

Academic Year: (2023 / 2024)

Review date: 07-02-2023

Department assigned to the subject: Statistics Department

Coordinating teacher: LOPES MOREIRA DA VEIGA, MARIA HELENA

Type: Electives ECTS Credits : 3.0

Year : 1 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Financial Statistics

Computer Tools in Finance (Empirical exercises will be done in Matlab)

OBJECTIVES

Financial econometrics is the intersection of statistical techniques and finance to ascertain how financial prices are determined and to test models that try to replicate how financial markets work. The course will cover the tools of financial econometrics and empirical finance with a moderate degree of sophistication, starting by introducing the extensions to the basic generalized autoregressive conditional heteroskedasticity model (GARCH) in terms of statistical properties, estimated parameters, and volatilities. Then, we will learn to differentiate between volatility, uncertainty, and risk, learning to apply these concepts to different financial assets. Finally, we will learn to estimate the implied volatility of equity indices and discuss the information contained in the implied volatility term structure and smile. Over the whole course, there will be a heavy emphasis on applications.

DESCRIPTION OF CONTENTS: PROGRAMME

1. Linear Regression Model

Introduction

The research question: the variable, the model, estimation and inference.

Applied Matlab workshop: the basics.

2. Extensions of volatility models

MGARCH models: conditional variance and correlation for a portfolio of assets.

Applied Matlab workshop: learning MFE Kevin Sheppard toolbox.

Constant or time-varying correlation? GARCH-CCC, GARCH-DCC, BEKK-GARCH

Applied Matlab workshop: MGARCH estimation

3. Volatility, uncertainty and risk

Realized vs. Expected volatility. Using options to approach expectations.

Applied Matlab workshop: estimating the implied volatility (IV).

IV Term-structure and the volatility smile. Understanding these concepts.

Applied Matlab workshop: estimating IV smiles and term-structure.

The VIX: model-free vs. model-based volatility indices.

Applied Matlab workshop: replicating the VIX from S&P500 options.

LEARNING ACTIVITIES AND METHODOLOGY

Students will work with Excel and Matlab. Every class, the Professor will present the main theoretical concepts using PDF presentations. After 1.5 hours of theory, the students solve exercises using Matlab and Excel for consolidating the concepts learnt before. The exercises are solved individually with the help of the Professor.

ASSESSMENT SYSTEM

There will be:

- A final exam (60% of the grade). The minimum grade in the exam to pass the course is 4. Students that do not meet the minimum passing grade should retake the subject. If the resit is taken, the above grade criteria also apply. The continuous evaluation is based on:

- Homework assignments
- Midterm Exam

Students that do not meet the minimum passing grade should retake the subject. If the resit is taken, the above grade criteria also apply.

- 60% end-of-term examination
- 40% of continuous assessment (assignments, laboratory, midterm, practical, etc.)

% end-of-term-examination:	60
% of continuous assessment (assignments, laboratory, practicals...):	40

BASIC BIBLIOGRAPHY

- Greene, W. H Econometric Analysis, Pearson - 8th edition, 2017
- Natenberg, S. Options Volatility and Pricing. Advanced Trading Strategies and Techniques. , McGraw-Hill; Updated edition, 1994
- Ruey S. Tsay Analysis of Financial Time Series, Wiley, 2010
- Wooldridge, J.M Introductory Econometrics: A Modern Approach, Thomson South-Western, 2003

ADDITIONAL BIBLIOGRAPHY

- Aggoun L. and Elliot R. Measure theory and filtering, introduction with applications, Cambridge University Press, 2004
- Campbell, J. Y., Lo, A. W., and MacKinlay, A. C. The Econometrics of Financial Markets, Princeton University Press, New Jersey, 1997
- Dacorogna, M. M., Gencay, R., Muller, U. A., Olsen, R. B., and Pictet, O. V. An Introduction to High-Frequency Finance, Academic Press, 2001
- Dacorogna, M. M., Gençay, R., Müller, U. A., Olsen, R. B., and Pictet, O. V. An Introduction to High-Frequency Finance, Academic Press, 2001
- Harvey A.C. Forecasting, structural time series models and the Kalman filter, Cambridge University Press, 1989
- James, J. and N. Webber Interest rate Modelling, John Wiley & Sons, 2002
- Silvennoinen, A. and Teräsvirta, T Multivariate GARCH models, Handbook of Financial Time Series, New York: Springer., 2008