UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Statistical Analysis for Business Processes

2526-1-F7703M006-F7703M006-1

Learning objectives

The course aims to provide students with training in the use of statistical information to support business decision-making, with particular reference to the analysis of economic and financial performance, the evaluation of business processes, and control and audit activities.
Through a methodological and applied approach, the course seeks to develop quantitative and critical skills useful for interpreting economic and managerial phenomena and for managing data from both internal and external sources of the firm.

At the end of the course, the student will be able to:

- understand the role of statistical information in business decision-making processes, distinguishing among different data sources (internal, external, official statistics, Big Data) and assessing their quality, reliability, and limits of use;
- correctly interpret and compare data and statistical indicators related to business phenomena, using statistical ratios, index numbers, and other summary measures for the analysis of economic and managerial dynamics;
- analyze firms' economic and financial performance through the use of financial statement ratios and multivariate statistical techniques, such as principal component analysis and cluster analysis, in order to support comparative evaluations and performance assessments;
- understand and apply the main statistical concepts underlying operational audit activities, with particular reference to the definition of the population, sample selection, error estimation, and the assessment of precision and confidence levels;
- use and compare the main sampling techniques employed in auditing (simple random sampling and monetary unit sampling), assessing their conditions of applicability and correctly interpreting the results obtained;

- develop critical autonomy in updating the statistical skills acquired, adapting them to different business, control, and reporting contexts.

Contents

The course addresses the use of statistical information to support business decision-making, analyzing data sources, their quality, and the main techniques for interpreting and comparing business phenomena. It explores the evaluation of firms' economic and financial performance through the analysis of financial statement ratios and the application of multivariate statistical techniques. The course also covers the concepts and methods of statistical sampling in support of control and operational audit activities.
The theoretical approach is complemented by practical activities in the R environment, aimed at developing operational skills using business data (real or simulated).

Detailed program

Methodological Part (27 hours)

1 AVAILABILITY AND PRODUCTION OF STATISTICAL INFORMATION
1.1 Statistical information for firms: general concepts and definitions
1.2 Internal sources: the corporate information system
1.3 External sources: official statistics and private statistics
1.4 The ISTAT and Eurostat websites
1.5 Statistical quality and official statistics
1.6 Big Data: types, characteristics, and their use in firms and by producers of official statistics
1.7 Ad hoc data production: sample surveys
1.8 Selected case studies

2 INTERPRETATION AND COMPARISON OF DATA RELATED TO BUSINESS PHENOMENA
2.1 Interpretation and comparison of statistical data: general criteria
2.2 Statistical ratios
2.3 Simple index numbers

3 EVALUATION OF FIRMS' ECONOMIC AND FINANCIAL PERFORMANCE
3.1 Evaluation of firm performance: general concepts
3.2 Financial statements and financial ratios
3.3 Statistical analysis of financial ratios
3.4 Principal component analysis
3.5 Cluster analysis

4 STATISTICAL CONCEPTS RELATED TO OPERATIONAL AUDITING
4.1 Sampling method
4.2 Selection method
4.3 Projection (estimation)
4.4 Precision (sampling error)
4.5 Population
4.6 Sampling unit
4.9 Materiality
4.10 Tolerable error and planned precision

4.11 Variability
4.12 Confidence interval and upper error limit
4.13 Confidence level
4.14 Error rate

5 SAMPLING TECHNIQUES FOR OPERATIONAL AUDITING
5.1 General framework
5.2 Conditions for the applicability of sampling methods
5.3 Notation

6 SAMPLING METHODS
6.1 SIMPLE RANDOM SAMPLING
6.1.1 Conventional approach
6.1.1.1 Introduction
6.1.1.2 Sample size
6.1.1.3 Projected error
6.1.1.4 Precision
6.1.1.5 Evaluation
6.1.1.6 Example

6.2 MONETARY UNIT SAMPLING
6.2.1 Conventional approach
6.2.1.1 Introduction
6.2.1.2 Sample size
6.2.1.3 Sample selection
6.2.1.4 Projected error
6.2.1.5 Precision
6.2.1.6 Evaluation
6.2.1.7 Example

6.2.2 Conservative approach
6.2.2.1 Introduction
6.2.2.2 Sample size
6.2.2.3 Sample selection
6.2.2.4 Projected error
6.2.2.5 Precision
6.2.2.6 Evaluation
6.2.2.7 Example

R Laboratory (8 hours)
Introduction to the R environment: structure, basic commands, packages
Data import and management
Sampling
Principal component analysis
Cluster analysis

Prerequisites

A basic knowledge of descriptive statistics (univariate and bivariate), probability (random variables and main distributions), and statistical inference is required, with particular reference to point and interval estimation.

Teaching methods

The course includes 27 hours of traditional classroom teaching and 8 hours of interactive activities in the statistics lab (using R). If the laboratories are unavailable due to renovation work, the activities will be divided between in-class sessions and remote sessions, both conducted using the virtual lab environment.

Assessment methods

The exam consists of a written test and either a project work or an oral examination.

WRITTEN TEST
The written test consists of four exercises to be completed in 2 hours:

- two exercises on sampling;
- two exercises on multivariate analysis.
  Students must choose and complete one sampling exercise and one multivariate analysis exercise.
  Each exercise is worth a maximum of 15 points.

PROJECT WORK
Students who choose to complete the project work must submit the assignment by 17/01/2025. The grade obtained in the project work contributes to the final module grade with a weight of 30%.
The final grade will therefore be composed as follows:

- 30%: project work grade;
- 70%: written exam grade.
  Any bonus points earned through the submission of coursework during the academic year will be added to the final score.

ORAL EXAMINATION
Students who choose to take the oral examination must sit an oral exam covering the entire syllabus.
The grade obtained in the oral examination contributes to the final module grade with a weight of 30%.
The final grade will therefore be composed as follows:

- 30%: oral examination grade;
- 70%: written exam grade.
  Any bonus points earned through the submission of coursework during the academic year will be added to the final score.

Textbooks and Reading Materials

- Teaching materials provided during the course: slides, exercises, and datasets to support theoretical and practical activities.
- Biggeri, L., Bini, M., Coli, A., Grassini, L., & Maltagliati, M. (2023). Statistica per le decisioni aziendali. Seconda edizione, Pearson. (Chap. 1, 2, 3.1-3.3, 8.1-8.5)
- Commissione Europea (2017). Guida ai metodi di campionamento per le autorità di audit (Chap. 1, 2, 3, 4.1-4.5, 5, 6.1.1, 6.3.1, 6.3.5)

Semester

First semester

Teaching language

Italian language

Sustainable Development Goals

INDUSTRY, INNOVATION AND INFRASTRUCTURE