UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Construction of Socio-Economic Scenarios

2627-1-F6303M003-F6303M003-2

Learning objectives

The course provides students with a core set of statistical and econometric tools for social science applied research.

KNOWLEDGE AND UNDERSTANDING
By the end of the course, students should be able to:

- identify and understand the knowledge questions that lead to the construction of socio-economic scenarios, with particular attention to research and evaluation questions;
- recognize and understand which statistical or econometric methodology is most appropriate to address the knowledge question posed, given the available data;
- understand the differences between various statistical and econometric methods;
- assess whether a methodology is correctly applied to the available data;
- interpret and critically understand the results obtained.

APPLYING KNOWLEDGE AND UNDERSTANDING
By the end of the course, students should be able to:

- define and formulate knowledge questions that lead to the construction of socio-economic scenarios, with a specific focus on correctly framing research and evaluation questions;
- design an empirical strategy to address the knowledge question using available data;
- competently apply basic statistical and econometric methods;
  -demonstrate mastery of appropriate methods for the analysis of economic and social data, at both micro and macro levels, including forecasting;
- use a suitable statistical software to analyze data, also with the support of generative AI tools;
- clearly present and comment on the results of the analysis, also with the support of generative AI.

MAKING JUDGEMENTS
By the end of the course, students should be able to:

- develop a critical attitude toward the methods and results of empirical analyses;
- independently assess the adequacy of a methodology in relation to the research problem and available data;
- identify possible limitations in the results obtained or in evidence-based decision-making processes.

COMMUNICATION SKILLS
By the end of the course, students should be able to:

- clearly and rigorously communicate the steps of an empirical analysis, from question formulation to result interpretation;
- present results in written, oral, and visual formats (tables, charts, summary texts);
- use appropriate language, both technical and accessible, depending on the audience (academic, technical, institutional, or general public).

LEARNING SKILLS
By the end of the course, students should be able to:

- independently update and deepen their methodological and applied knowledge;
- critically use digital resources, manuals, and technical documentation for continuous learning;
- learn how to integrate innovative tools (e.g., generative AI) into the analysis process and in solving complex empirical problems.

Contents

The course will cover the following topics:

- collection, organization, and interpretation of data useful for scenario building;
- review of elementary statistical tools for the descriptive analysis of economic and social phenomena;
- graphical representation and communication of empirical evidence, also with the support of generative AI tools;
- introduction to linear regression techniques, with one or more explanatory variables;
- introduction to models with a binary dependent variable;
- elements of panel data analysis;
- use of generative artificial intelligence as a support tool for quantitative analysis: prompt formulation, data exploration, interpretation of results, and narrative construction of scenarios;
- limitations, risks, and appropriate use of AI in empirical analysis and scenario development.

Detailed program

The course will cover the following topics:

1. Introduction to Scenario Building

- What is meant by an economic and social scenario: an example.
- Difference between forecasting, simulation, and scenario building.
- The role of data in scenario construction.
- Information sources, archives, databases, and data quality.
- Use of generative AI as a support tool for the preliminary exploration of a problem.

2. Review of Elementary Statistical Tools

- Data collection, organization, and tabulation.
- Treatment of individual and aggregate data.
- Univariate descriptive statistics: mean, median, quantiles, variance, and standard deviation.
- Relationships between variables: independence, association, and correlation.
- Comparison between two means.
- Graphical representation of data and statistical relationships.
- Use of generative AI to describe, summarize, and communicate statistical evidence.

3. Introduction to Regression Techniques

- The logic of regression as a tool for analyzing relationships between variables.
- Linear regression with one regressor.
- Multiple linear regression.
- Interpretation of coefficients and assessment of statistical significance.
- Use of regression results to build alternative scenarios.
- AI support in reading, explaining, and presenting empirical results.

4. Models for Binary Dependent Variables

- Introduction to problems with dichotomous outcomes.
- Linear probability models and an overview of logit/probit models.
- Interpretation of results.
- Applications to economic, social, and market phenomena.
- Construction of scenarios based on probabilities and alternative conditions.

5. Introduction to Panel Data

- Difference between cross-sectional data, time series, and panel data.
- Advantages of panel data analysis in interpreting economic and social phenomena.
- Introduction to models with fixed and random effects.
- Applications to comparisons across individuals, firms, territories, or countries over time.

6. Quantitative Methods and Generative AI for Scenario Building

- Introduction to prompt engineering for economic and social analysis.
- How to formulate effective prompts to explore data, hypotheses, and scenarios.
- Use of AI to generate hypotheses, identify relevant variables, and structure alternative scenarios.
- Use of AI to comment on tables, graphs, and regression results.
- Critical assessment of AI-generated outputs: errors, bias, hallucinations, and source checking.
- Principles for the responsible use of AI in empirical work.

Prerequisites

Participation to the course requires basic background in statistics.

Teaching methods

- Face-to-face lectures: 50% of the course, 24 hours
- Exercises in lab BYOD (Bring Your Own Device): 50% of the course, 24 hours
- Group and individual assignments

Assessment methods

The assessment is based on a written examination.

The written examination is administered electronically and consists of two open-ended questions, in the form of short essays, and ten closed-ended multiple-choice questions. The open-ended questions are designed to assess students' reasoning, analytical and critical discussion skills in relation to the topics covered in the course, with particular reference to the methods and tools used to construct socioeconomic scenarios. The closed-ended questions are designed to assess students' knowledge of all the topics covered in the course. The open-ended questions carry greater weight in the calculation of the final grade.

The assessment considers students' ability to answer specific questions by referring to the theoretical and methodological aspects related to the topic, including through the use of examples and the application of concepts to real-world cases. Students' ability to critically compare different statistical and econometric techniques will also be assessed.

The examination is the same for both attending and non-attending students.

There are no midterm examinations.

During the laboratory sessions, attending students are invited to complete a group project aimed at constructing and presenting one or more scenarios relating to a case study. The project is not compulsory; however, students who complete it, submit it and discuss it in class may receive additional points towards their final grade. Non-attending students may also choose to complete the project and submit it by the examination date.

Textbooks and Reading Materials

James H. Stock - Mark W. Watson *"Introduzione all'econometria" *5/Ed. •Pearson Ed.

A detailed reading list will be posted on the course web site

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | GENDER EQUALITY | DECENT WORK AND ECONOMIC GROWTH | REDUCED INEQUALITIES