UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Statistica - 2

2627-1-E3305M006-T2

Learning objectives

Economic disciplines study a variety of phenomena often showing different features. This course provides the main statistical methods to collect, represent, synthetize and analyze data for such phenomena. Students will learn how to select and apply the suitable statistical method to describe single phenomena and/or to interpret their relations.

Expected learning outcomes (Dublin Descriptors):

Knowledge and understanding
Students will learn the fundamental concepts of descriptive statistics and the most important methodologies to summarize data.

Applying knowledge and understanding
Students will learn to apply the introduced methodologies to socio/economic data.

Making judgements
Students will develop good autonomy of judgment in order to identify which technique/tool is methodologically correct to answer certain questions starting from the empirical evidence provided by the data.

Communication skills
Students will learn how to use the statistical technical language in order to effectively convey the conclusions obtained from data.

Learning skills
Deep knowledge of the fundamental/basic concepts of statistics will make the student autonomous in learning more sophisticated statistical techniques.

Contents

The course provides the main tools for synthesizing the main features of statistical data and for analyzing the relations between them. The meaning of Statistics: Statistics as a science, Applications of Statistics, The branches of Statistics. Summarizing univariate data: Data collection, Ratios of statistical data, Frequency distributions and graphical displays, Central tendency measures, Variability measures, Concentration measures, Skewness and Kurtosis measures, Mathematical models for frequency distributions. Summarizing multivariare data: Main interpolation methods, The least squares method, The least square line and its properties, Bivariate and partial frequency distributions, Independence and association measures, The regression function and the regression line, Concordance and correlation measures, The least square plane, Multiple correlation in the case of more than one independence variable.

Detailed program

1. Introduction to Statistics

2. Statistics and its partitions
· Descriptive Statistics
· Inferential Statistics

3. Foundations of descriptive Statistics
· Statistical data definition
. How to observe and collect survey and population data
. Data collection, examination and selection
. Preparation of data and statistical tables
. Statistical-mathematical data processing.

4. Statistical Ratios
· Their definition, aims and use
· Ratios of statistical data: composition ratio, density ratio, derivation ratio, coexistence ratio
. Index Numbers

5. Univariate descriptive Statistics
· Absolute, relative, cumulated, retro-cumulated and specific frequencies

· Graphical tools for representing frequency distributions.

· The means: the mode, the median and quantiles (quartiles, deciles, centiles, ...), the bipolar mean, the arithmetic mean, the harmonic mean, the quadratic mean and the geometric mean. Annual average variation rate and mean index number.

· Variability of qualitative data: general concept indeces.

· Variability of quantitative data: general concept and classification of the indeces. Absolute indices of variability: intervals of variation, mean deviation from a mean value, mean difference. Relative indices of variability

· Concentration (inequality): general concept and fields of applications. Alternative approaches to inequality: Bonferroni, Zenga, Gini. Lorenz diagram and Gini concentration ratio as a ratio among areas. Requirements of inequality measures.

· Asymmetry: general concept, within the study of the shape of a distribution. The definition of symmetry for a unit distribution and for a frequency distribution. Indices for measuring the direction and intensity of asymmetry.

· Kurtosis: general concept and Pearson's kurtosis index

· Models for the analytic representation of frequency distribution for continuous variables. General requirements. The normal curve: its analytical formulation, properties and usage. The standard normal curve and the usage of its statistical tables. Criteria for data normality.

6. Interpolation
· General definition and usage
· Interpolation of a given set of points
· Interpolation among a given set of points
. Choice of the interpolating curve and of the fitting criterium.
. The Least square fitting method.
. The least square line: parameters and properties
. Analysis of the residuals and of the goodness of fit.
. Interpolation with some non-linear functions.

7. Bivariate descriptive statistics
· Bivariate frequency distributions
· Dependence in distribution (association)
. Distributive independence and maximum dependence
. The contingencies
. Measures of association and interpretation of the dependence in distribution
· Mean dependence and the case of mean independence
. Pearson correlation ratio as a measure of the degree of mean dependence
· The regression line and the least square line for a bivariate frequency distribution, with the assessment of its goodness of fit.
· The positive and negative linear correlation among variables.
. The covariance and its properties.
. The Bravais-Pearson linear correlation coefficient: definition, properties, usage and interpretation.
. Further concordance measures: Kendall's Tau and Spearman's rho

8. Regression and correlation for three variables
· Introduction
· Some models
· The least square method
· The least square plane
· The least square parameters
· Properties of the residuals and of the least square plane
· Total variance, residual and explained variance
· Goodness of fit of the interpolating plane
· Improvement of the goodness of fit, when passing from the least square line to the least square plane
· Total and partial regression coefficients
· Multiple correlation coefficient
· Partial correlation coefficients
· Linearization in multiple regression

Prerequisites

Basic concept of mathemtical analysis such as the derivatives of a function.

Teaching methods

Traditional teaching method: lectures and practical sessions. In all lessons, a "mixed" approach is adopted: erogative teaching will alternate with interactive teaching in variable proportions. Typically the "interactive component" will be greater during practical sessions. Approximately, interactive teaching regards 30% of the course.

Assessment methods

The exam is written and oral. The written test contains exercises. To solve the excercises, the students have to produce the corresponding solutions. The exercises measure students' ability in the application of the statistical concepts to solve simple practical problems. Students who achieve a sufficient written test gain access to the oral exam. The oral exam is a discussion on the written test and on subjets/indicators of the program. These theoretical questions tests students' knowledge and understanding of the main concepts of the subject. The ability to comment the practical problems and to express the concepts with an appropriate language will be also considered in the global evaluation.

Textbooks and Reading Materials

M. Zenga "Lezioni di statistica descrittiva", Ed. Giappichelli, 2014
M. Zenga "Metodi statistici per l'Economia e l'Impresa", Ed. Giappichelli, 1994
D. Piccolo, "Statistica per le decisioni", Ed. Il Mulino, 2004
G. Leti "Statistica descrittiva", Ed. Il Mulino, 1983
M. Zenga "Esercizi di statistica", Ed. Giappichelli, 1993
M. Zenga "Richiami di matematica", Ed. Giappichelli, 1992
Material made available by the teacher on the e-learning page

Semester

Second semester

Teaching language

Italian

Sustainable Development Goals

QUALITY EDUCATION