent resources available (hint: see the reading list and look for my name). On the class website, I'll also supply links to other useful material.

Gretl

Gretl is an acronym for Gnu Regression, Econometrics and Time-series Library. It is a software package for doing econometrics that is easy to use and reasonably powerful. Gretl is distributed as free software that can be downloaded from `http://gretl.sourceforge.net` and installed on your personal computer. Unlike software sold by commercial vendors (SAS, Eviews, Shazam to name a few) you can redistribute and/or modify Gretl under the terms of the GNU General Public License (GPL) as published by the Free Software Foundation.

Gretl comes with many sample data files and a database of US macroeconomic time series. From the Gretl web site, you have access to more sample data sets from many of the leading textbooks in econometrics, including ours *Introduction of Econometrics* by Stock and Watson. Gretl can be used to compute least-squares, weighted least squares, nonlinear least squares, instrumental variables least squares, logit, probit, tobit and a number of time series estimators. Gretl uses a separate Gnu program called *gnuplot* to generate graphs and is capable of generating output in LaTeX format. Gretl is under development so you can probably expect some bugs, but in my experience it is pretty stable to use with my Windows XP systems.

So, why use Gretl? Well, its free, its fast, it will work on any platform, and it will do everything we are going to do in this class.

Why not use Stata? Stata is a professional piece of software that has many more capabilities than Gretl. In the long-run, knowing how to use Stata could be beneficial. On the other hand, by the time you get around to using Stata, you may have forgotten it all and have to start from scratch anyway. As it turns out, knowing one package well (any package) is a pretty good introduction to other packages. For learning econometrics, though, gretl is very good. You'll have to do a little programming and gretl makes this very easy. For doing sophisticated applied work using pre-programmed procedures, Stata is very good. But for learning how software works and how econometric theory translates into estimation results, gretl is excellent.

Early in the course you will begin to use the computer to do portions of your homework. You will be responsible for learning to use the software of your choosing, though I can help you as needed.

6 Grades

Your grade in this class will be based on your performance on 3 exams and on homework assignments.

Grade Weights	
Midterm Exam I	30%
Midterm Exam 2	30%
Final Exam	30%
Homework	10%

Grades will be assigned according to the following scale:

Grades	
91%–100%	A
76%–90.9%	B
60%–75.9%	C
50%–59.9%	D
$< 50\%$	F

All exams must be taken at the designated time. No make up exams will be given. If you miss an exam you will receive a grade of zero.

Unless you are specifically told otherwise by me, all homework must be turned in at the beginning of the class period on the date that it is due. Homework will not be accepted if late.

7 Attendance

Regular attendance is expected. You are responsible for any material you miss because of absence. In general, I do not permit students to copy my notes. If you miss class and need a copy of the notes, please obtain them from one of your classmates.

8 Cheating Policy

Cheating will not be tolerated. You may not, under any circumstance, use material that comes from the solution manual to any of our textbooks. If you do (and I can usually tell since I know where the errors are) I will consider that an extremely bad case of cheating and I will begin procedures that will earn you an F! for the course.

Any violation of the University's academic integrity policy will be prosecuted according to University regulations. If you are not sure what this is about, then visit the link at the bottom of my website. Basically, you will receive a grade of 0 on any test or assignment you are caught cheating on. If the violation is especially egregious or it threatens my ability to evaluate work for others in the course, then you could earn an F! for the course and you may be suspended from the University. Remember, you are responsible for the security of your work (in other words, if someone copies your work, you will also receive a zero on the test or assignment).

References

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Wooldridge, Jeffrey M. (2009), *Introductory Econometrics : a Modern Approach*, 4th edn, South Western, Cengage Learning, Mason, OH.

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