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ECS4355 Applied Econometrics

MODULE HANDBOOK FOR 1999-2000

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1. Module Particulars

People and Places

- Lecture Times: Tuesday: 11-12.30pm; Class 2.30-4.00pm
- Rooms Lecture: G234. Class: G236 or M221 (computer room)
- Date of Commencement: 15th February
- Duration: 12 sessions.
- Module Leader: Paul Dunne
- Lecturers: Alvin Birdi, Paul Dunne, Tim Hinks, Duncan Watson.
- Contact details: Paul Dunne, Room G304 Hendon: J.Dunne@mdx.ac.uk
Alvin Birdi: A.Birdi@mdx.ac.uk
Tim Hinks: T.Hinks@mdx.ac.uk
Duncan Watson: D.Watson@mdx.ac.uk

Website: Details of the course including datasets will be posted on the website at <http://bobbins.mdx.ac.uk/postgraduate.php3>

Module Aims and Objectives

The aim of this module is to build on the work covered in ECS4305 and aims to provide a more advanced econometrics course, with the emphasis on the use of econometrics in applied economics and finance. To introduce the linear model in matrix notation and then move on to consider particular topics in applied econometrics. Exercises with computer packages to replicate published studies will be provided.

Specifically the aims are to:

- Provide an appreciation of the use of econometrics in economic analysis.
- Introduce the advance tools required for applied econometric analysis.
- Provide a firm foundation for an understanding of the academic and professional literature.
- Prepare the student for research work as an economist in industry, government and possible academia.

By the end of the module you should:

- have developed your knowledge of econometric techniques beyond ECS4305
- be able to use the Microfit package in a more sophisticated manner and undertake empirical work with the Limdep package.
- Have a knowledge of the literature in a number of areas of applied econometrics and be able to replicate the results of the studies used in the classes.
- Be able to read and understand some of the applied articles published in academic and professional journals and monographs.
- be able to undertake independent applied econometric research: including data collection and analysis, using relevant econometric techniques, integrating economic theory and econometrics, understanding the problems and limitations.

Prerequisites

The prerequisite for this course is ECS4305 or an econometrics course of an equivalent level.

Plan of Semester

The plan is to have 1.5 hours of lectures and 1.5 hours of classes, but there is some flexibility depending on the individual topics being covered.

	Week Beginning	Lecture hours	Class hours
1.	15 th February	1.5	1.5
2.	22 nd February	1.5	1.5
3.	29 th February	1.5	1.5
4.	7 th March	1.5	1.5
5.	14 th March	1.5	1.5
6.	21 st March	1.5	1.5
7.	28 th March	Student presentations	11am onwards
8.	4 th April	1.5	1.5
9.	11 th April	1.5	1.5
	18 th April	Easter break	
	25 th April	Easter break	
10.	2 nd May	1.5	1.5
11.	9 th May	1.5	1.5
	22 nd May	Exams start	

Problems and Advice

You may make use of office hours.

Paul Dunne's are: Monday 5-6pm and Thursday 4-5pm. Please sign up for a slot with Maria Lane (rm G303 and x6825).

Alvin Birdi's are 3.30-4.30pm on Mondays and Wednesdays room G312. Please indicate you are coming by signing up on the office hour sheet outside G312.

Other contributors will provide you with details of their office hour arrangements.

2. Introductory Reading List

This course will start off by going through matrix algebra and then the standard results for the linear model using matrix algebra. This is covered in most of the text books used in Methods of Economic Investigation (ECS4305) in semester 1. There are also some more advanced texts referenced below.

General:

Charemza, WW and DF Deadman (1992) "New Directions in Econometric Practice", Edward Elgar.

Stewart, J (1991) "Econometrics", Philip Alan.

Cuthbertson, K, SG Hall and MP Taylor (1992) "Applied Econometric Techniques", Harvester Wheatsheaf.

Darnell AC and JL Evans (1990) "The Limits of Econometrics", Edward Elgar.

