Econometrics
Degree in Economics
2016/2017

Course Leader
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COURSE DESCRIPTION

This course is aimed at students that have an understanding of 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 focus 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 provide an introduction to 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. Topics on Functional Form (W6)
4.1 Models with quadratics (W6.2)
4.2 Models with interaction terms (W6.2)
4.3 Testing functional form misspecification: The RESET test (W9.1)

5. Multiple Regression Analysis with Qualitative Information: Dummy variables (W7)
5.1 Describing Qualitative Information (W7.1)
5.2 A Single Dummy Independent Variable (W7.2)
5.3 Using Dummy Variables for Multiple Categories (W7.3)
5.4 Interactions Involving Dummy Variables (W7.4)
5.5 Testing for differences in the regression functions across groups: the Chow test (W7.4)

6. Heteroskedasticity (W8)
6.1 Definition of Heteroskedasticity and consequences for OLS estimators (W8.1)
6.2 Heteroskedasticity-robust inference after OLS estimation of the coefficients (W8.2)
6.3 Estimation when the heteroscedasticity is known up to a multiplicative constant (W8.4)
6.4 Testing for heteroskedasticity (W8.3)

II - Regression Analysis with Time Series Data

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

7.1 The Nature of Time Series Data (W10.1)
7.2 Examples of Time Series Regression Models (W10.2)
7.3 Finite Sample Properties of OLS under Classical Assumptions (W10.3)
7.4 Functional Form and Dummy Variables (W10.4)
7.5 Trends and Seasonality (W10.5)

8. Further Topics in Using OLS with Time Series Data (W11)
8.1 Stationary and Weakly Dependent Time Series (W11.1)
8.2 Asymptotic Properties of OLS (W11.2)
8.3 Using Highly Persistent Time Series in Regression Analysis (W11.3)
8.4 Dynamically Complete Models and the Absence of Serial Correlation (W11.4)

9. Serial Correlation
9.1 Properties of OLS with Serially Correlated Errors (W12.1)
9.2 Testing for Serial Correlation (W12.2)
9.3 Differencing and Serial Correlation (W12.4)

TEXTS

- **Principal**
  — Wooldridge, J. M. (2012) [W], *Introductory Econometrics: a Modern Approach*, 5th. ed.,South Western. [W]

- **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 final grade may be achieved by attending one of the two alternatives:

  — **Alternative A1:** Assessment based on coursework which comprises the following tasks:

    - The resolution of **5 problem sets**. The final grade of this component, C1, (in a scale of 0-20) is equal to the <u>sum of the 4 best grades</u>.

    - **Two 1-hour tests**. The final grade of this component, C2, (in a scale of 0-20) is equal to the sum of the grades in both tests.

    - The Final grade of the course, F, results from a weighted average of C1 and C2 such that: **F = 0.35C1 + 0.65C2**. It is required though, that **C2 is no less than 7.5** in order to successfully complete the course.

    — **Alternative A2:** Assessment based in a final 2-hours written exam according to the General

The students are strongly advised to choose assessment based on coursework.

- **Problem Sets:** the exercises of the problem sets are based on the subjects taught in the previous 2 weeks.

- **Tests:** the first 1-hour test is delivered in the week break for mid-term assessments and covers the subjects from chapter 1 until section 5.3 (inclusive) of the program. The second one is delivered in the Regular assessment period and covers the remained subjects of the program. When doing the second 1-hour test, the student may choose also to repeat the first 1-hour test. In that case the grade obtained in the mid-term assessment is necessarily replaced by the grade obtained in the former.

- In all tests and exams Statistical Tables and a Formula Sheet (2 pages maximum) are allowed. The Formula Sheet is elaborated by the student.

SCHEDULE OF CLASSES

Subject	Theoretical	Exercises
I – Topics on Regression Analysis with Cross-Sectional Data	**13**	**8**
1. Introduction: The Nature of Econometrics and Economic Data	1	0
2. The Multiple Linear Regression Model (MLRM) and Ordinary Least Squares (OLS)	3	2
3. Inference in the Multiple Linear Regression Model	3	2
4. Topics on Functional Form	1	1
5. Multiple Regression Analysis with Qualitative Information: Dummy variables	3	2
6. Heteroskedasticity	2	1
II - Regression Analysis with Time Series Data	**9**	**3**
7. Basic Regression Analysis with Time Series Data	4	1
8. Further Topics in Using OLS with Time Series Data	3	1
9. Serial Correlation	2	1
Total	**22**	**11**
Total available	**23**	**11**