COURSE GUIDE

ECONOMIC STATISTICS

**Degree in Economics and International Business
University of Alcalá**

Academic Year 2019/2020
First Year – Second Term

GENERAL INFORMATION

Subject:	Economic Statistics
Code:	360005
Degree Title:	Economics and International Business
Department and Area	Department of Economics Quantitative Methods for Economics and Business
Module type:	Basic Training
ECTS credits:	9 ECTS
Year and Term:	First year, second term
Teaching Staff:	• Luis F. Rivera Galicia (luisf.rivera@uah.es) • Marcelo Sartarelli (marcello.sartarelli@uah.es) • Eva Senra Díaz (eva.senra@uah.es)
Staff Consultation Hours:	Will be published at the beginning of term
Language of Teaching:	English

1. MODULE DESCRIPTION

Economic Statistics is taught in the first year of the degree in International Business and Economics, in the second term. This basic course introduces students to the fundamental concepts of Statistics from the practical point of view of data analysis. As this is a foundation course, the only requirement is to have studied mathematics at high school level or equivalent.

This module deals with the basic concepts of statistics that will be applied generally to support and develop other topics covered throughout this degree. The material covered will be used to analyze and interpret published statistical information relating to different aspects of economics. The student will also learn to ascertain how to draw general conclusions regarding economics. Furthermore, the material covered will help the student to develop advanced quantitative analysis techniques and methodologies that will be dealt with in more depth in postgraduate studies.

Studying economic statistics is compulsory and is of the utmost importance as it will be applied to other topics covered later in this degree. The knowledge gained will allow the student to explore later topics in more depth using the same statistical methodology.

Requirements: Basic knowledge of calculus, and analytical and graphical command of variable functions at high school level or equivalent.

2. LEARNING OUTCOMES

The student is expected to develop the following skills through studying this module. These will be assessed throughout the term, see below for details of assessment methods.

General skills:

1. Applying common sense and logical reasoning.
2. Ability to transfer theoretical knowledge to empirical problems.
3. Learning independently.
4. Expressing ideas and giving oral presentations.

Subject-specific skills:

1. Handling factual information and preparing it for applied analysis.
2. Being familiar with the concepts and basic methods of Descriptive Statistics, the Theory of Probability and the Theory of Statistical Inference.
3. Describing and interpreting one-dimensional economic data.
4. Measuring and modelling basic dependence relations between statistical variables from a descriptive perspective.
5. Summarizing the temporal evolution of complex stochastic economic characteristics through statistical indexes and their use to solve economic problems.
6. Using temporal stochastic evolution models from a basic descriptive perspective to make preliminary predictions based on its components.
7. Identifying typical one-dimensional stochastic processes (Normal, Bernoulli, Binomial and Poisson).
8. Estimating and testing statistical hypotheses of mean variable values and the proportion of success in binary variables.
9. Using spreadsheets for statistical data analysis.

3. SYLLABUS

Blocks	Total number of classes, credits or hours
I. Description of statistical variables Following a brief introduction to the content and the basic concepts of random phenomena that will be studied throughout the module, the student will learn the tabulation, representation and concise description of one-dimensional statistical micro-data, focusing on aspects of economic interest, such as concentration and two-dimensional statistical data.	See itinerary and timetable below
II. Descriptive models for the analysis of statistical dependence and the dynamics of economic phenomena. The next block will begin with the description of statistical dependence relationships between variables by means of correlation. The student will then learn how to describe the functional form of potential dependence relationships through descriptive regression techniques. The description and analysis of the temporal evolution of random phenomena will be studied from various perspectives as it is of utmost importance in economic activity. Firstly, it will be studied from the perspective of descriptive decomposition techniques in the one-dimensional time series. Secondly, it will be studied from the perspective of its application for prediction and methodology of indices when dealing with complex stochastic phenomena.	See itinerary and timetable below
III. Random phenomena, theory of probability and statistical inference A brief introduction to the Theory of Probability is given as a foundation for the population study of stochastic phenomena that will be addressed throughout this module. In this introduction, the student will revise events, probability, random variables and their probability distribution and essential characteristics. They will study the basic Binomial, Poisson and Normal population models which can accurately reproduce a large number of common stochastic behaviour patterns in the economic sphere. Lastly, the student will be given a brief introduction to sampling and estimation theories as well as statistical and estimation hypotheses before studying and applying estimation processes (point and interval estimation). Statistical hypothesis testing will also be studied to make inferences on the mean value of a variable and to calculate the proportion of binary variables.	See itinerary and timetable below
The content of this module will be presented in a practical way that can be applied to real-world economic situations and agents.	