Greene, WH (1999) "Econometric Analysis", Prentice Hall, 4th edn.

Hendry D (1995) "Dynamic Econometrics", Oxford University Press.

Judge et al (1985) "The Theory and Practice of Econometrics", Wiley.

Griliches, Z and MD Intrilligator (eds) (1993) "Handbook of Econometrics", Elsevier.

Applied:

Intriligator M, R Bodkin, C Hsiao (1996) “Econometric Models, Techniques and Applications”, Prentice Hall.
 Mills T (1993) “Applied Financial Econometrics”
 Thomas RL (1993) “Introductory Econometrics: Theory and Applications”, Longman
 Other useful texts are:
 Berndt ER (1991) “The Practice of Econometrics”, Addison Wesley.
 Desai, M (1976) “Applied Econometrics”, Philip Allan.
 Wallis, K (1979) “Topics in Applied Econometrics

Software:

We will be using Microfit 4.0:
 Pesaran MH and B Pesaran (1997) “Microfit 4.0 Manual”, OUP. Available in the library.

and LIMDEP 7.0: The manual is available in the library and on the internet and a link to this resource can be found at:

http://bobbins.mdx.ac.uk/mdx_only/teaching.php3

3. Lecture and Class Outlines

The lecture course is designed as 12 1.5 or 2 hour lectures. These are followed by a 1 or 1.5 hour class. The first few weeks of lectures provide an introduction to matrix algebra and then go through the general linear model using matrix notation. The first class is in fact a lecture, dealing with the matrix algebra and an introduction on how to do the applied econometrics project. There is time for discussion. The second and third weeks classes are in the form of surgeries, where we will discuss individual students' ideas, how their work is developing and any problems they might be having. From the fourth week the lectures cover topics in applied economics and the classes will take the form of computer based workshops.

Week	Lecture (G234)	Class (M221)
1.	Matrix Algebra (PD)	Matrix Algebra Introduction to Project
2.	General Linear Model I (PD)	Project Surgery
3.	General Linear Model II (PD)	Project Surgery
4.	Demand Analysis (PD)	Computer class
5.	Industry: Growth and Size (PD)	Computer class
6.	Consumption (AB)	Computer class
7.	Student Project presentations (course team)	
8.	Efficiency and Volatility (PD)	Computer Class
9.	Production Functions (PD)	Computer Class
10.	Macromodelling/VARs (PD)	Computer Class
11.	Micro Econometrics (DW/TH)	Computer Class
12.	Panel Data (AB)	Computer Class

Course team:

AB Alvin Birdi
 DW Duncan Watson
 PD Paul Dunne
 TH Tim Hinks

Brief Lecture Outlines

1. Matrix Algebra (PD)

This lecture will introduce the basics of matrix algebra for use in the lectures in the next two weeks. You will need to go through the textbook section in your main text from last year, Maddala, although any other introduction to econometrics that has a section on matrices will do. You will need to read and do the exercises to familiarise yourself with the notation and the methods. This will allow you to follow the content of lectures 2 and 3.

Matrices and vectors; transposing a matrix; matrix addition; matrix and vector multiplication; identity matrices; determinant of a matrix; inverse of a matrix; orthogonality; rank of a matrix; trace of a matrix; quadratic form; matrix differentiation; eigenvalues and eigenvectors; idempotent matrices; kronecker products; systems of equations.

Introduction to Project

This session will consider how to choose a topic for your applied econometrics project and how to go about it. Section 2 of this handbook provides the notes and reading for this lecture. It is important that you keep referring to this as you go along.

2. General Linear Model I (PD)

This lecture will deal with the general linear model using matrix algebra. It goes over what you have covered last semester, but using matrices. Topics covered: simple linear model; ML estimator; Ordinary Least Squares (OLS); OLS as BLUE; assumptions.

Project Surgery

Will discuss general and individual problems with planning and implementing the project.

