



Econometrics

Degree in Economics

2018/2019 2º S

Course Leader

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COURSE DESCRIPTION

This course is aimed at students that understand the basic principles of probability and statistical inference. It intends to study a manifold of techniques to model cross-sectional and time series data. It focuses on the adequacy of the estimation methods to the nature of the data, model evaluation and interpretation of quantitative results obtained from empirical examples. The contents cover estimation and inference in linear regression models; topics on functional form specification (quadratic and interaction terms, qualitative explanatory variables), heteroskedasticity, time series regressions and autocorrelation.

COURSE PRE-REQUISITES

Students should have undergraduate courses in mathematics, probability and statistics equivalent to the following disciplines of ISEG – ULisboa: Mathematics I, Mathematics II, Statistics I and Statistics II.

COURSE OBJECTIVES

This course intends to introduce the estimation of simple models that describe the behavior of economic variables. It focuses on multiple linear regression models with ordinary least squares (OLS) estimation and inference for applications to cross-sectional and time series data with focus on trending, seasonal and non-stationary data. It also intends to give the student the understanding of the drawbacks of OLS to deal with specific situations related to real economic data. Overall, it intends to provide the basic skills in specifying and interpreting models applied to a variety of economic problems and data using the appropriate software and to emphasize the critical assessment of results delivered by the empirical studies.

COURSE LEARNING OUTCOMES

Upon successful completion of this course students will be able to:

- To understand the basic assumptions and concepts of the Multiple Linear Regression Model for cross-section data;
- To understand the mechanics of OLS estimator;
- To specify and test hypotheses on the context of the Linear Regression Model;
- To test the validity of the fundamental assumptions of OLS and deal with their violations.
- To understand the basic assumptions and concepts of the Multiple Linear Regression Model for Time Series;
- To specify and estimate models for time series that capture specific features of the data like trends and seasonality.
- To use econometric software (EViews).
- To conduct correctly empirical basic studies with real economic data.
- To critically assess existent studies.



PROGRAM

I – Topics on Regression Analysis with Cross-Sectional Data

1. Introduction: The Nature of Econometrics and Economic Data (W1)

- 1.1 Introduction
- 1.2 The scope of econometrics (W1.1)
- 1.3 The structure of economic data (W1.3)
- 1.4 Theoretical models and empirical models
- 1.5 Causality and the notion of *ceteris paribus*

2. The Multiple Linear Regression Model (MLRM) and Ordinary Least Squares (OLS) (W3)

- 2.1 The MLRM
- 2.2 The OLS estimator (W3.2)
- 2.3 Interpretation of OLS estimates for different functional forms (W3.2)
- 2.4 Goodness of fit (W3.2)
- 2.5 The Expected value of OLS estimators (W3.3)
- 2.6 The Variance of OLS estimators. Efficiency. (W3.3 and W3.4)
- 2.7 Additional topics

3. Inference in the Multiple Linear Regression Model (W4)

- 3.1 Introduction
- 3.2 Sampling distributions of the OLS estimators (W4.1)
- 3.3 Confidence intervals (W4.3)
- 3.4 Testing Hypotheses about a single coefficient: the *t* test (W4.2)
- 3.5 Testing Hypotheses about a single linear combination of the coefficients (W4.4)
- 3.6 Testing Hypotheses about multiple linear restriction: The *F* test. (W4.5)

4. Asymptotic results for OLS

- 4.1 Consistency
- 4.2 Asymptotic normality

5. Topics on Functional Form (W6)

- 5.1 Models with quadratics (W6.2)
- 5.2 Models with interaction terms (W6.2)
- 5.3 Testing functional form misspecification: The RESET test (W9.1)

6. Multiple Regression Analysis with Qualitative Information: Dummy variables (W7)

- 6.1 Describing Qualitative Information (W7.1)
- 6.2 A Single Dummy Independent Variable (W7.2)
- 6.3 Using Dummy Variables for Multiple Categories (W7.3)
- 6.4 Interactions Involving Dummy Variables (W7.4)
- 6.5 Testing for differences in the regression functions across groups: The Chow test (W7.4)

7. Heteroskedasticity (W8)

- 7.1 Definition of Heteroskedasticity and consequences for OLS estimators (W8.1)
- 7.2 Heteroskedasticity-robust inference after OLS estimation of the coefficients (W8.2)
- 7.3 Estimation when the heteroscedasticity is known up to a multiplicative constant (W8.4)
- 7.4 Testing for heteroskedasticity (W8.3)



II - Regression Analysis with Time Series Data

8. Basic Regression Analysis with Time Series Data (W10)

- 8.1 The Nature of Time Series Data (W10.1)
- 8.2 Examples of Time Series Regression Models (W10.2)
- 8.3 Finite Sample Properties of OLS under Classical Assumptions (W10.3)
- 8.4 Functional Form and Dummy Variables (W10.4)
- 8.5 Trends and Seasonality (W10.5)

9. Further Topics in Using OLS with Time Series Data (W11)

- 9.1 Stationary and Weakly Dependent Time Series (W11.1)
- 9.2 Asymptotic Properties of OLS (W11.2)
- 9.3 Using Highly Persistent Time Series in Regression Analysis (W11.3)
- 9.4 Dynamically Complete Models and the Absence of Serial Correlation (W11.4)

10. Serial Correlation

- 10.1 Properties of OLS with Serially Correlated Errors (W12.1)
- 10.2 Testing for Serial Correlation (W12.2)
- 10.3 Differencing and Serial Correlation (W12.4)

TEXTS

- **Principal**

- Wooldridge, J. M. (2013) [W], *Introductory Econometrics: A Modern Approach*, 5th. ed., international edition, South Western, Cengage Learning.

- **Auxiliary**

- Stock, J. H e Watson, M. W. (2011), *Introduction to Econometrics*, 3rd. ed., Pearson, Addison Wesley.

ASSESSMENT

- **Assessment method:** The student needs a final grade of 10 (in a scale of 0-20) in order to successfully complete the course. The assessment will be based on a final exam according to the Evaluation Regulation of ISEG. In all tests and exams, the student is allowed to use Statistical Tables and a Formula Sheet (2 pages maximum). The Formula Sheet is elaborated by the student.