

ECONOMETRICS

IE University

Professor: **RODRIGO ALEGRIA HUERTA**

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Academic year: 23-24

Degree course: SECOND

Semester: 1^o

Category: BASIC

Number of credits: 6.0

Language: English

PREREQUISITES

MATHEMATICS, STATISTICS, PROGRAMMING IN R

SUBJECT DESCRIPTION

Econometrics is the application of statistics tools and mathematical methods to describe, analyse and predict economic and business phenomenon. The main concern of Econometrics is related with the art of using economic theory and statistical techniques to analyse real world data sets.

This is an introductory Econometrics course. Students will learn the basic techniques to analyse, model and interpret business and economic data. On one hand, the course will provide a broad training in **basic econometric methods and tools**, mostly related to linear regression analysis. On the other hand, students will learn **practical applications** to real economic and business problems using those econometric approaches. Particular emphasis is given to the careful interpretation of numerical results and to understanding the implications of those results for economic policy and business decision making.

OBJECTIVES AND SKILLS

The course aims to provide students with a rigorous reasoning using the econometric approach when analysing problems and making decisions. Students will also learn practical applications mostly related within an economic and business context.

Objectives to be attained along the course:

- Apply econometric techniques for making decisions with quantitative and categorical data within an economic and business context.
- Understand the regression model (simple and multiple), its scope and limitations.
- Interpret and evaluate relationships between variables using econometrics.
- Understand and drive the properties of OLS.
- Interpret, evaluate and apply inferential methods to linear regression.
- Understand the use and implications of data scaling, functional form and dummy variables in regression modelling.
- Identify the presence of estimation problems.

- Acquire fluency in the use of R software in order to apply econometric techniques using real world data.

Skills to be acquired during the course:

- Fostering a logic and rigorous reasoning when facing quantitative analysis.
- The analysis and critical assesment of numerical results.
- The ability to formulate, express and solve a problem or question with a model.
- The ability to identify the relevant elements when facing a business decision.

METHODOLOGY

There will be a distribution 50/50 between theoretical and practical sessions.

Lectures:

Theoretical sessions will be concerned with the study of the different econometric tools. The appropriate use of mathematical and statistics concepts and methods is very relevant in this part of the course. Along the different lectures, examples and/or dicussions about real applications will be provided in order to improve the understanding of the different theoretical concepts.

Classes:

Practical sessions will consist on discussions about practical worksheets so called Problem Sets. The exercises of the Problem Sets can be found in a document, **Course Pack: Problem Sets**, that will be provided to students at the beginning of the course. Students are required to work by themselves on these Problem Sets that will be provided in advance to the due date.

Computer Classes:

In addition, practical sessions are complemented with **computer classes** along the course. Students will learn how to use R software in order to apply econometric techniques with real data sets. Part of the evaluation will consist on a computer exam with real data using R software. Computer classes are supported with a document, **Course Pack: R Guideline**, providing instructions about the software and computer exercises to practice.

The **program** of the course is divided into five parts (units) that are detailed in the next section (PROGRAM):

- UNIT 1: INTRODUCTION: sessions 1-5.
- UNIT 2: LINEAR REGRESSION MODEL (LRM): sessions 6-14.
- UNIT 3: HYPOTHESIS TESTING: sessions:15-19.
- UNIT 4: DUMMY VARIABLES: sessions: 20-23.
- UNIT 5: ESTIMATION PROBLEMS: sessions 24-30.

The sessions within each of the units are a combination of theoretical and practical classes (lectures, problem sets and computer classes).

In the below table you can find the teaching methodology by time dedication.

Teaching methodology	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	20.0 %	30 hours
Discussions	0.0 %	0 hours
Exercises	20.0 %	30 hours
Group work	20.0 %	30 hours
Other individual studying	40.0 %	60 hours
TOTAL	100.0 %	150 hours

PROGRAM

SESSION 1 (LIVE IN-PERSON)

PRESENTATION

Lecture 1: Presentation of the programme, aims and guidelines of the course. Definition of Econometrics and its applications.

SESSION 2 (LIVE IN-PERSON)

REVIEW OF STATS. & BASIC CONCEPTS IN ECONOMETRICS

Lecture 2: Definition of population, sample, random variable, expected value, summary statistics, graphical analysis and correlation analysis.

SESSION 3 (LIVE IN-PERSON)

ESTIMATOR & ITS PROPERTIES

Lecture 3: Definition of estimator and its properties: unbiasedness, efficiency, consistency and sufficiency.

SESSION 4 (ASYNCHRONOUS)

COMPUTER CLASS

R1: Introduction to R. Descriptive, graphical and correlation analysis.

SESSION 5 (LIVE IN-PERSON)

PRACTICAL CLASS

Problem Set 1: Descriptive, graphical and correlation analysis.