3. General Linear Model II (PD)

This lecture will continue from the previous lecture. Topics covered: testing restrictions and hypotheses; small sample F tests; large sample tests; Lagrangian multiplier; Wald; Likelihood ratio tests.

Project Surgery

Will discuss general and individual problems with planning and implementing the project.

4. Demand Analysis (PD)

The lecture will provide an overview of demand analysis from its important historical roots to come of the more recent developments. By attending the lecture and doing the reading you should achieve an understanding of the issues and problems.

Computer class

You will estimate an Almost Ideal Demand System using data on government consumption expenditure in the UK.

5. Industry: Growth and Size (PD)

This lecture will look at the part of industrial economics that studies the growth of firms and concentration. It will provide an overview of the literature and consider the ways in which Gibrat's law has been tested, the econometric problems involved and how they have been overcome.

Computer class

You will use data on the major international defence companies to test Gibrat's law and consider changes in concentration over time. This will require the use of the Limdep package and the probit and sample selection procedures.

6. Consumption (AB)

The lecture will consider the econometric analysis of aggregate consumption from the simple Keynesian analysis to recent more advanced analyses.

Computer class

You will use UK data to analyse aggregate consumption. This will involve investigating the empirical application of consumption theory and finding the best possible representation of the time series data.

7. Student Project presentations (course team)

Students will prepare presentations of their applied econometrics project proposal, any progress they have made and problems they have come across.

8. Efficiency and Volatility (PD)

The lecture will consider the econometric analysis of financial data and the issues involved. Specifically it will focus on tests of market efficiency and the possible impact of volatility in the markets and how these can be analysed using autoregressive conditional heteroscedasticity (ARCH) models and generalised forms of them (GARCH).

Computer Class

You will be provided with data on share prices and will consider the efficiency of the market and investigate the existence and importance of volatility

9. Production Functions (PD)

The lecture will provide an overview of the different empirical analyses of production function. It will start from the basic theory of Cobb Douglas and CES functions and their problems. The problems of applying the models will then be considered for cross section and time series data and some of the past applications and developments discussed.

Computer Class

You will be given South African data and will estimate production functions and growth models and replicate a study of the economic effects of military spending.

10. Macromodelling/VARs (PD)

The lecture will consider macroeconomic modelling and the use of vector autoregression (VAR) methods. It will discuss how to set up a VAR and the criticisms of the approach before linking it to cointegration. The Johansen procedure will be outlined briefly and application of Granger causality tests discussed.

Computer Class

You will be given long data series on military spending and unemployment for the UK and the US and use them to replicate published results for a simple two variable VAR.

11. Micro Econometrics (DW/TH)

The lecture will focus on labour economics and consider the issues involved in applying

microeconomic theory to aggregate and survey data. Specifically testing human capital theory, the econometric problems that arise e.g. heteroscedasticity and omitted variable bias, and how to deal with them.

Computer Class

You will be given some disaggregate data to allow you to undertake a microeconometric analysis of the labour market. Specifically you will estimate wage regression and calculate discrimination using Limdep.

12. Panel Data (AB)

The lecture will go through the issue involved in moving to panels of data –where time series and cross sectional data are combined. An overview of the available estimation methods and the problems involved in using them will then be outlined

Computer Class

You will be given a panel of data (time series data for a cross section of industries) for South Africa and replicate the result of a study of the impact of government procurement on industrial output.

4. Module Assessment Details

This module is assessed 50% unseen exam and 50% coursework. The coursework is an applied econometrics project of less than 5,000 words and the unseen exam is a 2 hour exam which requires you to answer 2 questions from seven.

5. Coursework

As part of the assessment of this module you must produce an applied econometrics projects, which counts for one half of the marks and so it is important that you start work on it immediately and read the guidance notes carefully (see Part II). There are surgeries in weeks two and three to provide advice and guidance and you are expected to have agreed a topic and have produced a brief written proposal acceptable to your supervisor by week 3. You will then give a short presentation of your work in progress and plans on 28th March.

