AUTUMN TERM

Aims

Economists apply statistical methods to data in order to give empirical content to economic relations and to test economic models. This branch of economics is known as econometrics. The first term of QMII aims to provide students with basic understanding and practical experience of econometrics, with an exclusive focus on linear regression techniques.

Learning Outcomes

By the end of the Autumn term, students should

- have a basic understanding of different types of economic data and by able to manipulate such data using computer software (STATA)
- understand the statistical properties of the linear regression model
- formulate statistical hypotheses and carry out formal statistical tests of these hypotheses
- be able to apply linear regression techniques using computer software (STATA)
- be able to interpret regression output from computer software (STATA), including regression coefficients and diagnostics tests
- communicate econometric evidence in a concise and coherent written format

Course Delivery

There will be a two-hour lecture and a one-hour seminar each week.

Lectures

The lectures will combine discussion of econometric theory with demonstrative use of the econometric software STATA. Relevant reading material for each lecture will be published on Moodle.

Seminars
One problem set will be given out and discussed in the seminar each week. The problem sets involve both written questions and computer-based exercises. It is essential for meeting the learning that students make attempts at every problem set. Students should bring written answers to the seminar to be discussed by the seminar leader, but will be allowed to retain their work so that they can add comments and rectify errors during the discussion. It is unlikely that there will be time to discuss all the answers to every question in the problems sets. Answers to the problems sets will be posted on Moodle with a lag.

Most of the assigned problem sets include questions requiring the use of data sets and the STATA econometric software. Some STATA instructions will be provided. The seminars take place in computer labs.

Readings


Tentative lecture plan

Week 1: The nature of econometrics and economic data
Read Woodridge, chapter 1

Week 2: The simple regression model
Read Wooldridge, chapter 2

Week 3: Multiple regression analysis: Estimation
Read Wooldridge, chapter 3

Week 4: Multiple regression analysis: Inference
Read Wooldridge, chapter 4

Week 5: Multiple regression analysis: OLS asymptotics and further issues
Read Wooldridge, chapters 5 and 6

Week 6: Multiple regression analysis: Analysis with qualitative information
Read Wooldridge, chapter 7
Week 7: OLS and heteroscedasticity
Read Wooldridge, chapter 8

Week 8: More on specification and data issues
Read Wooldridge, chapter 9

Week 9: Basic regression analysis with time series data
Read Wooldridge, chapter 10

Week 10: Further issues in using OLS with time series data
Read Wooldridge, chapter 11

SPRING TERM

Aims
The second term of QMII is devoted to optimisation theory which in turn will use the concepts of vectors and matrices, drawn from linear algebra, and require the study of concave functions.

Course Delivery
The course will be delivered through a two-hour lecture every week, plus a one-hour seminar. Seminars will be based upon problems assigned in the previous week's lecture, some of which will come from the recommended text. Problem sets will be given weekly. Although these will not be part of the formal method of evaluation, you are advised that solving the problems will be of enormous help in examinations and tests.

Seminar attendance is compulsory and failure to attend can lead to students being issued with a formal warning.

You should prepare answers to the problems before the weekly seminars and expect to present them to the rest of the group. Skeleton solutions for a few select problems will be posted on the web, after the relevant seminars.

Reading
Although there is no set textbook for this half of the course, the lecture notes effectively serve as a text. The most appropriate standard textbook is:

Alpha Chiang and Kevin Wainwright, Fundamental Methods of Mathematical Economics, McGraw-Hill.
Note that the previous edition authored solely by Chiang is also suitable, though chapter numbers are different.

The book is a good source of additional problems beyond that ones that will be handed out. So I recommend that you buy a copy of this book should you struggle to keep up with the lectures.

Dowling, Edward T., *Theory and Problems for Mathematics for Economists*, Schaum is a cheap supplement that contains many worked examples.

Course materials will be available on Moodle and I will hand out the notes in lecture. Please go to the website for additional copies of the lecture notes.
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<tr>
<th>Week</th>
<th>Title</th>
<th>Learning Outcomes</th>
<th>Reading</th>
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<tbody>
<tr>
<td>1-3</td>
<td>Introduction to optimisation theory: linear programming</td>
<td>By the end of this topic you should understand how to set up a linear programming problem, identify its first order conditions, know what Lagrange multipliers are and understand their connection to market prices.</td>
<td>Lecture notes.</td>
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<tr>
<td>4</td>
<td>Vectors</td>
<td>By the end of this topic you should understand the concept of a vector in n-dimensional space, be able to perform basic operations on vectors, and understand the concepts of linear combinations of vectors, linear independence, and the inner product of vectors.</td>
<td>Lectures notes and Chiang and Wainwright, chapter 4, sections 1, 3</td>
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<tr>
<td>5-7</td>
<td>Matrices and solving systems of linear equations</td>
<td>By the end of this topic, you should understand the concept of matrix, know the rules of matrix algebra, know what an inverse of a matrix is and how to calculate it, be able to define the rank of a matrix, know how to perform elementary row operations on a matrix, and use matrix algebra to solve systems of linear equations.</td>
<td>Lecture notes and Chiang and Wainwright, chapter 4, sections 1-2, 3-5, and chapter 5, sections 1-4.</td>
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<td>8</td>
<td>Further applications of programming and matrix algebra: Input-output analysis.</td>
<td>By the end of this topic, you should how matrix algebra can be used for input-output analysis, understand how to calculate input requirements given an output requirement and understand how to check for productiveness of in input output system.</td>
<td>Lecture notes.</td>
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<tr>
<td>9-10</td>
<td>Concavity and nonlinear programming</td>
<td>By the end of this topic, you should know what concave functions are and understand how Lagrange multipliers can be used to solve nonlinear constrained maximisation problems and able to apply the method to various economic problems.</td>
<td>Lecture notes and Chiang and Wainwright, chapter 11, chapter 12 section 3, and chapter 13, sections 1-3.</td>
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Assessment

60% of the course grade will come from an examination taken during the summer term. The exam will test your knowledge of and understanding of the material covered in both parts of the course and your ability to manipulate and solve related problems.

Assessment comprises an Econometrics project (based on material covered in the Autumn term) to be handed in early in the Spring term. Students will have to devise their own econometric project, find data and present estimation results - to be completed by the beginning of the Spring term. More details about the project will also be given in a separate handout in the Autumn term.

The project carries a weight of 20%.

There will be a written 1 hour mid-term test in each term worth 5% each.

There will also be 1 assessed online test in each term. Each online test carries a weight of 5%.

You will receive standardised feedback on your project and tests.

Test and project hand-in dates can be found in the student handbook.