SESSION 6 (LIVE IN-PERSON)

INTRODUCTION TO LINEAR REGRESSION ANALYSIS

Lecture 4: The simple linear regression model and its assumptions.

SESSION 7 (LIVE IN-PERSON)

OLS ESTIMATION AND PROPERTIES OF THE REGRESSION COEFFICIENTS (I)

Lecture 5: Ordinary Least Squares estimation method. Model derivation and interpretation of the estimated coefficients. Determination coefficient. Unbiasedness and precision of the regression coefficients. Gauss-Markov theorem.

SESSION 8 (LIVE ONLINE)

OLS ESTIMATION AND PROPERTIES OF THE REGRESSION COEFFICIENTS (II)

Lecture 6: Ordinary Least Squares estimation method. Model derivation and interpretation of the estimated coefficients. Determination coefficient. Unbiasedness and precision of the regression coefficients. Gauss-Markov theorem.

SESSION 9 (LIVE IN-PERSON)

TRANSFORMATION OF VARIABLES

Lecture 7: Transformations in a new variable. Logarithmic, semilogarithmic and quadratic transformations.

SESSION 10 (LIVE IN-PERSON)

MULTIPLE LINEAR REGRESSION MODEL

Lecture 8: Model derivation and interpretation of the estimated coefficients.

SESSION 11 (ASYNCHRONOUS)

COMPUTER CLASS

R2: Linear regression analysis.

SESSION 12 (LIVE IN-PERSON)

PRACTICAL CLASS

Problem Set 2: Linear regression analysis.

SESSION 13 (LIVE IN-PERSON)

REVIEW SESSION

Review 1: Midterm review (Discussion and Q&A).

SESSION 14 (LIVE IN-PERSON)

MIDTERM EXAM

Exam 1: Mid-term exam covering Unit 1 and Unit 2 of the course.

SESSION 15 (LIVE IN-PERSON)

HYPOTHESIS TESTING (I)

Lecture 9: One-tailed test and two-tailed test (normal and Student tests).

SESSION 16 (LIVE IN-PERSON)

HYPOTHESIS TESTING (II)

Lecture 10: Overall F-test. F-test for the addition of a group of variables and F-test for linear restrictions in the coefficients.

SESSION 17 (LIVE IN-PERSON)

DISCUSSION CLASS

Lecture 11: Practical applications and discussion of mid-term results.

SESSION 18 (ASYNCHRONOUS)

COMPUTER CLASS

R3: Hypothesis testing.

SESSION 19 (LIVE IN-PERSON)

PRACTICAL CLASS

Problem Set 3: Hypothesis testing.

SESSION 20 (LIVE IN-PERSON)

DUMMY VARIABLES (I)

Lecture 12: Definition, application, types and interpretation. Hypothesis Testing with DV. Chow test.

SESSION 21 (LIVE IN-PERSON)

DUMMY VARIABLES (II)

Lecture 13: Definition, application, types and interpretation. Hypothesis Testing with DV. Chow test.

SESSION 22 (ASYNCHRONOUS)

COMPUTER CLASS

R4: Dummy variables.

SESSION 23 (LIVE IN-PERSON)

PRACTICAL CLASS

Problem Set 4: Dummy variables.

SESSION 24 (LIVE IN-PERSON)

ESTIMATION PROBLEMS (I)

Lecture 14: Specification errors. Measurement errors. Multicollinearity problem. Non-linearity. Outliers.

SESSION 25 (LIVE IN-PERSON)

ESTIMATION PROBLEMS (II)

Lecture 15: Definition, causes and how to detect heteroscedasticity.

SESSION 26 (ASYNCHRONOUS)

COMPUTER CLASS

R5: Estimation problems.

SESSION 27 (LIVE IN-PERSON)

PRACTICAL CLASS

Problem Set 5: Estimation problems.

SESSION 28 (LIVE IN-PERSON)

COMPUTER EXAM

Exam 2: Computer exam using R.

SESSION 29 (LIVE IN-PERSON)

REVIEW SESSION

Review 2: Final review, Q&A.

SESSION 30 (LIVE IN-PERSON)

FINAL EXAM

Exam 3: Final exam covering all the content of the course.