Note that this project should not be a major part of your dissertation.

6. Internet Resources

Module Website

Many resources for this module will be placed on the module websites. This will include reading lists, classwork instructions and datasets. The address is:

<http://bobbins.mdx.ac.uk/courses/ecs4355>

Information will be added throughout the semester so you should look at it periodically.

Suggestions for Improvement

Suggestions for improvement of any aspect of the module or documentation are welcome and can be made via the website or by emailing the individual lecturers at the addresses given above.

Part 2 Doing An Applied Econometrics Project

These notes provide advice on how to undertake a piece of applied econometrics using the skills learnt in the Econometrics course.

1. Starting

By the end of the first semester's *Methods of Economic Investigation* course you should be able to run regressions and interpret the results. The applied econometrics exercises you undertook were designed to provide you with the required skills.

You should give some thought to the topic you would like to do before the beginning of the second semester. Once the course starts you will be asked to provide a brief proposal, describing the topic, the general form of the model and the data to be used. Surgeries to provide advice and guidance will be given in the second and third weeks and you will be assigned a member of staff to provide supervision. You will be required to make a short presentation of your work in week seven.

2. Topic

You can choose any topic. Useful sources are:

- an interesting dataset
- your job if you are a part time student
- your optional subject if you are full time
- published articles
- members of staff
- foreign students might choose topics using data from their own country.

Do not put a lot of effort into the theory until you have the data and avoid choosing a topic that is too ambitious. Also, do not worry about whether the results you get are good or bad, you will be assessed on how well you analyse a problem, not on your final result.

An important way of developing your project is to replicate a published paper. Applying the researcher's model to the same data, updating the analysis, and then maybe attempting to improve upon the model. Alternatively, you could use the data for a different country, industry or time period. It is often very difficult to get exactly the same results as those published. See Dewald et al (1986).

Read empirical economics papers and try to copy their style. Have a look through some recent journals.

- American Economic Review
 - Economic Journal
 - National Institute Review
 - International Review of Applied Economics
- are good places to look for empirical papers

If you want to find a paper or book on a particular topic look in the Journal of Economic Literature, which classifies them by subject.

Do not agonise for too long over choosing a topic and once you have chosen a topic and collected the data do not be tempted to change.

The topics should involve explaining at least one variable by some others. Some examples might be standard economic relationships:

- explaining a country's imports by the level of demand, GDP; domestic process; import prices; tariffs; exchange rates.

- explaining consumption by income, inflation and wealth.

- explaining money demand by income and interest rates.

Or non-economic relationships:

- explaining attendance at football matches by ticket price, the quality of the teams, hooliganism, and the weather.

- explaining carbon dioxide concentrations by industrial production and sea temperature

- explaining crime rates by unemployment and economic factors.

3.Data

Finding the appropriate data can be the most difficult part of the project. You should check that the data is available before deciding on a topic and make sure you are clear what the data is. You can use time series data, cross section data (observations at one moment in time over countries, regions, families, etc...), or panel data which combines time series and cross section.

Make sure there are enough observations and variables. The sample size can be important in determining the techniques you can use and the precision of our results. Aim to have at least 30 observations for annual or cross section data; more for quarterly or monthly data. Unless you have experience of large data sets, or can get help in handling them, do not go much above 100 observations.

Make sure you know the exact definition of your data and what they are measuring. Terms like income and prices are not acceptable as they give little information. The sort of questions you should consider are:

Are the data current or constant price?

What is the base year?

What is the coverage (Net or Gross, Domestic UK or GB)?

Are they seasonally adjusted?

Have the definitions changed over the sample period?

If it is constructed data, how was this done?

Is the data based on a sample?

You may have to do a lot of work to make the data useable or comparable. If so provide information on this work, possibly in the form of a data appendix, so that you can be given credit.

