
University of Glasgow | Business School

**CENTRE FOR DEVELOPMENT STUDIES**

# BASIC ECONOMETRICS

**2010-11**

**SEMESTER ONE**

**COURSE COORDINATOR AND LECTURER: Dr Alexandros Kontonikas**

**Total number of teaching hours:** 20 hours lectures, 8 hours labs
**Course credits:** 20
**Course code:** 0SRS

## Brief description

This is a 20 credit course which consists of three parts.The first part introduces regression analysis: the basic idea behind the classical linear regression model (CLRM), the underlying assumptions, and the problem of estimation. Building on the two-variable model, we analyze a few extensions, the multiple regression model, and the matrix approach to the linear regression model. During the second part of the course, we consider hypothesis testing, and interval estimation, using both two-variable and multivariate regression models. The last part of the course analyzes the consequences on the estimators from relaxing the assumptions of the classical linear regression model, and discusses various remedies. We examine the cases of heteroskedasticity, autocorrelation, multicollinearity, non-linearity, and non-stationarity.

## Teaching

The class will meet for a total of 28 hours during the first semester, divided into ten 2-hour lectures, and four 2-hour labs. Students are strongly encouraged to communicate with the lecturer through email or phone, and come to the lecturer's office hours for any questions they may have.

## Aims and intended learning outcomes

The aim of this course is to provide students with a basic foundation in econometric analysis combining theoretical knowledge with practical problems.

By the end of the course, students should be able to:

- Explain the principles that underlie the traditional methodology in econometrics and the CLRM.
- Illustrate the mathematical derivation of the Ordinary Least Squares (OLS) estimators, the standard error of the regression, and the variance of estimators.
- Assess the predictive power of the CLRM using various measures of fit.
- Explain the standard CLRM assumptions, and use them to show that the OLS estimators are best linear unbiased estimators.
- Construct hypothesis tests and compute t-statistics and confidence intervals, to conclude whether or not there are statistically significant relationships among the variables in the model.
- Detect the violation of the standard CLRM assumptions, evaluate the effects of the breakdown on the OLS estimators and their variance, and apply some remedial procedures.
- Apply the OLS method with appropriate computer software to various types of datasets.

## Course main text

Gujarati, D.N. (2003). *Basic Econometrics*, 4th edition, London: McGraw-Hill (DG).

**Other texts**

Chiang, A. (1974). *Fundamental Methods of Mathematical Economics*, Tokyo; London: McGraw-Hill Kogakusha.
Greene, W.H. (2002). *Econometric Analysis*, 5th edition, Prentice Hall.
Gujarati, D.N. (1992). *Essentials of Econometrics*, 2nd edition, New York; London: McGraw-Hill.
Johnston, J. (1984). *Econometric Methods*, 3rd edition, New York; London: McGraw-Hill.
Kennedy, P. (1998). *A Guide to Econometrics*, 4th edition, Oxford: Blackwell.
Maddala, G.S. (2001). *Introduction to Econometrics*, 3rd edition, Chichester; New York: John Wiley.
Stock, J. and Watson, M. (2003). *Introduction to Econometrics*, Boston, Mass.; London: Addison Wesley.

**Assessment**

Students are assessed on the basis of course work (25%) and a two hour final written examination (75%). In the examination, students are required to answer two questions from a choice of four. The coursework consists of 1 quantitative / computer assignment; these will be assessed and returned to students.

**Penalty for lateness**

Penalties for late submission of coursework apply. Please refer to the MSc handbook, section 'In-course assessment'.

**Course timetable**

| *Weeks* | *Lecture* | *Tutorial / Lab* |
|---|---|---|
| Week 1 | Lecture 1 | |
| Week 2 | Lecture 2 | |
| Week 3 | Lecture 3 | |
| Week 4 | Lecture 4 | |
| Week 5 | Lecture 5 | Lab 1 |
| Week 6 | Lecture 6 | |
| Week 7 | Lecture 7 | Lab 2 |
| Week 8 | Lecture 8 | Lab 3 |
| Week 9 | Lecture 9 | |
| Week 10 | Lecture 10 | Lab 4 |

**Outline of lectures**

**PART I: Regression analysis**

**Lecture 1:** The aim of this lecture is to provide an introduction to regression analysis using the CLRM. By the end of it students should be able to:

- Explain the traditional methodology in econometrics
- Differentiate the notions of regression, causation and correlation
- Recognize the terminology and notation of regression analysis
- Compare the population regression function with the sample regression function

- Explain why the error term is important in regression analysis

*Main text reading:* DG Chapters 1 and 2.

