



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Introduzione alle Serie Storiche M

2021-1-F8204B012

---

#### Learning objectives

The main aims of the course are two. The first one is to provide the students with a solid theoretical background in time series analysis. The second aim is to enable students to apply time series analysis to real economic datasets, using econometrics software packages.

#### Contents

1. Overview
2. Stochastic processes
3. Linear projection and Wold's decomposition
4. Stationary Time Series Models
5. Nonstationary Time Series Models
6. Box-Jenkins approach to model identification
7. Seasonal Time Series Models
8. Maximum likelihood estimation
9. Diagnostic Checking and Model Selection

10. Forecasting ARMA models
11. Unit root tests

## Detailed program

1. Overview
2. Stochastic processes
3. Stationarity
4. The Autocovariance , Autocorrelation and Partial Autocorrelation Function
5. White Noise Processes
6. Sample Mean, Autocovariances, and Autocorrelations
7. Ergodicity
8. Linear projection and Wold's decomposition
9. Autoregressive Processes,  $AR(1)$ ,  $AR(2)$ ,  $AR(p)$
10. Moving Average Processes,  $MA(1)$ ,  $MA(2)$ ,  $MA(q)$
11. The Dual Relationship Between  $AR(p)$  and  $MA(q)$  Processes
12. Autoregressive Moving Average  $ARMA(p, q)$  Processes,  $ARMA(1, 1)$  and  $ARMA(p, q)$
13. a. Nonstationarity in the Mean. Deterministic and Stochastic Trend Models
14. Autoregressive Integrated Moving Average (ARIMA) Models
15. Nonstationarity in the Variance and the Autocovariance. Variance Stabilizing Transformations
16. Box-Jenkins approach to model identification
17. Seasonal ARIMA Models
18. Condition and unconditional Maximum likelihood estimation
19. Diagnostic Checking and Model Selection
20. Residual analysis. Ljung-Box test
21. Forecasting ARMA models
22. Linear projection and optimal forecast
23. 12 Unit root tests

## Prerequisites

Knowledge of the topics of descriptive and inferential Statistics and Multivariate Statistical Analysis is recommended

## **Teaching methods**

On line lessons and exercises with software Gretl

## **Assessment methods**

The exam consists of an oral test, carried out via the webex platform aimed at verifying the mastery of the subject by the student, demonstrated by illustrating in a synthetic but exhaustive way the topics proposed in the questions.

## **Textbooks and Reading Materials**

HAMILTON, James Douglas. *Time series analysis*. Princeton: Princeton university press,.

Slides provided by the teacher and published on e-learning site

## **Semester**

First semester

## **Teaching language**

Italian

---