BIBLIOGRAPHY

Recommended

- Wooldridge, J.M. (2019). *Introduction to Econometrics: A modern approach*. 7th edition. Thompson Learning. ISBN 9781337558860 (Printed)

EVALUATION CRITERIA

ORDINARY EVALUATION

Your final grade in the course will be based on a combination of different items that are described in the following table:

Criteria	Percentage	Comments
Class Participation	10 %	Participation
Intermediate Tests	20 %	Mid Term Exam
Workgroups	20 %	Computer Exam
Final Exam	50 %	Final Exam

A. CLASS PARTICIPATION (10%)

Two main criteria will be used in reaching judgment about your class participation:

1-Attendance: Attendance to class is compulsory. (1) Students must comply with the 70% attendance rule. Otherwise they will lose their 1st and 2nd chance, and go directly to the 3rd one (they will need to enrol again in this course next academic year). (2) Punctuality will be taken into consideration when grading this assistance item and the teacher reserves the right to allow attendance to class to those students not being on time. Finally, (3) general attitude and behaviour in class will be also considered. Students affecting the class environment in a negative way will lose points in the assistance grade.

2-Active participation: participation in class will be evaluated positively if students: (1) attain a threshold quantity of contributions that is sufficient for making a reliable assessment of comment quality. Additionally, (2) participation will be evaluated in quality terms. A high quality comment reveals depth of insight, rigorous use of case evidence, consistency of argument, and realism. A high quality presentation of ideas must consider the relevance and timing of comments, and the flow and content of the ensuing class discussion. It demands comments that are concise and clear, and that are conveyed with a spirit of involvement in the discussion at hand.

B. MID-TERM EXAM (20%)

The mid-term exam will take place in **session 14** and will cover Units 1 and 2 of the content of the course. More details about this exam will be provided in advance in class.

C. COMPUTER EXAM (20%)

Students are also expected to write a R computer exam at the end of the second semester (**session 28**). This exam will give you the opportunity to reflect on what you have learnt during the course and specially in the computer classes and apply it to some practical problems. This exam mainly consists in solving and discussing some questions about a case study in econometrics with real data using R software. This exam is in group (no more than 4 students per group). More details about this exam will be provided in advance in class.

D. FINAL EXAM (50%)

The final exam will take place at the end of the second semester (**session 30**) and will cover all the content of the course. More details about this exam will be provided in advance in class.

IMPORTANT: In order to pass the course, you need a minimum grade of 5 in the final exam. If your grade in the final exam do not reach the threshold value of 5, you will fail the course, even the case in which your weighted average of the course exceeds 5.

Additionally, given that the dates of exams are provided in advance, no exceptions will be made. If you do not attend an exam (for whatever reason), this will automatically imply a 0 in this part of the course. Please take this into consideration when planning your semester and your attendance.

GENERAL OBSERVATIONS

Each student has four attempts over two consecutive academic years to pass this course.

For every BIE Program mandatory class, students are required to obtain the minimum grade of 5 required to pass the course. **Students whose grade in the Final Exam (or the largest assignment) is below 5 will fail the course.** The rule applies to whichever assignment carries the greatest weight to the final grade. Dates and location of the final exam will be posted in advance and will not be changed.

Students must attend at least 70% of the sessions. Students who do not comply with the 70% attendance rule will receive a 0.0 on their first and second attempts and go directly to the third one (they will need to enroll in this course again the following academic year).

Students who are in the third or fourth attempt must contact the professor during the first two weeks of the course.

ATTENDANCE

In-person attendance is mandatory at IE University, as it is an essential factor of IE's learning methodology. While we do closely monitor attendance in each course, we also consider our students responsible for their own agenda and commitments, as adult university students. With that in mind, each student may miss up to 30% of the sessions within a given course and still maintain the possibility of passing that given course. This 30% "buffer" is to be used for any absences, such as: illnesses, personal emergencies, commitments, official/governmental matters, business and/or medical appointments, family situations, etc. Students should manage their various needs, and situations that may arise, within that 30% buffer. If a student is absent to more than the allowed 30% of the sessions (regardless of the reason), s/he will obtain a 0.0 grade for that course in both the ordinary and extraordinary calls of the current academic year, and s/he will have to retake the course during the following academic year.

Please pay close attention to your attendance. The program strongly encourages attending 100% of the sessions as it will improve your learning outcomes, it will increase the class performance and it will benefit your participation grade. Noncompliance with deadlines for Non-Classroom Learning activities or assignments will result in an absence for the session.

Extreme cases involving emergencies such as: extended hospitalizations, accidents, serious illnesses and other cases of force majeure, are to be consulted with the Program Management (bir.biemadrid@ie.edu) for assessment of the situation and corresponding documentation, in order to support and guide each student optimally.

For more information about the university attendance policy, please check; <https://www.ie.edu/student-guide/bir/policies-and-guidelines/attendance/>

RETAKE POLICY

Any student whose weighted final grade is below 5 will be required to sit for the retake exam to pass the course (except those not complying with the attendance rules, whom are banned from this possibility).

