STATISTICAL METHODS WITH APPLICATION TO FINANCE

a.y. 2025-2026

Introduction

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University of Trieste

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Summary

General Info

The core of this course is the use of basic statistical techniques and tools to deal with time series analysis in the framework of economics and finance, with emphasis on financial risk.

Course duration: 45 hours

- Frontal lectures ($\approx$ 35h)
- Practical sessions with R ($\approx$ 10h)

Access the syllabus of the course:
https://units.coursecatalogue.cineca.it/cerca-insegnamenti

Lecture recordings will be available in the course team in MS Teams (available till the end of the semester). Practical session are interactive and hence recordings may not be available.

Lecturer

Roberta Pappadà

Contact rpappada@units.it

Office: room 2.18, 2nd floor, Via Valerio 4/1

Office hours at the personal page
https://www.units.it/persone/index.php/from/abook/persona/18327

If necessary, office hours can also be arranged via Teams.

Lessons timetable

	Monday	Tuesday	Wednesday	Thursday
08:00-09:00				
09:00-10:00				
10:00-11:00				STATISTICAL METHODS WITH APPLICATION TO FINANCE Aula 1_B
11:00-12:00				STATISTICAL METHODS WITH APPLICATION TO FINANCE Aula 1_B
12:00-13:00				
13:00-14:00			STATISTICAL METHODS WITH APPLICATION TO FINANCE Aula 1_B	
14:00-15:00			STATISTICAL METHODS WITH APPLICATION TO FINANCE Aula 1_B	
15:00-16:00				
16:00-17:00		STATISTICAL METHODS WITH APPLICATION TO FINANCE Aula 1_B		
17:00-18:00		STATISTICAL METHODS WITH APPLICATION TO FINANCE Aula 1_B		

Any change that occur in the timetable will be communicated via Moodle or posted on the main page deams.units.it

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17:00-18:00				

25/02/2026 - 02/04/2026

Wednesday and Thursday

No lesson on 4/03/2026

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25/02/2026 - 02/04/2026
Wednesday and Thursday
No lesson on 4/03/2026

Easter holidays: from April 3rd to April 7th 2026
Lessons Suspended: April 8–10

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14/04/2026 - 28/05/2026
Tuesday and Thursday

+ 15/04/2026 (Wednesday)

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Summary

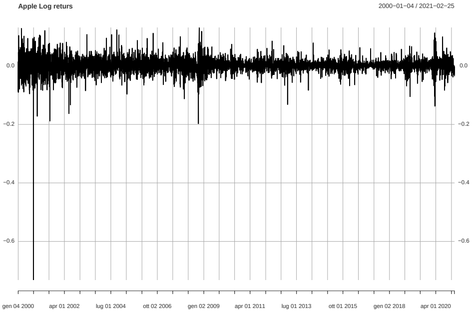
Course Objectives

The course aims to provide students with an introduction to well-established *statistical methods and models* in the financial and economic context, with a focus on time series data.

Closing prices of Apple stock (2000–2021)

Course Objectives

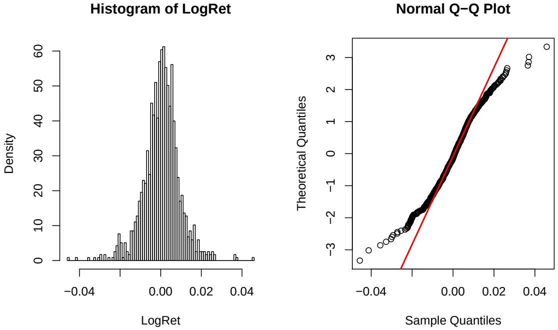
It is a common practice to consider returns rather than prices.
Returns on an asset are relative changes in price, often obtained via a log transformation: $y_t = \ln(P_t/P_{t-1})$



Log-returns of Apple stock (2000–2021)

Course Objectives (cont)

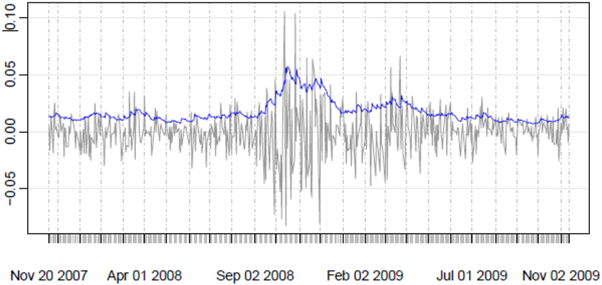
Starting from stock prices and asset returns, the R statistical software will be used in hands-on sessions for exploratory data analysis and time series modelling.



Histogram and QQ plot of daily log returns of the McDonald's asset (Jan 2010 - Sept 2014).

Course Objectives (cont)

We will also explore more advanced statistical topics such as forecasting techniques and models for non-constant variance used in the financial framework



GARCH one-step-ahead predictions of the DJIA volatility (solid line) superimposed on part of the DJIA series including the financial crisis of 2008.

