UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Economic Statistics M (blended)

2425-1-F8204B003

Learning objectives

This course aims to provide 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. The application of the methods to real economic data and problems takes place in a computer lab using R with the package KFAS.

The class of Economic Statistics M completes the statistical-economic preparation of students in all tracks of the master's degree program, providing statistical tools for working with macroeconomic, business, financial, and other types of time series.

Contents

- Prediction theory
- Unobserved Component Models
- State space form and Kalman filtering
- 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

Knowledge of statistical inference and matrix algebra, as well as the fundamentals of time series analysis (stationary processes, integrated processes, ARIMA).

Fundamentals of R.

Teaching methods

The course is provided in *blended learning*: 50% of the course is in the presence (in a computer lab), and 50% is online through video lessons, web apps, tests and exercises, and question-and-answer forums.

The in-person lessons take place in the computer lab and make the theory acquired autonomously by the student through video lessons, the manual, and other teaching aids available on the e-learning page, practical through applications to real data. Additionally, the in-person lessons allow students to express their doubts and ask questions about what they have learned in autonomy so that the instructor can provide alternative explanations for anything unclear.

The in-person lessons are two or three hours long, for a total of 21 hours.

Assessment methods

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

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

The written part assesses the student’s knowledge of theoretical aspects of unobserved component models, the state space form, and the filtering algorithms. This part of the exam consists in 4 open questions.

For the practical part, the students are given a time series to analyze with 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)
Hyndman, R.J., & Athanasopoulos, G. (2018) *Forecasting: principles and practice*, 2nd edition, OTexts: Melbourne, Australia. OTexts.com/fpp2

Semester

4th term (May - June)

Teaching language

Italian

Sustainable Development Goals