Itinerary

PART I	**Description of one-dimensional and two-dimensional statistical variables**	
Lesson 1	INTRODUCTION TO STATISTICS	Statistics and random phenomena. Population, elements and characters. Methods of observation. Measuring the Characters: Variables and measure scales. Steps in a Statistical Study. Qualitative and Quantitative Data. Tables. Frequency distributions: absolute, relative, accumulated. Graphs.
Lesson 2	DESCRIPTION OF UNIVARIATE DATA SETS (I)	Location Measures. Non-central tendency measures. Measures of central tendency.
Lesson 3	DESCRIPTION OF UNIVARIATE DATA SETS (II)	Variability Measures. Moments. Measures of Shape. Graphical Summary: The box and whiskers plot. Concentration measures. Transformation of Variables.
PART II	**Descriptive models for analyzing statistical dependence and the dynamics of economic phenomena**	
Lesson 4	2-DIMENSIONAL STATISTICS AND STATISTICAL DEPENDENCE	Information of a two-way table. Two-way tables: correlation and contingency tables. Marginal Frequency distributions. Conditional Frequency distributions. Moments in two-way tables. Statistical independence.
Lesson 5	REGRESSION AND CORRELATION	Introduction to dependence modelling. Least-square regression. Correlation: degree of intensity in the dependence relationship. Forecasting with the linear model. Introduction to non-linear regression.
Lesson 6	TIME SERIES DESCRIPTIVE ANALYSIS	Introduction to the dynamic characteristics of variables. Time Series components. Models. Methods to compute the trend. Methods to compute the seasonal variations. Forecasting. Seasonal adjustment. Rates of growth.
Lesson 7	INDEX NUMBERS (I)	Introduction to the analysis of complex phenomena dynamics. Simple index numbers. Non-weighted composite index numbers. Weighted composite index numbers: Laspeyres and Paasche index numbers. The elaboration of index numbers by groups. Variation rate, effect and share.
Lesson 8	INDEX NUMBERS (II)	Base shifting. Renewal and linking of two series. Value index numbers and deflating. Chain index numbers. The Consumer Price Index (CPI).

PART III	**Random Phenomena, Theory of Probability and Statistical Inference**	
Lesson 9	RANDOM PHENOMENA AND PROBABILITY MODELS	Random phenomena. Events and operations with events. The axiomatic definition of probability and the assignment of probabilities to events. Conditional probability. Independence. Law of Total Probability and Bayes Theorem.
Lesson 10	RANDOM VARIABLES AND FUNDAMENTAL CHARACTERISTICS	Introduction. Random variable. Distribution Function of a random variable. Discrete one-dimensional random variable. Continuous one-dimensional random variable. Characteristics of the random variables: Mean and variance. Standardization of a random variable. Introduction to two-dimensional random variables.
Lesson 11	MAIN PROBABILITY DISTRIBUTIONS	Introduction Main discrete distributions: Bernoulli, Binomial and Poisson distributions. Main continuous distributions: Normal distribution. Central Limit Theorem.
Lesson 12	INTRODUCTION TO ESTIMATION	Populations, parameters, samples and estimators. Desirable properties for point estimators. Main point estimators and their characteristics. Point estimation in normal populations. Point estimation with big samples. Introduction to confidence intervals. Most common confidence intervals.
Lesson 13	INTRODUCTION TO HYPOTHESIS TESTING	Introduction to hypothesis testing. Test statistic and its sampling distribution. Rejection and acceptance regions. Typical errors in hypothesis testing. Steps to make a test. Most common hypothesis tests.

