Economics 5213

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1 Purpose

The purpose of this course is to prepare first year graduate students in business and economics to use linear regression to analyze well-defined problems. I want you to learn how to choose a particular model or technique, how to estimate it using software, and how to interpret the results. I will also introduce a few ways to determine whether your model is correctly specified, although there is no way to ever be certain about this.

This course is the first in a two-course sequence that covers the use of regression analysis in economics and, at least to a small extent, finance. The second course which is sometimes offered in the Spring semester is a continuation of this course, with an emphasis on time-series analysis.

Econometrics exists because so many things can go wrong in statistical analysis when data are not the outcomes of repeatable experiments. You will learn a few techniques that help indicate when data are being generated in a way that prevents valid conclusions to be drawn from standard techniques. When the standard techniques fail to provide us with useful information, econometricians suggest alternatives that are usually better and we will study a few of these as well. Unfortunately, there is never any guarantee that your analysis is valid or that the assumptions that permit valid inference are met by your data. In the end, though, obtaining useful results from statistical analysis is as much art as science. Whether you are able to become a competent artist or not depends on your knowledge, creativity, and humility. I can help you with the science, as for the art you are on your own.

2 Textbooks

Required

Principles of Econometrics, 5th edition. Hill, Griffiths, and Lim (2018).

Other Sources

There is an excellent website that is provided by the author of your book. It can be found at

`http://principlesofeconometrics.com/poe5/poe5index.html`

Adkins and Hill, *Using Stata for Principles of Econometrics, 5th edition*, 2018. This book is good for point-and-click instructions and for the basics. This is an e-book.

Adkins, *Using gretl for Principles of Econometrics, 5th edition*, 2018. It is freely available from my website,

`http://www.learneconometrics.com/gretl/using_gretl_for_POE5.pdf`.

Kennedy, Peter. A Guide to Econometrics, 6th edition. John Wiley, 2008. This is a particularly valuable book for anyone whose plan of study includes more econometrics. Chapter 22 on what can go wrong and what to do about it is worth $43 that Amazon charges for this book.

3 Prerequisites

This course requires you to work with basic probability, statistics, algebra, and to use Stata or Gretl. I may use a little matrix algebra and I will use a very small amount of calculus. You will not be asked to derive estimators using either of these tools. They are used in order for you to see where the estimators come from (as opposed to believing that they come from the ether).

As prerequisites I recommend 2 undergraduate courses in statistics in addition to a good command of algebra. You should have some notion about what random variables are, what a probability distribution is, what a statistic is, and what a hypothesis test is. These are things that we will cover, but we move through them quickly. If you haven't learned about these before you'll never be able to keep up. It is not necessary that you have any previous experience with linear regression, though this would be *very* helpful.

4 Course Outline

The following outline will be followed (at least approximately).

1 Economic Questions and Data (Chapter 1)

    1.1 Economic questions: empirical themes of the course

    1.2 Causal effects and idealized experiments

    1.3 Data: sources and types

2 Review of Probability (Probability Primer)

    2.1 Random variables and probability distributions

    2.2 Expected values, mean and variance

    2.3 Two random variables

    2.4 Normal, χ^2, $F_{m,\infty}$, and Student-t distributions

    2.5 Random sampling and the distribution of the sample average

    2.6 Large-sample approximations to sampling distributions

3 Linear Regression with One Variable (Chapters 2 - 4)

    3.1 Linear regression model

    3.2 Estimating the coefficients of the linear regression model

    3.3 Least squares assumptions

    3.4 Sampling distribution of least squares

    3.5 Testing hypotheses about one coefficient

    3.6 Confidence intervals for a regression coefficient

    3.7 Regression when X is binary

    3.8 R^2 and the standard error of the regression

    3.9 Modeling Issues and nonlinearity

4 Linear Regression with Multiple Regressors (Chapters 5 - 6)

    4.1 Omitted variable bias

    4.2 Multiple regression model

    4.3 The OLS estimator

    4.4 Least squares assumptions

5   Software

There are two basic pieces of software that you can use to complete assignments in class: Stata and gretl. Given a choice, I use gretl. Although it is open-source freeware, it is professional strength software and learning how to use it will serve you well in the future. If you believe that only things that have a price are valuable, then feel free to use the commercial software Stata. It is excellent in nearly every way, it is becoming a defacto standard in many disciplines (including ours), and it comes with an outstanding–and comprehensive-documentation in pdf form. A year long license to Stata IC cost $125 and is available to OSU students through their GradPlan website.

I have written a free book that will show you how to use gretl with every example in our book. There is a version for Stata as well, but that one costs about $75.

Please don't use SPSS. Its design encourages a particulary large number of bad statistical practices and in poorly trained hands (95% of users) can produce quite misleading results. Just because there is a button that does X, does not mean you should use it! If you learn nothing else in this course, I want you to develop a very sceptical attitude toward applied work in statistics. I would venture to guess that fewer than 1% of applications are statistically valid. This is due to user error and is not the fault of the software or techniques themselves.

Stata

The first is *Stata*. *Stata* is currently available in the SSB virtual lab.

For those interested in what *Stata* can do, here is a link to a *Stata* brochure:

http://www.stata.com/products

and to a brief list of *Stata*'s statistical capabilities

http://www.stata.com/capabilities

For basic examples and tutorial for Stata, and other software see:

https://stats.idre.ucla.edu/

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 *Principles of Econometrics* by Hill et al. 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 7 and 10 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. If you want to use Gretl instead of Stata, then feel free to do so.

Why 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.

6 Exams

There will be 3 exams in the course. 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.

7 Grades

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

Grades will carry the following weights and be measured according to the accompanying scale.

Grade Weights

Exam 1	30%
Exam 2	30%
Exam 3	30%
Homework	10%

Grades

92%–100%	A
79%–92%	B
68%–79%	C
57%–68%	D
$< 57\%$	F

8 Homework

There will be some homework in the course. The best way to learn econometrics is to do econometrics. A large portion of your homework will require you to use a computer. The computer software we are using is Stata or Gretl. Stata is a Windows program that operates under the Windows 7 operating system on the microcomputers in the Spears virtual lab. Gretl is free and has Mac, Windows, and Linux versions available for download.

I will not accept late homework under any circumstance. I expect homework to be legible and well organized. I encourage you to work with others in the class while doing homework,

and you may turn in assignments in groups of 2. The homework receives style points, so identical answers may receive different grades. I am predisposed to to look favorably upon work that is well organized and legible.

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.

If you want a copy of your homework, then make one to keep before you turn it in. In most cases, I do not return assignments unless I find something seriously wrong with them.

9   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. And remember, if you miss an exam, you'll earn a zero.

10   Cheating Policy

Cheating will not be tolerated. 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 **Academic Integrity** 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 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).

<div align="center">**Econometrics is Fun!**</div>

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