Year 2013-14

Forecasting Techniques (21896)

Course: 3rd or 4th (MQA program)
Term: second
Number of ECTS credits: 5 credits
Language of instruction: English
Professor: Omiros Papaspiliopoulos
TA: Dmitry Khametshin

1. Presentation of the subject

The course focuses on time series analysis with view towards model-based prediction. Basic skills in statistics and computing with R is a prerequisite, a previous course in econometric analysis of linear time series is desirable although by no means necessary (additionally, such material can be learnt parallel to this course). The modelling and computational methodology developed in the course applies to a wide range of scientific fields, including engineering, environmental sciences, biochemistry, natural language processing, but in this course we concentrate on applications to economics and finance, such as the extraction of stochastic business cycles and volatility prediction using daily and intraday high-frequency data. The aim of the course is to train the skills and the understanding of building, fitting, checking, and predicting with sophisticated linear and non-linear time series models. Additionally, to study the structure and the empirical characteristics of certain financial time series.

2. Competences to be attained

The student should comfortably carry out time series analysis with the following classes of models: the ARMA family, Markov chains, and GARCH. The student will be able to understand the underlying mathematical and statistical framework for their estimation (e.g. maximum likelihood), their properties in terms of prediction (step-ahead forecast distributions and moments thereof), and the appropriateness of the different models for different type of data. The student also acquires a working knowledge of the choice among competing models. An important aspect of the course is the empirical analysis of time series with the view towards identifying important structures and signals that lead to the choice of the appropriate model. Another important aspect of the course is the development of the skills required for carrying out such analyses in the computer using the R language.

3. Contents

1. Stochastic processes, prediction, and the Black-Scholes model

2. Empirical analysis

3. Elements of Markov processes

4. ARMA models

5. Data analysis with time series models

4. Assessment

50%: weekly exercises

50%: Final exam

There is the option to carry out a data analysis project that contributes 20% to the overall mark, in which case the final exam forms 30% of the final mark. There is also an alternative option to carry out a considerably more advanced project that contributes 50% to the overall mark, in which case the student does not take the final exam.

For that student whose final global grade is less strictly than 5, and took the final exam, there will be a recuperation exam during the second term that will count as 50% as well. The grade of the weekly exercises cannot be modified. For the students that do not take the exam (and have chosen the advanced project) if the failure to pass is due to the mark in the project, they can submit a revised version within the first 2 weeks of the next term.

5. Bibliography and teaching resources

5.1. Basic bibliography

1. Lecture notes, provided on a weekly basis. They have been specially prepared for the course by Prof. Papaspiliopoulos and Prof Laurini
2. Tsay: Analysis of Financial Time Series
3. Harvey: Time Series Models

5.2. Teaching resources

1. Video-recorded lectures
2. PDF of the lecture slides at each class

6. Methodology

In class there will be 20 lectures and 6 seminars. The lectures will essentially follow the lecture notes. Before each seminar a list of exercises will be distributed and students do the exercises at home in groups and they are graded. These exercises will be corrected and commented during the seminars.

7. Activities Planning

20 lectures and 6 seminars. Individually work and study at home for each student to do the list of exercises and study the lectures. Invited lecture on week 8.