M.Sc. in Economics

Department of Economics, University College London

Econometric Theory and Methods (G023) [1]

Autumn term 2007/2008: weeks 2 - 8

Jérôme Adda

for an appointment, e-mail j.adda@ucl.ac.uk

Introduction

This course provides students with a foundation in econometric theory and methods. Courses in Microeconometrics and Time Series Econometrics in the Spring Term provide further instruction on specific econometric topics. Many of the other M.Sc. course in economics provide material essential in developing econometric models and a strong motivation for the use of econometric methods.

Some of these courses will make frequent reference to the results of econometric analysis. Econometric methods are used by academic researchers to develop and test models of economic behaviour and interaction, by government in the design and evaluation of economic and social policy and by commercial users to understand aspects of the markets in which they operate.

Most practicing professional economists, and many academic economists, have to conduct, evaluate, or use the results of econometric analysis on a day to day basis. There has been recent rapid growth in the availability of information on economic phenomena, in the computing power necessary to access and analyse this information, and in the scope and power of econometric techniques. As a result there is rapidly increasing demand for people with good econometric skills.

---

[1]I am grateful to Andrew Chesher, the previous lecturer of this course to make the teaching material available.

Econometrics

Econometrics is the collection of tools and methods used to understand and predict economic phenomena. These phenomena include the responses of individual economic agents to their environment, for example of people, households, firms and other organisations. They also include the levels of and changes in prices and in economic aggregate flows and stocks. These latter are the aggregate consequence of the behaviour of individual agents in response to the economic environment.

Econometric methods are applied to data recording economic phenomena and the environment in which they are observed. Data can arise in many forms.

For example in studying economic aggregates we may use (a) time series recording the evolution of prices flows and stocks in a single economic environment (e.g. a country), (b) cross sections recording the state of prices, flows and stocks at a point in, or during a short period of time, in a variety of environments (e.g. regions, countries), and (c) records of the simultaneous evolution of prices, flows and stocks in many environments.

Individual agents are rarely observed for long enough to provide useful time series data on any single agent. Sometimes we have short time series on a set of individual agents - longitudinal data, but often just a single set of responses from many agents - cross sectional data.

In econometric analysis, data are regarded as realisations of random variables which are subject to probability laws. It is necessary to be accomplished in the use of the elementary tools of probability theory in order to specify and work with these laws. Data can tell us about the distributions of these random variables. The statistical methods of econometrics are designed to do this job efficiently with a view also to robustness. A large part of this course, and almost all of the textbooks on the market, is devoted to study of these statistical methods.

It is important not to lose sight of the fact that as economists we are interested in the economics processes that lie behind, and give rise to, the probability distributions of outcomes about which data are informative. Distinct economic data generating processes can give rise to identical distributions of observable outcomes. Such processes are called observationally equivalent. Knowledge of the distributions of outcomes leads to knowledge of the economic process generating data only when this ambiguity is eliminated. That is done by specifying econometric models which rule out certain economic

data generating processes as inadmissible. With a very restrictive model it may be possible to conclude that for each distribution of outcomes there is one and only one admissible economic data generating process. The model is then said to identify the data generating process. A less restrictive model may be able to identify interesting and important if not all features of a data generating process. It is interesting to know what is the least restrictive model than can identify a feature of interest. This is a major preoccupation in the modern study of identification.

The study of identification is at the core of econometrics and is one of the great contributions of economics to the social sciences. This course will lay particular emphasis on identification issues.

The models used in practice contain many restrictions that are not essential for identification. Many of these additional restrictions, made to make up for data deficiencies and to allow the use of particular methods of inference, do not flow directly from economic argument. Good econometric practice attempts to determine whether such additional restrictions are tenable. So the subject of detecting model misspecification is an important one in econometrics. Because inferences can be critically dependent upon non-economic assumptions, one of the active agendas of modern econometrics is the development of robust procedures whose properties are minimally dependent on non-economic assumptions.

Objective

On completing this course students should have an appreciation of the purpose of econometric analysis, of the use of econometric models in securing identification of economic magnitudes, of the scope of econometric methods, an understanding of the properties of a variety of econometric procedures and the ability to derive the properties of some procedures in relatively simple settings.

Students completing the course should have sufficient awareness of basic econometric techniques to be able to understand the presentation of basic econometric results in academic articles and professional reports and to critically appraise their usefulness and appropriateness.

Topics

- Identification and econometric models.

- Linear models, regression, point estimation, least squares estimators.

- Approximate, large sample, methods: concepts and inference.

- Hypothesis tests, interval estimators and specification testing in linear models.

- Nonlinear models, likelihood functions and estimation.

- Models for binary data and counts.

- Identification, endogeneity.

- Simultaneous equations models, instrumental variables methods.