TIMETABLE
(Timetable is approximate and will vary according to the teaching calendar)

Lessons will take the form of group seminars (all students on the course), tutorials (small group classes) and practical exercises.

Week	Content
1	Lesson 1: INTRODUCTION TO STATISTICS Group tutorial/seminar: Basic required foundation knowledge. Practical exercise: Introduction to using spreadsheets.
2	Lesson 2: DESCRIPTION OF UNIVARIATE DATA SETS (Part I) Practical exercise: Tables and graphs of discrete statistical variables and attributes. Practical exercise: Tables and graphs of continuous statistical variables and attributes.
3	Lesson 3: DESCRIPTION OF UNIVARIATE DATA SETS (Part II) Practical: Description of discrete attributes and variables. Practical exercise: Averages.
4	Lesson 4: 2-DIMENSIONAL STATISTICS AND STATISTICAL DEPENDENCE Practical exercise: Description of continuous variables: Measures of concentration.
5	Lesson 5: REGRESSION AND CORRELATION Practical exercise: Two-dimensional tabulation and description of marginal and conditional distributions. Practical exercise: Linear dependence and regression. Group seminar/tutorial (lessons 1-4).
6	Lesson 6: TIME SERIES DESCRIPTIVE ANALYSIS Test 1- Written test on lessons 1-4 (part of continuous assessment). Practical exercise: Regression and correlation.
7	Lesson 7: INDEX NUMBERS (Part I) Practical exercise: Time series: Calculating trends and seasonal component. Practical exercise: Time series: prediction, seasonal adjustment and evolution rates.
8	Lesson 8: INDEX NUMBERS (Part II) Practical exercise: Index calculation. Practical exercise: group indices and analysis of index variation. Group seminar/tutorial (Lessons 5-8).
9	Lesson 9: RANDOM PHENOMENA AND PROBABILITY MODELS Practical exercise: Basis change, time series link and deflation. Practical exercise: modelling events, operations of events and calculating probability Seminar/ Group tutorial (Lessons 1-8)
10	Test 2- Written test on lessons 1-8 (part of continuous assessment). Practical exercise: Assigning probability and calculus applied to probability.
11	Lesson 10: RANDOM VARIABLES AND FUNDAMENTAL CHARACTERISTICS Practical exercise: Characteristics of one-dimensional random variables. Practical exercise: Calculating probabilities and quantiles using tables and spreadsheets.
12	Lesson 11: MAIN PROBABILITY DISTRIBUTIONS Practical exercise: Normal distribution. Practical exercise: Binomial and Poisson distributions.
13	Lesson 12: INTRODUCTION TO ESTIMATION Practical exercise: Point and confidence interval estimation. Seminar / group tutorial (Lessons 9-12).
14	Lesson 13: INTRODUCTION TO HYPOTHESIS TESTING Practical exercise: Parametric tests of hypothesis for the mean and proportion Seminar/group tutorial: (Lessons 1-13).
15	Test 3- Written test on lessons 1-13 (part of continuous assessment) + final exam (during examination period).

