6 ECTS

12F005

Financial Econometrics

Professor: Christian Brownlees
Professor e-mail: christian.brownlees@upf.edu
Office: 20.2E10 Jaume I Building

Introduction

This course provides an introduction to the quantitative techniques used for the analysis of economic and financial time series. The course begins with an overview of regression with time series data. It then introduces linear time series models (ARMA models). The course then focuses on the nonlinear time series model used for the analysis of financial time series. In particular, the course will introduce the univariate nonlinear time series models used for the analysis of financial volatility (GARCH models) and the multivariate nonlinear models for the analysis of correlations (DCC models). The last segment of the course will introduce some of the more recent developments of the literature, which includes network models, model for intra-daily financial time series and time-varying GAS models.

The course heavily relies on R for the implementation of the techniques illustrated in class. Computer lab sessions using R will be used to apply the techniques illustrated in class on real and simulated data sets. Students will replicate findings documented in the literature and engage in forecasting exercises. No prior knowledge of R is required to attend the course

Objectives

The main objective of this course is to give students the ability to apply state of the art time series techniques for the analysis of economic and financial data.

Required Background Knowledge

Students are supposed to have a background in Statistics and Econometrics. No prior knowledge of R is required.

Learning Outcomes

The student should comfortably carry out time series analysis with the following classes of models: the ARMA family 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, and the appropriateness of the different models for different types of data.

Methodology

Theory classes will introduce the content of the course. Practice session will be used to introduce students to R and replicate the methodology and findings documented in class. Weekly problem sets will be assigned to review the content of the course.

Evaluation

The grade of the course is based on a number of items:

Problemsets. Students will be required to complete a series of personalized problemsets. The problemsets typically require carrying out time series analysis in R using a simulated data or a real time series. There is approximately one problemset for each topic of the course.

Computing Project. The time series computing project consists of writing a set of R routines to implement some of the time series methodologies introduced in class.

Research Project. The time series research project consists of analysing an economic or financial time series of your choice using the tools introduced in class and writing a short report describing the findings of your analysis.

Forecasting Competition. The forecast competition consists of developing a forecasting algorithm in R to predict the future realizations of a time series. The time series used in the competition is simulated according to a secret model. Students have to organize themselves in teams (of no more than four members). The teams have access to a training sample of data and have to develop a prediction algorithm for the future realizations of the series. The grade of the competition is based on the out--of--sample performance of the algorithm.

Final Exam. The final exam is made up of a set of open questions covering the content of the course. **A minimum of 4 in the final exam is required to pass the course.**

6 ECTS

12F005

Financial Econometrics

Grade Weights:
25% Problem Sets
5% Forecast Competition
20% Research or Computing Project
50% Final Exam

Course contents

Intro to Times Series

- Time Series in Economics and Finance
- Time Series as Stochastic Processes
- Time Series Properties

Regression with Time Series Data

Linear Time Series (ARMA modeling)

- Linear Time Series: Models
- Linear Time Series: Prediction
- Linear Time Series: Estimation
- Linear Time Series: Practice

Volatility Modeling

- Volatility Modeling: ARCH and GARCH
- Volatility Modeling: Asymmetric Effects
- Volatility Modeling: Prediction and Evalution
- Volatility Modeling: Stochastic Volatility
- Volatility Modeling: High Frequency Data Based Volatility Modelling

Conditional Distribution of Returns and Value--At--Risk

Covariance Modeling

- Multivariate Volatility Models

12F005
Financial Econometrics

- Multivariate Volatility Models: DCC

Bibliography

Campbell, J. Y., Lo, A. W. and MacKinlay, A. C. (1996), The Econometrics of Financial Markets, Princeton University Press
Christoffersen, P. (2003), Elements of Financial Risk Management, Elsevier
Engle, R. F. (2009), Anticipating Correlations: A New Paradigm for Risk Management, Princeton University Press
Tsay, R. S. (2010), Analysis of Financial Time Series, Wiley

Professor's Biography

Christian Brownlees is an Associate Professor in the Department of Economics and Business at the Universitat Pompeu Fabra. He received his (B.S.) degree in Economics and Quantitative Methods in 2003 and Ph.D. degree in Statistics in 2007 from Università di Firenze. Prof. Brownlees was also a Post-Doc Research Fellow at NYU Stern until 2011. Over the years Prof. Brownlees has studied, visited and researched at the University of Reading, Monash University, UCSD and EUI. Prof Brownlees has published in the *Journal of Econometrics, Review of Financial Studies and Annals of Statistics*.