- Dynamic models and time series topics (weeks 9-11, Dr)

Textbooks

The course is accompanied by a set of lecture notes which cover the main topics. Additional material can be found in the following textbooks.

1. Jeffrey Wooldridge, Econometric Analysis of Cross Section and Panel Data, The MIT Press, 2002, ISBN: 0262232197.

2. Jeffrey Wooldridge, Introductory Econometrics: A Modern Approach, South Western College Publishing, 2002, ISBN: 0324113641.

3. W.H. Greene, Econometric Analysis, 5th edition, Prentice-Hall, 2002, ISBN: 0131108492.

4. J. Johnston and J. DiNardo, Econometric Methods, 4th edition, McGraw-Hill, 1997, ISBN: 007115342X .

(1) covers more material than this course. Some of the additional material will be covered in the second term course in Microeconometrics. The approach is up to date and not overloaded with algebra. It does not cover the time series material of weeks 9-11. There are materials associated with

the book at: http://www.msu.edu/ ec/faculty/wooldridge/book2.htm (2) takes you though most of the course material without using matrix algebra methods some may find this helpful at least as a companion to one of the other texts. (3) provides a lot of algebraic detail this suits some people but not others. There are errata and discussion at the books web site (http://pages.stern.nyu.edu/ wgreene/Text/econometricanalysis.htm). (4) lies at a level in between (2) and (3). Students with a good statistics background will appreciate the following textbook.

- Paul Ruud, An Introduction to Classical Econometric Theory, 1st edition, Oxford University Press, 2000. This gives a very thorough treatment of many of the methods we will address. Other textbooks students have found useful in the past include the following.

- G.C. Judge, C. Hill, W. Griffiths, T. Lee and H. Lutkepol , An Introduction to the Theory and Practice of Econometrics, Wiley, 1988.

- R.S. Pindyck and D.L. Rubinfeld, Econometric Models and Forecasts, 4th edition, McGraw-Hill, 1998. Deeper analysis of certain subjects (some of which we will deal with only briefly) and extensive references to the econometric literature can be found in the following book.

- R. Davidson and J. MacKinnon, Estimation and Inference in Econometrics, Oxford University Press, 1993 (hardback).

Students who want to study particular topics in greater depth will find many useful review articles with extensive references in the Handbook of Econometrics (hardback) series published by North Holland.

Journals and other resources

The leading journals publishing econometric theory are Econometrica, Econometric Theory, The Econometrics Journal and Journal of Econometrics. Other journals occasionally publishing important results in econometric theory include the Review of Economic Studies, the Review of Economics and Statistics and the International Economic Review.

Many mainstream statistics journals such as the Journal of the American Statistical Association, the Annals of Statistics, the Journal of the Royal

Statistical Society and Biometrika occasionally publish econometric theory and often publish related work which is highly relevant.

Many of the major economics journals publish applications of econometric methods. Three journals that frequently publish applied work are the Journal of Applied Econometrics, the Journal of Human Resources and the Journal of Business and Economic Statistics. A number of useful econometric resources can be found at: http://www.feweb.vu.nl/econometriclinks/. See also the cemmap web site at: http://cemmap.ifs.org.uk for lecture notes etc., accompanying cemmap Master Classes. Many of the journals listed above can be accessed via the internet through JSTOR. See the UCL library home page for details.

The Web of Science (http://wos.mimas.ac.uk/) is very useful for finding references by keyword, name of author and for finding articles that cite other articles. Register at UCL Library.

Prerequisites

Students embarking on this course should have a good understanding of elementary probability distribution theory, classical statistical inference, elementary differential and integral calculus of functions of many variables, limits and elementary matrix algebra, and of course of economics.

Assessment

Assessment is by a single 3 hour written examination in the summer examination period. The format of the examination will be announced during term 1.

Classes and exercises

During the term you will receive exercise sets. You should attempt all the exercises, some of which may introduce you to new material which is an important element of the course. You will be asked to hand in completed answers to just a small number of selected exercises. Your performance in these exercises does not count directly towards your final grade for the course but may be influential in determining your grade if you encounter difficulties

which degrade your examination performance. You should also attempt some of the exercises contained in the textbooks. There are answers to some of the Wooldridge exercises at the books web site.

You will have the opportunity to raise questions concerning the set exercises in the weekly classes. If you encounter problems that cannot be resolved there, please come to see me. Book an appointment by sending email to me at j.adda@ucl.ac.uk. We will usually be able to find a mutually convenient time to meet within 2 days.

Lectures are timetabled on Mondays, 10.00- 11.30 and 15.00 - 16.30 in the Jevons Lecture Theatre, Drayton House, Room B20, starting on Monday October 8th. Classes start the week after lectures start.