4. LEARNING AND TEACHING METHODS

4.1. Distribution of credits

72 contact hours	Theory classes: 19.5 hours (thirteen 90-minute lessons) Practical classes: 34.5 hours (twenty-three 90-minute lessons) Group seminars + group tutorials: 9 hours (six 90-minute lessons) Tests: 6.5 hours (3 tests lasting 90, 120 and 180 minutes respectively) ECTS tutorials: 2.5 hours
Independent study: 153 hours	
Total hours of study: 225 hours	

4.2. Teaching methods, materials and resources

Theory lessons (attendance contributes to final grade)	• Theoretical concepts and practical applications are taught in lectures. These lectures guide students' research and cover the topics detailed in the module program. • The fundamental aim of these lessons, together with the corresponding homework tasks, is to develop all the course-specific skills listed on page 3 of this guide through studying theory. Attending these lessons also helps to reinforce the general skills (1-3). • Classes are taught in large groups using an overhead projector and follow the module timetable shown above. • The bibliography given below should be used for the research project based on these lessons. Additional relevant ad-hoc materials (slides, examples etc.) are also provided on the university virtual learning platform (Blackboard). • These lessons are worth approximately 0.78 ECTS credits altogether.

Practical classes (attendance contributes to final grade)	• Classes are taught in various formats, including lectures and interactive seminars. In lectures, problem-solving methods are explained. The student will solve economic case studies by applying the theoretical concepts covered in the module. In seminars, the student will have the opportunity to contribute to problem-solving and discuss the methods used. • These lessons, in addition to the homework tasks set, help to develop all the subject-specific skills listed on page 3 of this handbook through applied or practical tasks. They also help to reinforce the general skills listed. • Lessons are taught in small groups using the overhead projector, whiteboard and computer spreadsheets. • The bibliography given below should be used for homework tasks related to these lessons. Additional relevant ad-hoc materials is also provided on the university virtual learning platform. • These lessons are worth approximately 1.38 ECTS credits altogether.
Applied assignments	• Throughout the term the student must do various applied assignments covering a range of topics studied in this module. They will analyse micro-data using computer technology. • In addition to developing the subject-specific skills relating to theoretical and practical topics through each assignment, doing these assignments will develop subject-specific skill 1 listed above and general skills 1-3. • These assignments are worth approximately 1.4 ECTS credits.
Practical small group seminars + group tutorials (attendance contributes to final grade)	• The practical assignments students must do are discussed in small-group seminars. Students must also attend group tutorials in which the tutor addresses and directs the learning process as well as clarifying any doubts students have and giving advice about tests students must sit as part of continuous assessment. • General skills 1, 2 and 4 mentioned above are developed during these lessons. • Lessons are taught in small groups. The overhead projector, whiteboard and computer spreadsheets are used. • These lessons are worth approximately 0.36 ECTS credits altogether.
Tests (contribute to final grade)	• Students must sit written tests throughout the term as part of continuous evaluation. These include theory and practical elements and are based on all previous classes. See module timetable for test schedule. • These tests are worth approximately 0.26 ECTS credits altogether.
Independent and/or group assignment	• Students must carry out an independent and/or group assignment. The aim of this is to learn and consolidate theoretical concepts as well as to become competent in resolving case studies and interpreting results. • This assignment is worth approximately 3.52 ECTS credits. • Students must prepare in advance for tests in order to demonstrate their knowledge of the subject and achieve the highest possible grades. • These tests are worth approximately 1.2 ECTS credits.
ECTS tutorials (attendance contributes to final grade)	• Attending these tutorials is worth approximately 0.1 ECTS credits.

5. ASSESSMENT: Assessment methods, marking criteria and grading scale

> **IMPORTANT**:
> The following instructions explain the assessment methods used in this course. Please, note that **the assessment system will depend on the teaching staff and to the number of students per group. Students will be duly informed at the beginning of term.**

Standard assessment procedure

A. Continuous assessment:

The student will usually adopt the process of continuous assessment. If this is unsuitable due to extenuating circumstances, the student may be allowed to accomplish a single final exam instead, depending on approval from the Dean of the School. See section B below for details about this final exam. This agrees with the University of Alcalá's "Regulations for assessment", dated 24th March 2011.

