Forecasting Techniques
Pla Docent (Syllabus)

1 Summary Information

Course Name: Forecasting Techniques (MQA Program)

Degree: ADE/ECO/IBE

Course: Third and fourth year

Terms: 2nd

Number of ECTS Credits: 5

Course Code: 21896 (ADE/ECO) 21896 (IBE)

Hours: 20 Theory Lectures and 6 Practice Sessions

Professor: Christian Brownlees

2 Description

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.

3 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.

General competences:

G4. The ability to satisfactorily use the English language for academic purposes (read, write and speak using a medium-high register).

G5. Proficiency in the use of computing tools and their main applications in ordinary academic work.

G9. Consolidated habits as regards self-discipline, personal standards and thoroughness in academic work and in organization and fulfilment of timescales.

G10. A proactive attitude to ascertaining the unknown, essential in all training processes and in all prestigious professional activities.

G11. The ability to apply the knowledge acquired and to adapt it to new situations flexibly and creatively.

G12. The ability to make progress autonomously and continuously in training and learning processes.

G16. Use of the right information in formulating proposals and problem-solving.

G19. Identification of the key factors in a problem.

4 Methodology

The course is divided in Theory and Practice sessions. Theory sessions will be used to introduce the material of the course. Practice sessions will be used to review problem sets that will be assigned in class.

5 Evaluation

- 10% Class Partecipation
- 10% Problem sets
- 10% Forecast Competion
- 70% Final Exam

6 Contents

1. Intro to Times Series
   (a) Time Series in Economics and Finance
   (b) Time Series as Stochastic Processess
   (c) Time Series Properties
2. Linear Time Series

   (a) Linear Time Series: Models
   (b) Linear Time Series: Prediction
   (c) Linear Time Series: Estimation
   (d) Linear Time Series: Practice

3. Volatility Modeling

   (a) Volatility Modeling: ARCH and GARCH
   (b) Volatility Modeling: Asymmetric Effects
   (c) Volatility Modeling: Prediction and Evalution
   (d) *Volatility Modeling: Stochastic Volatility
   (e) *Volatility Modeling: High Frequency Data Based Volatility Modelling

4. Conditional Return Distribution and Value–At–Risk

   (a) Conditional Distribution of Returns and Value–At–Risk

5. Covariance Modeling

   (a) Multivariate Volatility Models
   (b) Multivariate Volatility Models: DCC

6. Recent Developments in Time Series Analysis

7 Textbook

- R. S. Tsay, "Analysis of Financial Time Series"
- P. F. Christoffersen, "Elements of Financial Risk Management"