Course and Examination Fact Sheet: Spring Semester 2019

6,270: Introduction to Time Series Modelling

ECTS credits: 6

Overview examination/s
(binding regulations see below)
Decentral - Oral examination (individual) (50%, 15 mins.)
Central - Written examination (50%, 90 mins.)

Attached courses
Timetable -- Language -- Lecturer
6,270.00 Introduction to Time Series Modelling -- Englisch -- Audrino Francesco, Fengler Matthias

Course information

Course prerequisites
Statistics knowledge at the level of the HSG Bachelor in Economics course "Statistics".

Course content

This course is aimed at students who wish to gain a working knowledge of time series and forecasting methods as applied in economics, finance, engineering, and the natural and social sciences. The emphasis is on methods and the analysis of data sets. The core of the course covers the identification and estimation of trend and seasonal components, as well as the theory underlying ARMA, and ARIMA processes. Turning to specific topics in financial econometrics, the class covers the basic facts of asset returns, market efficiency and the predictability of asset returns, ARCH and GARCH models, and market microstructure and high-frequency data. Theoretical exercises as well as practical implementations in R for the analysis of real and simulated datasets are discussed during the exercise sessions.

The class provides the basic, fundamental knowledge needed to understand the main concepts in time series econometrics. It will teach students how to deal with possible practical applications related to the analysis of a time series basic characteristics, going from data acquisition, the identification and filtering of eventual non-stationary components, to the estimation of a suitable time series process. Moreover, students will learn how to choose and use the different packages and commands available in the free R software.

Course structure

1. Introduction
2. Basic Concepts
   Estimation and elimination of trend and seasonality components; Tests for the estimated residual sequence.
3. Stationary Processes
   Basic properties; Linear Processes; Wold Decomposition.
4. ARMA models
   Definition and basic properties of ARMA models; autocorrelation function (ACF) and partial autocorrelation function (PACF).
5. Modeling and prediction with ARMA processes
   Preliminary estimation; Yule-Walker equations; Maximum-likelihood estimation (MLE); Order selection; Diagnostic checking.
6. Non-stationary time series models
   ARIMA models; Unit roots tests in time series models
7. Prices, returns, and volatility
   Computing prices, returns, and volatility
8. Stylized facts of asset returns
   normality tests; tail index regression; dependence structure of returns
9. Conditional heteroscedasticity
   ARCH models, GARCH models
10. Forecasting
    prediction of volatility
11. Market Microstructure
    elements of high-frequency data; Roll’s model; realized variance

Course literature

- F. Audrino, Lecture Notes on Studynet (mandatory).
- M. Fengler, Slides on Studynet (mandatory).
- Brockwell, P.J. and Davis, R.A. (2002), Introduction to Time Series and Forecasting, 2nd edition, Springer Texts in Statistics (available online at Researchgate). This is the main reference book used to prepare the slides.

Additional course information

Examination information

Examination sub part/s

1. Examination sub part (1/2)
   Examination time and form
   Decentral - Oral examination (individual) (50%, 15 mins.)
   Remark
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   Examination-aid rule
   Extended Closed Book
   The use of aids is limited; any additional aids permitted are exhaustively listed under “Supplementary aids”. Basically, the following is applicable:
   - At such examinations, all the pocket calculators of the Texas Instruments TI-30 series and mono- or bilingual dictionaries (no subject-specific dictionaries) without hand-written notes are admissible. Any other pocket calculator models and any electronic dictionaries are inadmissible.
   - In addition, any type of communication, as well as any electronic devices that can be programmed and are capable of communication such as notebooks, tablets, PDAs, mobile telephones and others, are inadmissible.
   - Students are themselves responsible for the procurement of examination aids.
   Supplementary aids
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   Examination languages
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2. Examination sub part (2/2)

Examination time and form
Central - Written examination (50%, 90 mins.)

Remark
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Examination-aid rule
Extended Closed Book
The use of aids is limited; any additional aids permitted are exhaustively listed under "Supplementary aids". Basically, the following is applicable:

- At such examinations, all the pocket calculators of the Texas Instruments TI-30 series and mono- or bilingual dictionaries (no subject-specific dictionaries) without hand-written notes are admissible. Any other pocket calculator models and any electronic dictionaries are inadmissible.
- In addition, any type of communication, as well as any electronic devices that can be programmed and are capable of communication such as notebooks, tablets, PDAs, mobile telephones and others, are inadmissible.
- Students are themselves responsible for the procurement of examination aids.

Supplementary aids
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Examination languages
Question language: English
Answer language: English

Examination content
Part I: (oral exam)
1. Introduction
2. Basic Concepts
Estimation and elimination of trend and seasonality components; Tests for the estimated residual sequence.
3. Stationary Processes
Basic properties; Linear Processes; Wold Decomposition.
4. ARMA models
Definition and basic properties of ARMA models; autocorrelation function (ACF) and partial autocorrelation function (PACF).
5. Modeling and prediction with ARMA processes
Preliminary estimation; Yule-Walker equations; Maximum-likelihood estimation (MLE); Order selection; Diagnostic checking.
6. Non-stationary time series models
ARIMA models; Unit roots tests in time series models

PART II (written exam)
7. Prices, returns, and volatility
Computing prices, returns, and volatility
8. Stylized facts of asset returns
normality tests; tail index regression; dependence structure of returns
9. Conditional heteroscedasticity
ARCH models, GARCH models
10. Forecasting
prediction of volatility
11. Market Microstructure
elements of high-frequency data; Roll's model; realized variance

Fact sheet version: 2.0 as of 06/03/2019, valid for Spring Semester 2019
Examination relevant literature

Part I:

F. Audrino, Lecture Notes available on Studynet at the beginning of the term.

Part II:

Slides of Matthias Fengler

Please note

We would like to point out to you that this fact sheet has absolute priority over other information such as StudyNet, faculty members’ personal databases, information provided in lectures, etc. When will the fact sheets become binding?

- Information about courses and examination time (central/decentral and grading form): from the start of the bidding process on 24 January 2019
- Information about decentral examinations (examination-aid rule, examination content, examination relevant literature): after the 4th semester week on 18 March 2019
- Information about central examinations (examination-aid rule, examination content, examination relevant literature): from the start of the enrolment period for the examinations on 08 April 2019

Please look at the fact sheet once more after these deadlines have expired.