To pass continuous assessment, the student must perform the following: attend classes, actively participate in class, solve cases studies and applied tasks (individual and group tasks) and take theoretical tests throughout the term. The student must successfully complete at least 75% of the tasks set during the term.

Subject-specific skills will be assessed in the following three ways:
- Theory: Assessment of the student's knowledge of theory content.
- Theory in practice: Assessment of the student's ability to select, adapt and empirically apply statistical instruments taught in theory classes.
- Application: Assessment of the student's ability to adapt and apply course material to solve practical problems using real-world data and ICT.

The student must take written tests throughout the term as part of the continuous assessment process, as detailed in the module timetable. These tests assess the material covered up until that date and last approximately the same time as a theory lesson. The maximum duration of the final exam is 3 hours.

- **Assessment criteria: Theoretical dimension of course-specific skills (worth 30% of final score)**
    - The theory section of the written mid-term tests consists of:
        - Multiple choice questions. For each wrong answer, 50% of the mark for that question is deducted; and/or
        - Theoretical essay questions: The student must give and defend their opinion. Answers must be short as space may be limited.

- **Assessment criteria: Theoretical-practice dimension of course-specific skills (worth 45% of final score)**
    - In written mid-term tests, there is clearly defined 'theory in practice' section that consists of theoretical-practical exercises like those completed in class.

o **Assessment criteria: Applied course-specific skills (worth 20% of final score)**
  ▪ Throughout the term the student must carry out various applied tasks and/or resolve case studies using computer technology. This assesses the student's ability to apply these skills.

o **Assessment criteria: General skills (worth 5% of final grade)**
  ▪ Throughout the term the tutor will observe and evaluate the students' participation in classes and their general performance in tests and other activities.

The student must obtain at least 30% in each of the above continuously assessed areas to pass the course. The final grade will be calculated from the weighted average of points obtained in each of the aforementioned skill areas. Zero points will be given for any assignment or test that has not been completed. The student must obtain at least 50% of the maximum possible overall grade to pass.

B. Final Exam

If extenuating circumstances prevent any student from following the continuous assessment process and he/she wishes to be assessed by a final exam instead, he/she must submit a written request to the Dean of the School of Economics during the first two weeks of the term explaining why continuous assessment is unsuitable for him/her. Acceptable reasons for this that do not require further investigation include doing an internship, work obligations, family obligations, health reasons and disabilities, among others. This is in accordance with article 3.2 of the University of Alcalá's "Regulations of Assessment", published on the 24th March 2011. In this case, the student will take a final exam lasting up to 3 hours. The following assessment criteria will be used:

o **Assessment criteria: Theory (worth 30% of final grade)**
  ▪ The theory section of the final exam consists of the following:
    ● Multiple choice questions. For each wrong answer, 50% of the mark for that question is deducted; and/or
    ● Theoretical essay questions: The student must give and defend their opinion. Answers must be brief as space is limited.

o **Assessment criteria: 'theory in practice' dimension of subject-specific skills (worth 45% of final grade)**
  ▪ In the final exam, there is a clearly defined 'theory in practice' section consisting of theoretical-practical exercises like those done in class.

o **Assessment criteria: 'applied' dimension of subject-specific skills (worth 20% of final grade)**
  ▪ At the beginning of the final exam, the student must hand in all applied assignments and/or resolved case studies that were set throughout the term. They will be assessed on these. The student must keep in contact with their tutor throughout the term and communicate with them at least a month before sitting the exam so that the required assessment materials can be prepared.

o **Criteria for assessment of general skills (worth 5% of final grade):**
  The aforementioned general skills will be assessed through the student's performance in exams.

To pass the module by this method, the student must obtain at least 30% in each of the

assessment areas. The final grade will be calculated from the weighted average of each of the above assessment areas. No points will be given for any work not completed. The student must obtain at least 50% overall to pass this module.