Prerequisites

The *Statistics* course is a prerequisite course:
students should be familiar with the basics of probability and statistics, including exploratory data analysis, random variables and distribution functions, and the fundamentals of statistical inference.

No prior knowledge of computer programming is required for attending the R Lab sessions.

Summary

Course Content

Review of basic statistics, prices and returns.

- Returns; log returns; multi-period returns; portfolios.
- Distributional properties of returns; review of statistical distributions and their moments; visualization of financial data
- Index numbers and Stock Market Indices.

  R Lab Exploratory data analysis and Stylized Facts of returns

Linear models for financial time series

- Characteristics of time series data; Simple models for time series of returns; model selection techniques
- Unit-root nonstationarity; Integrated ARMA (or ARIMA) models

  R Lab Fitting ARMA models to time series data

Course Content / 2

Forecasting

- Point forecasts and prediction intervals; forecasting using ARMA models
- exponential smoothing

  R Lab Prediction of time series using linear models

GARCH and conditional volatility

- Testing for ARCH effects; the ARCH model; GARCH models and their extensions.

  R Lab Fitting ARMA-GARCH models to financial returns

Course Activities

The activities include

- Lessons with slides illustrating the theoretical background of the statistical methods presented in the course, as well as examples on simulated and real-world datasets
- Sessions of exercises with full solutions
- *R* Labs to focus on statistical models for financial returns, primarily for the purpose of forecasting risk
- Wooclap or Moodle Quizzes for self-evaluation (homework or live quizzes)

More on quizzes and live tests

- There will some interactive quizzes during the lessons, which may serve for self-evaluation
- You will be given homework to complete by a set deadline; these tests are not mandatory but highly recommended
- Students that obtain at least the 60% of correct answers in each test can receive up to 2 additional points in the final grade (only for the summer session of June–July)

Summary

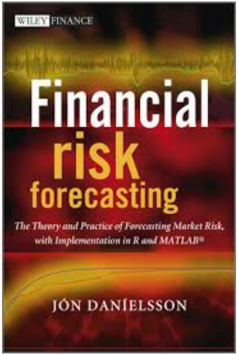
1. Course Overview
   - General information
2. Course aim and content
   - Aim of the Course
   - Summary of the course
   - Course Material
3. Expected learning outcomes and Final Exam

Textbooks

Main textbooks:

J. Danielsson (2011)

Financial Risk Forecasting: The Theory and Practice of Forecasting Market Risk with Implementation in R and Matlab, Wiley

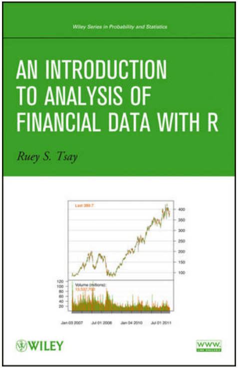


Textbooks

Main textbooks:

Tsay, Ruey S. (2013)

An Introduction to the Analysis of Financial Data with R, Wiley



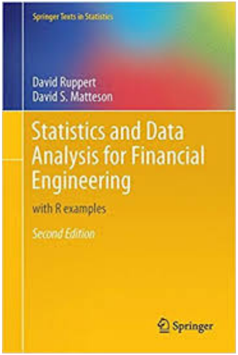
Textbooks

Further textbooks (demanding)

D. Ruppert, D.S. Matteson (2015)

Statistics and Data Analysis for Financial Engineering with R examples

Second edition, Springer Texts in Statistics



Course Material and further resources

Slides, exercises, R source files and datasets will be available on the Moodle page of the course.

To access the **Moodle page** of the course 569EC - STATISTICAL METHODS WITH APPLICATION TO FINANCE 2025 you will need to use the key **SMAF25**

Online resources for review of statistical concepts and `R` language

- D. M. Diez, C. D. Barr, M. Çetinkaya-Rundel, *OpenIntro Statistics* https://leanpub.com/openintro-statistics (get the full book PDF for free by setting to zero the amount to be paid)
- R Manuals and tutorials available at https://cran.r-project.org/

Expected learning outcomes

By the end of this course, you will be able to

- discuss the main features of financial data and recognize the stylized facts of returns;
- understand the basics of time series modeling and forecasting in economic and financial contexts
- interpret, comment, and compare the results from different analyses, making judgments on the appropriateness of the adopted methods
- employ the R statistical software to perform simple exploratory data analysis, model selection, and model checking for real data

Structure of the Final exam

The final exam consists of a written test of 2 hours with

- exercises and open questions to assess your comprehension level of all the topics covered during the course
- questions concerning the output of various statistical analysis to assess your ability to interpret results, plots, and evaluate different models in applied contexts

Examples of past exams will be made available via Moodle.

There will be three exams dates in June–July and one in September (remember to register on Esse3 by the indicated deadline, i.e. four days before the exam).

Q&A

Questions?