

*Course syllabus*

# Finansiell statistik Financial Statistics

**FMSN60, 7,5 credits, A (Second Cycle)**

**Valid for:** 2023/24

**Faculty:** Faculty of Engineering, LTH

**Decided by:** PLED I

**Date of Decision:** 2023-04-14

## General Information

**Elective for:** F5, F5-fm, I5-fir, Pi4-fm, R5

**Language of instruction:** The course will be given in English

## Aim

The course should be regarded as the statistical part of a course package also including EXTQ35 Financial Valuation and Risk Management and FMSN25 Valuation of Derivative Assets. Its purpose is to give the student tools for constructing models for risk valuation and pricing, based on data.

## Learning outcomes

### *Knowledge and understanding*

For a passing grade the student must

- handle variance models such as the GARCH family, stochastic volatility, and models used for high-frequency data,
- use basic tools from stochastic calculus: Itô's formula, Girsanov transformation, martingales, Markov processes, filtering,
- use tools for filtering of latent processes, such as Kalman filters and particle filters,
- statistically validate models from some of the above model families.

### *Competences and skills*

For a passing grade the student must

- be able to find suitable stochastic models for financial data,
- work with stochastic calculus for pricing of financial contracts and for transforming models so that data becomes suitable for stochastic modelling,

- understand when and how filtering methods should be applied,
- validate a chosen model in relative and absolute terms,
- solve all parts of a modelling problem using financial and statistical theory (from this course and from other courses) where the solution includes model specification, inference, and model choice,
- present the solution in a written technical report, as well as orally,
- utilise scientific articles within the field and related fields.

## Contents

The course deals with model building and estimation in non-linear dynamic stochastic models for financial systems. The models can have continuous or discrete time and the model building concerns determining the model structure as well as estimating possible parameters. Common model classes are, e.g., GARCH models with discrete time or models based on stochastic differential equations in continuous time. The course participants will also meet statistical methods, such as Maximum-likelihood and (generalised) moment methods for parameter estimation, kernel estimation techniques, non-linear filters for filtering and prediction, and particle filter methods.

The course also discusses prediction, optimization, and risk evaluation for systems based on such descriptions.

## Examination details

**Grading scale:** TH - (U,3,4,5) - (Fail, Three, Four, Five)

**Assessment:** Written report and oral presentation of a larger project and compulsory computer exercises.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

### Parts

**Code:** 0117. **Name:** Project Work.

**Credits:** 4,5. **Grading scale:** TH. **Assessment:** Written and oral project presentation

**Code:** 0217. **Name:** Laboratory Part 1.

**Credits:** 1,5. **Grading scale:** UG. **Assessment:** Computer exercise 1 and 2

**Code:** 0317. **Name:** Laboratory Part 2.

**Credits:** 1,5. **Grading scale:** UG. **Assessment:** Computer exercise 3 and 4

## Admission

### Admission requirements:

- FMSF10 Stationary Stochastic Processes or FMSF15 Markov Processes

**Assumed prior knowledge:** EXTF45 Financial Management and preferably also one or several of FMSN45 Time series analysis, TEK180/EXTQ35 Financial Valuation and Risk Management, and FMSN25 Valuation of Derivative Assets.

**The number of participants is limited to:** No

**The course overlaps following course/s:** FMS161, MASM18

## Reading list

- Henrik Madsen, Erik Lindström and Jan Nygaard Nielsen: Statistics for Finance. Chapman and Hall/CRC , 2015, ISBN: 9781482228991.

## Contact and other information

**Director of studies:** Johan Lindström, [studierektor@matstat.lu.se](mailto:studierektor@matstat.lu.se)

**Course administrator:** Susann Nordqvist, [expedition@matstat.lu.se](mailto:expedition@matstat.lu.se)

**Course homepage:**

<https://www.maths.lu.se/utbildning/civilingenjoersutbildning/matematisk-statistik-paa-civilingenjoersprogram/>

**Further information:** The course is also given at the faculty of science with the code MASM18.