UNIVERSITY OF GOTHENBURG

# DEPARTMENT OF MATHEMATICAL SCIENCES

## MSA410 Financial Time Series, 7.5 higher education credits

Finansiella tidsserier, 7,5 högskolepoäng

*Second Cycle*

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### Confirmation

This course syllabus was confirmed by Department of Mathematical Sciences on 2015-03-12 and was last revised on 2017-06-14 to be valid from 2017-07-01, autumn semester of 2017.

*Field of education:* Science 100%
*Department:* Department of Mathematical Sciences

### Position in the educational system

The course can be part of the following programmes: 1) Mathematical Sciences, Master's Programme (N2MAT) and 2) Bachelor's Programme in Mathematics (N1MAT)

| *Main field of studies* | *Specialization* |
|---|---|
| Mathematical Statistics | A1N, Second cycle, has only first-cycle course/s as entry requirements |

### Entry requirements

Knowledge corresponding to the courses *MMG200 Mathematics 1*, *MMG300 Multivariable Analysis*, and *MSG110 Probability theory*. Some knowledge of stochastic processes is highly desirable.

### Learning outcomes

Students will gain an understanding of the classical time-series theory and practice with an emphasis on the modeling of financial time series.
They will develop an appreciation of the issues, goals and approaches of this theory through being exposed to basic probabilistic models, tools,

and statistical estimation methods specific to this field. In the frame of the general time-series set-up they will develop an appreciation of
the specific issues related to the analysis and forecasting of financial returns.

On successful completion of the course the student will be able to

- compute and interpret marginal distributions and autocorrelation functions in time series
- derive the properties of ARIMA and GARCH models
- choose an appropriate ARIMA/GARCH model for a given set of data and fit the model using an appropriate package
- compute forecasts for a variety of linear and non-linear methods and models.

**Course content**

This course introduces time-series techniques and their application to the analysis and forecasting of financial time-series. Emphasis is given to nonlinear methods applied to high-frequency financial data. Topics covered include:

ARIMA models - probabilistic properties and estimation

- Stationary processes
- The autocovariance and the autocorrelation functions
- Basic properties of ARMA processes
- Linear process representation
- Estimation of ARMA processes

ARCH and GARCH processes - theory and practice of volatility modeling

- The ARCH family, definition and relation with ARMA processes
- Extensions of GARCH processes

Nonlinear models

- Bilinear models and Markov switch autoregressive models
- Model fitting using kernel regression, bandwidth selection, and local linear regression
- Non-parametric and parametric tests for non-linearity
- Forecasting and prediction performance measures

**Form of teaching**

The theoretical discourse is supplemented by hands-on data analysis.
Familiarity with a statistical software analysis tool (like Matlab, Splus, R) is assumed.

*Language of instruction:* English

**Assessment**

Written exam. Programming exercises to gain bonus points for the final exam.

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

**Grades**

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

**Course evaluation**

The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.