You may have to adjust the data in various ways to deal with missing observations, to splice series on different bases, or to convert them into a different currency. Published data are not infallible, so always be on the look out for possible mistakes.

You should know something about the relevant history and institutions, such as important events, like strikes, wars, or changes of government.

Once you have loaded the data onto the computer, you should conduct a descriptive analysis. Print the data out and check carefully for typing errors. Plot the data and note the distinctive features such as trends, temporal dependencies, seasonality, unusual observations, etc. Calculate the means, variances of your variables and their correlations.

Repeat this process after you transform the data in any way:

- growth rates or ratios (the savings rate, the velocity of circulation, the share of profits) are often more informative because they are not dominated by trends.
- logarithmic transformations are often used in economic models as the coefficients can then be interpreted as elasticities; the change in the logarithm is approximately equal to the growth rate; variances are more likely to be constant; and many interesting economic hypotheses can be expressed as linear restrictions in logarithmic models.

The introduction to the article by Hendry on house prices in Hendry and Wallis (1984) is a good model for this descriptive analysis. As part of the data description for time series you should check the order of integration of the variables and whether they are co-integrated.

Where there are a number of possible measures for a series use all of them and try to decide which is best. You can report this in the project. e.g. Do wages respond more to the consumer price index or the retail price index? Do not decide a priori, test and find out.

Keep detailed notes on the sources of data and anything you do to them. Its easy to forget at a later stage. You might end up with some adjustments you made and forgot about dominating your results.

Keep at least two backed up copies of your data on separate discs, stored separately. There are many ways of loosing or corrupting disks and it can be a lot of work typing the data in again.

Sources

For UK data:

- Economic Trends Annual Supplement: is the best single source
- The Blue Book (National Income and Expenditure)
- The Annual Abstract of Statistics
- Financial Statistics
- Employment Gazette
- Family Expenditure Survey
- Census of Production
- Key Data a CSO publication provides a good introduction to what data is available and will give the relevant specialist publication.

For international data:

- World Development Report: published by the World Bank
- OECD Main Economic Indicators
- International Financial Statistics: Published by IMF

For the US:

Economic Report of the President: has an appendix giving the main economic aggregates.

Financial data:

Datastream: provides various financial and company accounts information and is available in the library. It also has some coverage of international macroeconomic and financial data. Similar but more limited data sources are available in the Hendon library.

There are also a number of publications which present data, such as:

- Maddison (1982) which gives long runs of historical data for the main capitalist countries.
- Berndt (1991) provides data on a floppy disc.

NB CSO, OECD and Eurostat data are available on disk if required. It is still a good idea to study the publications to make sure the data is what you think it is and to check on any idiosyncrasies

4. Analysis

Conduct your research with the final written project in mind. Make sure you can answer all the questions posed in the next section. Write fairly detailed notes of what you are doing and what your results are as you go along. It is very easy to forget what you did and be left with a vast pile of incomprehensible printout.

Try and organise your investigations around a few central questions. This will allow you to structure your specification search. The implicit methodology in these notes is broadly the Hendry/Spanos approach. This is not the only way to structure the analysis but it does provide a convenient framework.

5. Writing Up

Leave plenty of time for writing up, this tends to be the weakest link. In exercises like this students who can do all the rest, often fail to describe what they have done and what it all means. It should read like a good empirical paper in an economics journal, not a piece of autobiography. Read some more empirical papers and copy their style.

You are expected to type the project before submitting it, though equations can be handwritten. **Do not submit computer print outs.** You should process and digest the relevant information from them and report it in the project. Do not just transcribe the results of running dozens of regressions. Try to structure the interpretation of the results; pose questions and explain how the regressions provide answers to them. As you write up you are bound to think of something else you need to do. So start writing up early, don't leave it till the last minute.

Write about all the things the reader does not know and will need to know to understand what you have done. Do not copy large chunks of econometrics textbooks. The reader will know most of that, just give a reference.