Examination resit period:
If a student does not pass the course during the standard assessment period (*convocatoria ordinaria*), he/she must take another exam during the designated examination resit period (*convocatoria extraordinaria*). The nature of this assessment will be like that stated above in the section entitled 'B. FINAL EXAM'.

Final Score:
The student will receive a numeric decimal score which corresponds to a qualitative classification. (This conforms to the European Credit Transfer System Royal Decree 1125/2003 which stipulates that the student must receive a numeric decimal grade and a qualitative classification). The grading scale is as follows:

0.0 – 4.9   FAIL (SUSPENSO)

5.0 – 6.9   PASS (APROBADO)

7.0 – 8.9   VERY GOOD (NOTABLE)

9.0 – 10   EXCELLENT (SOBRESALIENTE)

9.0 – 10   OUTSTANDING (MATRICULA DE HONOR, limited to a maximum of 5% of students)

6. BIBLIOGRAPHY

Required reading:

Parts I and II (and III, Lesson 7):
 CASAS, J.M.; et al. (2010): Estadística para las Ciencias Sociales. Ed. Centro de Estudios Ramón Areces.
Reminder of part III:
 CASAS, J.M.; CORTIÑAS, P.; ZAMORA, A.I. (2010): Estadística económica y empresarial. Distribuciones e inferencia. Ed. Centro de Estudios Ramón Areces.
Practical exercises:
 CASAS, J.M.; GARCIA, C.; RIVERA, L.F; ZAMORA, A.I. (2006): Ejercicios de Estadística: Descriptiva y Probabilidad para Economía y Administración de Empresas. Ed. Pirámide.
 CASAS, J.M.; GARCIA, C.; RIVERA, L.F; ZAMORA, A.I. (2006): Ejercicios de Inferencia Estadística y muestreo para Economía y Administración de Empresas. Ed. Pirámide.
 SLAGER, D. (2016): Essential Excel 2016. A Step-by-Step Guide. Apress.
 WINSTON, W.L. (2016): Microsoft Excel 2016. Data Analysis and Business Modelling. Microsoft Press.

Further reading

Parts I and II:
 CASAS, J.M.; SANTOS, J. (2002): Introducción a la Estadística para Economía. Ed. Centro de Estudios Ramón Areces.
 MARTIN PLIEGO, J.J. (1994): Introducción a la Estadística Económica y Empresarial (Teoría y Práctica). Ed. AC.
 URIEL, E.; MUÑIZ, M. (1988): Estadística Económica y Empresarial. Teoría y ejercicios. Ed. AC.
Part III:
 ARANDA, J.; GÓMEZ, J. (1992): Fundamentos de Estadística para Economía y Administración de Empresas. Ed. PPU.
 ARNAIZ, G. (1990): Introducción a la Estadística Teórica. Ed. Lex Nova.
 CANAVOS, C.G. (1987): Probabilidad y Estadística. Aplicaciones y Métodos. Ed. McGraw-Hill.
 CASAS, J.M. (2000): Estadística I: Probabilidad y Distribuciones. Ed. Centro de Estudios Ramón Areces.
 CASAS, J.M. (1997): Inferencia Estadística. Ed. Centro de Estudios Ramón Areces.
 CASAS, J.M. (1996): Tablas y Fórmulas Estadísticas. Ed. Centro de Estudios Ramón Areces.
Practical exercises:
 LÓPEZ ORTEGA, J. (1994): Problemas de Inferencia Estadística. Ed. Flores Tebar.
 MARTIN, F.J.; MONTERO, J.M.; RUÍZ-MAYA, L. (2000): Problemas de Inferencia Estadística. Ed. AC.
 SANZ, J.A.; VEDATE, A.; RIVAS, A.; GONZALEZ, J. (1996): Problemas de Estadística Descriptiva y Empresarial. Ed. Ariel.
 TOLEDO, I. Y ARNAIZ, G. (1989): Problemas de Estadística. Ed. Lex Nova.

Additional learning materials are available on the university online learning platform (Blackboard).