



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## SYLLABUS DEL CORSO

### Statistica Economica M (blended)

2122-1-F8204B003

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#### Learning objectives

The objective of this course is providing the students with the theory, methods and practice of unobserved component models (UCM). We will treat the fundamentals of prediction theory, the state space form and the related filtering and smoothing methods. The course is provided in "blended learning" with video-lessons and lessons in a computer lab. All the models are implemented in a computer lab using R with the package KFAS.

#### Contents

- Prediction theory
- Unobserved Component Models
- State space form
- Real world applications with R/KFAS

#### Detailed program

- Optimal predictor
- Optimal linear predictor
- Main components of UCM (trend, cycle, seasonal)
- Static regressors
- Dynamic regressors
- Regressors with time varying coefficients
- State space form

- ARIMA and UCM in state space form
- Kalman filter and maximum likelihood estimation
- State and disturbance smoothing
- Exercises and case studies using R/KFAS

## **Prerequisites**

Foundamentals of time series analysis (stationary processes, integrated processes, ARIMA).

Foundamentals of R.

## **Teaching methods**

The course is provided in "blended-learning": 50% of the course is in presence (in a computer lab), 50% is on-line through video-lessons, web-app, tests and exercises and question & answer forums.

## **Assessment methods**

Written exam on the theory (1h) + practical exam using R (1h).

The result of each part concurs for 50% of the final grade.

The written part assesses the knowledge of the student in theoretical aspects of unobserved component models, the state space form and the filtering algorithms

For the practical part, the students are given a time series to analyse by unobserved component model techniques using R with the package KFAS.

## **Textbooks and Reading Materials**

Pelagatti (2015) *Time Series Modelling with Unobserved Components*, Chapman and Hall/CRC (freely available under IP address of Bicocca)

## **Semester**

Second half of second semester

## **Teaching language**

Italian

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