UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Statistics for Finance - 2

2324-2-E1803M048-T2

Learning objectives

This course is about regression analysis, probability theory and statistical inference. The topics covered in this course will be supplemented with examples which illustrate their application economics and finance.

Contents

The first part of this course is about regression analysis based on the least squares method. This part of the course introduces methods and indexes related to least squares regression and illustrates applications in economics and finance.

The second part of this course deals with modeling of stochastic phenomena. This part of the course introduces probability theory according to Kolmogorov's axiomatic approach as well as some basic concepts of probability theory such as random variables, distributions, quantiles, joint distributions, expected value, variance, moments and moment generating functions. Some well known distribution families will be introduced too.

The third and final part of this course deals with statistical inference. Some basic concepts such as random samples, estimators, point estimates and confidence intervals will be introduced. Applications will be confined to estimation of means and proportions.

Detailed program

First part:

- Interpolation and interpolation methods

- The least squares method and least squares regression lines

- Properties of residuals of least squares regression lines

- The deviance decomposition

- The coefficient of determination

- The linear correlation coefficient

- Interpolation with power functions

- Least squares regression planes

- Properties of residuals of least squares regression planes

- The deviance decomposition for the least squares interpolation plane

- The coefficient of determination of the least squares interpolation plane

- The coefficient of multiple correlation

- Partial correlation coefficients

- Interpolation with generalized Cobb-Douglas production functions

- Least squares hyperplanes and extensions for the case of more than two independent variables

Second part:

- Probability interpretations and methods for assigning probabilities

- Kolmogorov's axioms

- Classes of events, fields and sigma-fields

- The basic laws of probability

- Basic concepts of combinatorics

- Conditional probability, (global) independence, total probability law and Bayes' theorem

- Random variables, distribution functions, probability mass functions, density functions and quantiles

- Joint distribution functions, (globally) independent random variables, joint probability mass functions, conditional probability mass functions, joint density functions

- Expected value, variance and moments

- Relevant discrete distributions: Bernoulli distributions, hypergeometric distributions, binomial distributions, trinomial distributions, geometric distributions, negative binomial distributions and Poisson distributions

- Relevant continuous distributions: exponential distributions, gamma distributions, normal distributions, lognormal distributions and the Pareto distributions

Third part:

- Estimation problems, sample random variables, estimators

- Mean square error, unbiasedness, efficiency and consistency

- Sample mean, sample proportion and the sample variance

- Confidence intervals for means and proportions

- Introduction to statistical hypothesis testing

Prerequisites

Basic knowledge of mathematics and statistics.

Teaching methods

During the covid-19 emergency period physical presence lessons will be replaced by online videos and web conferences.

Assessment methods

The exam is made up of a written and oral part. The oral part takes place some days after the written part. Both parts contribute to the final grade in the same way.

In the written part of the exam students are required to answer two open questions and to solve four exercises. The open questions test students' ability to explain the relevance of the course contents to find solutions to real-world problems, while the four exercises test students' ability to apply those contents in order to solve practical problems. The oral part of the exam is an open conversation about the topics treated during the course.

Students can choose to split the written part of the exam into two parts by taking the first part of the written exam at the end of April/the beginning of May and the second part of the written exam concomitantly with the regular exam sessions of June or July. Both parts of the written exam are made up of one open question and two exercises. Student who choose to split the written part of the exam into two parts are required to take the oral part of the exam after having completed both written parts.

During the Covid-19 emergency period both the written and oral parts of the exam will be held online. The written part will be managed by the RESPONDUS proctoring system, while the oral part will be held through the Webex web conferencing system. In order to ensure publicity of oral examinations, public links will be made available through the e-learning platform.

Textbooks and Reading Materials

Lecture notes

M. Zenga “Metodi statistici per l’Economia e l’Impresa”, Ed. Giappichelli; 1994

M. Zenga “Modello probabilistico e variabili casuali”, Ed. Giappichelli, 1995;

M. ZENGA, Elementi di Inferenza, Vita e Pensiero;

S.M. ROSS, Introduzione alla Statistica, Apogeo 2008, (solo capitolo 9)

Semester

Second semester.

Teaching language

Italian

Sustainable Development Goals

QUALITY EDUCATION