Grading for retakes will be subject to the following rules:

- The retakes will consist of a comprehensive exam or equivalent assignment. The grade will depend only on the performance on this exam; continuous evaluation over the semester will not be taken into account.
- Dates and location of the retakes will be posted in advance and will not be changed.
- The exam/assignment will be designed bearing in mind that the passing grade is 5 and the maximum grade that can be attained is 8 out of 10.

PLAGIARISM / ACADEMIC HONESTY

Plagiarism is the dishonest act of presenting another person's ideas, texts or words as your own. This includes in order of seriousness of the offense:

- providing faulty sources;
- copy-pasting material from your own past assignments (self-plagiarism) without the instructor's permission;
- copy-pasting material from external sources even while citing them;
- using verbatim translations from sources in other languages without citing them;
- copy-pasting material from external sources without citing them;
- and buying or commissioning essays from other parties.

IEU students must contact the professor if they don't know whether the use of a document constitutes plagiarism. For help with your academic writing, contact the Writing Center (writingcenter@faculty.ie.edu). The professor will also advise the student on how to present said material. All written assignments must be submitted through Turn-it-in, which produces a similarity report and detects cases of plagiarism. Professors are required to check each student's academic work in order to guarantee its originality. If the originality of the academic work is not clear, the professor will contact the student in order to clarify any doubts. Students using external tutorial support should report it to the professor and the BIR Program from the moment they began receiving this support. In the event that the meeting with the student fails to clarify the originality of the academic work, the professor will inform the Director of the Bachelor Program about the case, who will then decide whether to bring the case forward to the BIR Academic Review Panel. Very high similarity scores will be automatically flagged and forwarded to the Academic Review Panel. Plagiarism constitutes a very serious offense and may carry penalties ranging from getting a zero for the assignment to expulsion from the university depending on the severity of the case and the number of times the student has committed plagiarism in the past.

PROFESSOR BIO

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RODRIGO ALEGRIA HUERTA

Rodrigo Alegría got his Bachelor in Economics from Universidad de Navarra (2001). At a postgraduate level, he got a Master in Economics and Finance from Universidad de Navarra (UN) and a Master in Regional Economics from London School of Economics (LSE). He also holds a title in Big Data (UN). He has worked mainly as a researcher in different research centers such as UN in Pamplona, Geography Department (LSE), Centre for Economic Performance (LSE) and European Institute (LSE) all of them in London. As a professor he has lectured in Spain and United Kingdom and has visited different countries such as Greece, Netherlands, United States or France for conferences and seminars. He is currently an adjunct professor at IE University and at other institutions lecturing quantitative courses such as maths, statistics, data analysis and econometrics. He is also the co-director of the EconData Lab at IE University. His interests focus on urban, regional and international economics with a special interest in the spatial econometrics analysis of MNEs' location choices.

OTHER INFORMATION

Office hours and contact details

- **Office hours:** To be announced (or by email to set a date and time).
- **Contact details:** r Alegria@faculty.ie.edu

CODE OF CONDUCT IN CLASS

1. Be on time. Students arriving more than 5 minutes late will be marked as "Absent". Only students that notify in advance in writing that they will be late for a specific session may be granted an exception (at the discretion of the professor). Students attending online must always have their cameras on during the session or risk being marked absent.
2. If applicable, bring your name card and strictly follow the seating chart. It helps faculty members and fellow students learn your names.

3. Do not leave the room during the lecture: Students are not allowed to leave the room during lectures. If a student leaves the room during lectures, he/she will not be allowed to re-enter and, therefore, will be marked as "Absent". Only students that notify that they have a special reason to leave the session early will be granted an exception (at the discretion of the professor).
4. Do not engage in side conversation. As a sign of respect toward the person presenting the lecture (the teacher as well as fellow students), side conversations are not allowed. If you have a question, raise your hand and ask it. If you do not want to ask it during the lecture, feel free to approach your teacher after class. If a student is disrupting the flow of the lecture, he/she will be asked to leave the classroom and, consequently, will be marked as "Absent".
5. Use your laptop for course-related purposes only. The use of laptops during lectures must be authorized by the professor. The use of Social Media or accessing any type of content not related to the lecture is penalized. The student will be asked to leave the room and, consequently, will be marked as "Absent".
6. No cellular phones: IE University implements a "Phone-free Classroom" policy and, therefore, the use of phones, tablets, etc. is forbidden inside the classroom. Failing to abide by this rule entails expulsion from the room and will be counted as one absence.
7. Escalation policy: 1/3/5. Items 4, 5, and 6 above entail expulsion from the classroom and the consequent marking of the student as "Absent." IE University implements an "escalation policy": The first time a student is asked to leave the room for disciplinary reasons (as per items 4, 5, and 6 above), the student will incur one absence, the second time it will count as three absences, and from the third time onward, any expulsion from the classroom due to disciplinary issues will entail 5 absences.