Attempt the impossible: try to make it lively and interesting.

Introduction: Don't jump in at the middle. Introduce the subject, give some background information and refer to any relevant literature. Then explain the questions you are going to try to answer, or the problems you are going to solve and why they are interesting. Say how your project differs from other work.

Theory: Set out the economic theory and use it to specify a model. Wallis (1979) and Berndt (1991) are good on the process of moving from economic theory to econometric models. Discuss the economic interpretations of the parameters (elasticities, marginal propensities, long and short run effects, etc). Set out any a priori expectations about signs and magnitudes of the parameters. Set out any hypotheses to be tested: constant returns to scale; homogeneity; unit

elasticities. Note any identities linking the data. Discuss any identification problems.

It is often useful to think of economic theory as specifying: a long run equilibrium relationship; an adjustment process; an expectations formation process. Discuss each of these separately. Think about the time series structure of the data. You will get into trouble if you try to explain a stationary variable just by a single, highly trended, variable. Check that orders of integration match.

Remember that some theories imply that variables should follow random walks, so the basic theoretical model is that the change in the variable is a 'white noise' error, unpredictable from earlier information.

Data: Discuss the sources of the data, the exact definitions of the variables, the sample used for estimation, the correspondence of the data to the relevant theoretical concepts, the possible measurement errors etc. Describe the main features of the series, with graphs if necessary, and point out any peculiarities or outliers. Ask whether the series are stationary in levels or first differences.

Credit is given for data collection but you need to give information about it. If you have done a lot of work developing a new or unusual data set make sure you describe what you have done.

Statistical Model: Use the theoretical and the probabilistic structure of the data to choose a statistical model; linear regression model; dynamic linear regression; multivariate regression; vector autoregression; simultaneous equations model; etc. Discuss your choice of statistical model in terms of the assumptions it involves. You need to convince the reader that you have made an appropriate choice. It pays to start by trying both a simple model using just levels of the main variables (which you may want to treat as a cointegrating regression) and a fairly general model with lots of lags and variables.

Estimation and Misspecification Testing: Estimate the statistical parameters of interest and test the validity of the assumptions underlying the statistical model (no serial correlation, linear functional form, homoscedasticity, normality, constant parameters, etc). If any of the assumptions are rejected you should respecify the model and try again. With luck you should get a "well defined statistical model" that passes all the misspecification tests. Report the results briefly. How you lay out and present the results is very important. Try to copy articles in the literature.

Specification Testing and Interpretation: When you have a "well defined statistical model", then you can proceed to reparameterise/restrict the statistical model in order to construct an empirical econometric model. This involves testing economic hypotheses (eg homogeneity in prices, constant returns to scale), calculating the economic parameters of interest (eg long run solutions, elasticities), and interpreting the adjustment process (eg error correction, common factors).

Finally, evaluate your chosen empirical econometric model in the light of the original theoretical model, the estimated theoretical parameters of interest, and how your results compare with other published estimates. If you were unable to find a well defined statistical model go through this stage anyway, but point out that your results may be less reliable because of the possible misspecifications.

Conclusions: Explain the significance of the results and how they relate to the original questions or problems posed in the introduction. What is their relevance for practical questions of policy, forecasting, business? Are they consistent with theory and with institutional and historical information you might have? Is the model statistically adequate in representing the data.

References: Provide a list of works cited at the end, with references in the text of the form Berndt (1991).

References:

Berndt ER (1991) "The Practice of Econometrics", Addison-Wesley.

Dewald WG , Thursby JG and RG Anderson (1986) Replication in Empirical Economics, American Economic Review, September, p587-603.

Hendry DF and Wallis KF (eds) (1984) Econometrics and Quantitative Economics, Basil Blackwell.

Maddison A (1982) Phases of Capitalist Development, Oxford.

Wallis KF (1979) Topics in Applied Econometrics, Basil Blackwell.

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