University of St.Gallen

Course and Examination Fact Sheet: Autumn Semester 2021

7,322: Quantitative Asset Management

ECTS credits: 4

Overview examination/s

(binding regulations see below)
Decentral - Written examination (with defined exam duration) (100%, 90 mins.)
Examination time: term time

Attached courses

Timetable -- Language -- Lecturer
7,322,1.00 Quantitative Asset Management -- Englisch -- Seiz Ralf , Kind Axel

Course information

Course prerequisites

Participants are expected to be familiar with basic topics in the fields of investments, portfolio theory, and econometrics. Further, participants should be willing to work on practical implementations of some of the techniques covered in class by using MATLAB, Python (TensorFlow and Keras for applications in machine learning). While specific pre-existing knowledge of those languages is not required, an open-minded and positive learning attitude toward them is necessary and requested. Finally, participants are expected to read the research articles related to the topics presented in class.

Learning objectives

This Master-level course aims at:

- providing students with state-of-the-art knowledge in the field of Quantitative Asset Management (QAM)
- providing students with up-to- date programming tools and skills (the current industry standards) to efficiently implement the concepts and techniques covered in class (In particular, hands-on applications in MATLAB, Python (TensorFlow and Keras for artificial intelligence, i.e., for QAM applications involving machine learning and big data).
- offering a general overview of the recent development in the field
- inspiring critical thinking and developing a feeling for the strengths and weaknesses of existing techniques in Quantitative Asset Management.

Course content

Besides reviewing established and fundamental concepts in the fields of investments and portfolio theory, the course focuses on recent developments in QAM stemming both from academic research (as proposed in recent working papers or in articles published in leading academic journals) and the financial industry. Given the ever- increasing role of computer science and digitalization in financial economics, the course aims at providing students with up-to- date programming tools and skills (the current industry standards) to efficiently implement the concepts and techniques covered in class. In particular, hands-on applications in MATLAB, Python (TensorFlow and Keras for artificial intelligence, i.e., for QAM applications involving machine learning and big data) will be presented and discussed. Given the immense number of techniques in the field of Quantitative Asset Management, the course aims at offering a general overview of the recent development in the field but also - for some selected topics - in-depth analyses with hands-on applications. Finally, the course aims at inspiring critical thinking and developing a feeling for the strengths and weaknesses of existing techniques in Quantitative Asset Management.

Course structure and indications of the learning and teaching design

The course consists of six 4-hour lectures in the first half of the semester.

Session 1: State-of-the-art asset management and portfolio theory (introduction); robustness in parameter estimation; portfolio optimization.

Session 2: Return predictability; return anomalies; market price of event risk; the value of volatility timing.

Session 3: Quantitative Asset Allocation; new asset classes; currently debated topics in QAM.

Session 4: Introduction to programming for QAM based on MATLAB and Python; portfolio optimization; indexation problems; portfolio resampling; random numbers and stochastic processes.

Session 5: Selected QAM applications based on machine learning algorithms.

Session 6: Selected QAM applications based on deep learning (using TensorFlow and/or Keras).

Course literature

- Brandimarte, Paolo, 2006, "Numerical Methods in Finance: A MATLAB-Based Introduction", Wiley
- Fabozzi, Frank J. et al., 2007, "Robust Portfolio Optimization and Management", Wiley
- Fabozzi, Frank J. et al., 2010, "Quantitative Equity Investing: Techniques and Strategies", Wiley
- Gilli, Manfred et al., 2011, "Numerical Methods and Optimization in Finance", Academic Press Goodfellow, Ian et al., 2016, "Deep Learning", MIT Press.
- Litterman, Robert, 2003, "Modern Investment Management: An Equilibrium Approach", Wiley Lopez de Prado, Marcos, 2018, "Advances in Financial Machine Learning", Wiley
- Maginn, John L. et al., 2007, "Managing Investment Portfolios: A Dynamic Process", Wiley, third edition
- Meucci, Attilio, 2005, "Risk and Asset Allocation", SpringerMohri, Mehryar, 2018, "Foundations of Machine Learning", MIT Press
- Mohri, Mehryar, 2018, "Foundations of Machine Learning", MIT Press
- Murphy, Kevin, 2012, "Machine Learning - A Probabilistic Perspective", MIT Press
- Nyholm, Ken, 2008, "Strategic Asset Allocation in Fixed-Income Markets: A MATLAB- Based User's Guide", Wiley
- Pachamanova, D. and F. Fabozzi, 2010, "Simulation and Optimization in Finance: Modeling with MATLAB, Risk, or VBA", Wiley
- Scherer, Bernd, 2007, "Portfolio Construction and Risk Budgeting", Riskbooks
- Scherer, Bernd and Douglas Martin, 2003, "Introduction to Modern Portfolio Optimization", Springer

Additional course information

In the case of the President's Board having to implement new directives due to the SARS-CoV-2 pandemic in AS2021, the course information listed above will be changed as follows:

The entire course (sessions 1-3 and sessions 4-6) will be conducted online via the platform Zoom. The recordings of the course will not be saved.

The lecturers will inform via email on the changed implementation modalities of the course. The examination information listed below would be changed as follows:

The written examination will be substituted by an oral online examination via the platform Zoom. Further information will be communicated via email.

Examination information

Examination sub part/s

1. Examination sub part (1/1)

Examination time and form

Decentral - Written examination (with defined exam duration) (100%, 90 mins.)
Examination time: term time

Remark
--

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, mobile telephones and others, are inadmissible.
- Students are themselves responsible for the procurement of examination aids.

Supplementary aids

During the exam students are allowed to use a non-programmable calculator and one A4 cheat sheets, writable/printable on both sides.

Examination languages
Question language: English
Answer language: English

Examination content

All content covered during the lectures.

This includes:

- robustness in parameter estimation
- asset management and portfolio theory
- portfolio optimization
- return predictability
- return anomalies
- market price of event risk
- the value of volatility timing
- Quantitative Asset Allocation
- new asset classes
- programming for QAM based on MATLAB and Python
- portfolio optimization
- indexation problems
- portfolio resampling
- random numbers and stochastic processes.
- QAM applications based on machine learning algorithms.
- QAM applications based on deep learning (using TensorFlow and/or Keras)

Examination relevant literature

All material (in particular slides) made available (or indicated) to students on StudyNet/Canvas until one day after the end of the last lecture.

University of St.Gallen

Please note

Please note that only this fact sheet and the examination schedule published at the time of bidding are is binding and takes precedence over other information, such as information on StudyNet (Canvas), on lecturers' websites and information in lectures etc.

Any references and links to third-party content within the fact sheet are only of a supplementary, informative nature and lie outside the area of responsibility of the University of St.Gallen.

Documents and materials are only relevant for central examinations if they are available by the end of the lecture period (CW51) at the latest. In the case of centrally organised mid-term examinations, the documents and materials up to CW 42 are relevant for testing.

Binding nature of the fact sheets:

- Course information as well as examination date (organised centrally/decentrally) and form of examination: from bidding start in CW 34 (Thursday, 26 August 2021);
- Examination information (regulations on aids, examination contents, examination literature) for decentralised examinations: in CW 42 (Monday, 18 October 2021);
- Examination information (regulations on aids, examination contents, examination literature) for centrally organised mid-term examinations: in CW 42 (Monday, 18 October 2021);

Examination information (regulations on aids, examination contents, examination literature) for centrally organised examinations: two weeks before the end of the registration period in CW 45 (Monday, 8 November 2021).