**Lecture 2:** The aim of this lecture is to introduce various concepts and assumptions related to the estimation of a bivariate regression model. By the end of it students should be able to:

- Use the method of ordinary least squares (OLS) to compute estimators and their standard errors in the bivariate regression model
- Explain the assumptions underlying OLS in the bivariate regression model
- Explain the Gauss-Markov theorem
- Compute goodness of fit measures for the bivariate regression model

*Main text reading:* DG Chapter 3.

**Lecture 3:** In this lecture, we will analyse issues related to the estimation of a multivariate regression model. By the end of it students should be able to:

- Use the OLS method to compute estimators and their standard errors in the multivariate regression model
- Explain the assumptions underlying OLS in the multivariate regression model
- Illustrate the properties of OLS estimators
- Compute goodness of fit measures for the multivariate regression model

*Main text reading:* DG Chapter 7.

**Lecture 4:** In this lecture we will explain the matrix approach to multivariate regression modelling. By the end of it students should be able to:

- Write the matrix representation of the k-variable regression model
- Explain the OLS assumptions in matrix format
- Compute the vector of OLS estimators and their variance-covariance matrix
- Illustrate the properties of the vector of OLS estimators

*Main text reading:* DG Appendix C.

**PART II: Interval estimation and hypothesis testing**

**Lecture 5:** The aim of this lecture is to introduce the concepts of interval estimation and hypothesis testing using the bivariate regression model. By the end of it students should be able to:

- Explain the interval estimator
- Construct a confidence interval
- Perform hypothesis testing using the confidence interval, and *t*-test of significance approaches

*Main text reading:* DG Chapter 5.

**Lecture 6:** The aim of this lecture is to explain how various hypotheses can be tested within the multivariate regression model. By the end of it students should be able to:

- Test hypotheses about individual coefficients
- Test the equality of two coefficients
- Test joint hypotheses
- Test linear restrictions

*Main text reading*: DG Chapter 8.

**PART III: Relaxing the assumptions of the classical linear regression model**

**Lecture 7:** The aim of this lecture is to analyse the problem of heteroskedasticity. By the end of it students should be able to:

- Summarize the sources of heteroskedasticity
- Illustrate the consequences of heteroskedasticity for OLS estimators and their variances
- Detect heteroscedasticity using formal and informal methods
- Apply remedial measures for heteroskedasticity

*Main text reading:* DG Chapter 11.

**Lecture 8:** The aim of this lecture is to analyse the problem of autocorrelation. By the end of it students should be able to:

- Summarize the sources of autocorrelation
- Illustrate the consequences of autocorrelation for OLS estimators and their variances
- Detect autocorrelation using formal and informal methods
- Apply remedial measures for autocorrelation

*Main text reading:* DG Chapter 12.

**Lecture 9:** In this lecture we will analyse various issues related to multicollinearity, non-linearity and non-stationarity. By the end of it students should be able to:

- Summarize the sources of multicollinearity
- Illustrate the consequences of multicollinearity for OLS estimators and their variances
- Distinguish between intrinsically linear and non-linear regression models
- Contrast stationary with non-stationary processes

*Main text reading:* DG Chapters 10, 14, 21.

- **Lecture 10:** In this lecture we will analyse some academic papers that have applied regression analysis to examine economic and/or finance-related hypotheses of interest.

*Main text reading:* TBA.

**Labs outline**

**Lab 1:** The aim of this lab is to provide an introduction to applied regression analysis using appropriate econometric software. By the end of it students should be able to:

- Input and save data files
- Perform data transformations and preliminary data analysis
- Perform graphical analysis
- Specify a linear regression model and compute OLS estimates

**Lab 2:** The aim of this lab is to show how to conduct hypothesis testing using appropriate econometric software. By the end of it students should be able to:

- Perform hypothesis testing in a bivariate regression model
- Perform hypothesis testing in a multivariate regression model

**Lab 3:** The aim of this lab is to demonstrate additional regression models and explain the regression's diagnostics. By the end of it students should be able to:

- Specify and estimate an autoregressive model
- Interpret the regression's diagnostics
- Test for structural stability using sub-sample regressions
- Specify and estimate a dummy variable model

**Lab 4:** TBA