

Quantitative and Statistical Methods II: Finance

6 ECTS

TERM 2

MANDATORY

Professor

Prof. Cristian Brownlees

Prerequisites to enroll

None

Overview and objectives

This course provides an introduction to the quantitative techniques used for the analysis of economic and financial time series. We begin with a brief review of regression with time series data and linear time series models. The main topics that will then be covered in the course are nonlinear time series models. In particular, nonlinear model for the analysis of time varying volatility (GARCH, Stochastic Volatility) and correlations (DCC).

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 data sets. Students will replicate findings documented in the literature and engage in forecasting exercises.

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

Course outline

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.

Indicative course plan.

| Session | Topic Number and Lecture Title |
|---------|---|
| 1 | 1.1. Time Series in Economics and Finance |
| 2 | 1.2. Time Series as Stochastic Processes |
| 3 | 1.3. Time Series Properties |
| 4 | 1.4. Time Series: Testing for stationarity |
| 5 | 2.1. Regression with Time Series Data |
| 6 | 2.2. Spurious Regression |
| 7 | 3.1. Linear Time Series: Models |
| 8 | 3.2. Linear Time Series: Prediction |
| 9 | 3.3. Linear Time Series: Estimation |
| 10 | 3.4. Linear Time Series: Practice |
| 11 | 4.1. Volatility Modeling: ARCH and GARCH |
| 12 | 4.2. Volatility Modeling: Asymmetric Effects |
| 13 | 4.3. Volatility Modeling: Prediction and Evaluation |
| 14 | 4.4. *Volatility Modeling: Stochastic Volatility |
| 15 | 4.5. *Volatility Modeling: High Frequency Data Based Volatility Modelling |
| 16 | 5.1. Conditional Distribution of Returns and Value–At–Risk |
| 17 | 6.1. Multivariate Volatility Models |
| 18 | 6.2. Multivariate Volatility Models: DCC |
| 19 | 7. Recent Developments in Time Series Analysis I |
| 20 | 7. Recent Developments in Time Series Analysis II |

Topics marked with an asterisk are advanced.

Required activities and Evaluation

30% problemsets

70% final exam

Materials

Campbell, J. Y., Lo, A. W. and MacKinlay, A. C. (1996), The Econometrics of Financial Markets

Christoffersen, P. (2003), Elements of Financial Risk Management

Engle, R. F. (2009), Anticipating Correlations: A New Paradigm for Risk Management

Hayashi, F. (2000), Econometrics

Tsay, R. S. (2010), Analysis of Financial Time Series

Competencies

☒ To (be able to) communicate with determination and in the English Language, the results and implications of the required analytical study using a language that the receiver can relate to.

☒ To possess and understand the knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context.

☒ That students know how to apply the acquired knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their field of study.

☒ That the students be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, include reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments.

Learning outcomes

☒ Recognizes the statistical, econometric and analytical instruments required for economic analysis.

☒ Applies analytical and quantitative tools to economic problems, formulating the suitable hypotheses and using the necessary tools.

☒ Analyzes complex problems.

☒ Uses evidence to solve new problems and develops an adequate analysis