Portfolio Optimization
Overview

Prof. Dr. Philipp Baumann

University of Bern

Spring 2020
(as of February 11, 2020)
Outline

1. Lecturers
2. Course
3. Exam
4. Content
5. Literature
Outline

1 Lecturers
   - Curriculum Vitae
   - Contact

2 Course

3 Exam

4 Content

5 Literature
CV Philipp Baumann

- Born in Bern
- 2009: MSc in Business Administration, University of Bern
- 2013: PhD in Business Administration, University of Bern
- 2013–14: Research Scholar at IEOR Department, UC Berkeley
- 2014–15: Postdoc at IEOR Department, UC Berkeley
- Since 2015: Professor in Quantitative Methods/Operations Research, University of Bern
- Research:
  - Mathematical programming in finance and operations
  - Machine learning/Data mining
CV Tamara Bigler

- Born in Vinelz
- 2018: MSc in Business Administration, University of Bern and Copenhagen Business School
- 2016–18: Junior assistant in Quantitative Methods, University of Bern
- Since 2018: Teaching assistant and PhD student in Quantitative Methods/Operations Research, University of Bern
- Research:
  - Data mining (feature selection)
  - Combinatorial optimization
Contact

- Department of Business Administration
- Chair in Quantitative Methods
  - Engehaldenstr. 4, 3012 Bern, office 226 (TB)
  - Schützenmattstr. 14, 3012 Bern, office 008 (PB)
- E-Mail:
  - tamara.bigler@pqm.unibe.ch
  - philipp.baumann@pqm.unibe.ch
- Website: http://www.pqm.unibe.ch
Outline

1. Lecturers

2. Course
   - General information
   - Components of course

3. Exam

4. Content

5. Literature
Course in context of master studies

- 2015 course scheme: course can be selected as
  - part of the *Management Science* module or
  - elective course

- 2007 course scheme: course is
  - part of the choice area for MSc BA and MSc B&Ec students
  - not part of any focus area

- No registration required for participation

- Required knowledge: completion of Bachelor degree in Business Administration or Economics
  - Introduction to Mathematics
  - Introduction to Statistics
  - Quantitative Methods in Business Administration I
Lecture

- Time: Tuesday, 10:15am to 12:00pm
- Location: main building, room 114
- Start: Feb 18, 2020
- Lecture notes
  - Download: ILIAS
  - Password will be provided on Feb 18 during the lecture
- Lecture includes
  - Explanations
  - Examples
  - Discussion of case studies
Exercises

- Time: Wednesday, 10:15am to 12:00pm
- Location: main building, room 115
- Download of exercises: ILIAS
- Types of exercises
  - Review of the lecture content
  - Formulation of optimization problems
  - Manual application of discussed methods
  - Application of discussed methods using Software Python
Project

- Available on ILIAS on Tuesday Mar 31
- Project is conducted in groups of two students
- Access to Software Python required
- Project tutorial: Wednesday Apr 8, 2020 (instead of exercises)
- Deadline for submission of solution: Wednesday Apr 22, 2020
- Grading: 8 extra points can be achieved
- Discussion of solutions on Wednesday Apr 29
Outline

1. Lecturers
2. Course
3. Exam
   - Overview
   - Dates
   - Exam additional information
4. Content
5. Literature
Overview exam

- 6 ECTS
- Written exam
- Exam will cover lecture and exercises
- Permitted aids:
  - Non-programmable hand-held calculator
  - Formulary (will be distributed before the exam)
  - List of symbols (will be distributed before the exam)
- Grading
  - Maximal attainable score in exam: 90 points
  - Maximal attainable score in project: 8 points
  - At most 90 points required for highest grade
  - Project points can be credited to exams in Jun 2020 and Sep 2020
Dates for final exam

- Dates (duration of final exam is 90 minutes)
  1. Tuesday Jun 2, 2020 from 10:15am to 11:45am
  2. Tuesday Sep 8, 2020 from 10:15am to 11:45am

- Location: will be announced on ILIAS after closing date for exam deregistration

- Discussion of past exam questions in lecture on Tuesday May 19, 2020

- Q&A in lecture on Tuesday May 26, 2020
Final exam: additional information

Exam on Jun 2, 2020
- Closing date registration: May 26, 2020
- Closing date deregistration: May 31, 2020
- First date to access graded exam: Jun 10, 2020 (2pm–3pm)
- Second date to access graded exam: Jun 15, 2020 (9am–10am)

Exam on Sep 8, 2020
- Closing date registration: Sep 1, 2020
- Closing date deregistration: Sep 6, 2020
- First date to access graded exam: Sep 15, 2020 (11am–12pm)
- Second date to access graded exam: Sep 25, 2020 (4pm–5pm)

Registration and deregistration only via KSL
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Structure

1. Basics of optimization
2. Portfolio selection
   - Mean-variance model/Mean-absolute deviation model
   - Minimax model
   - Value-at-risk model/Conditional value-at-risk model
   - Models for fixed income securities
3. Portfolio management
   - Practical portfolio constraints
   - Portfolio rebalancing
   - Portfolio evaluation
4. Index tracking
   - Basics of market indices
   - Indexation models
   - Exchange traded funds
Learning outcomes I

The students are able to

- compute well-known risk measures for equities and fixed-income securities
- implement portfolio-selection models in Python and compute optimal portfolios for real-world data
- understand and apply models and methods to optimize fixed-income portfolios
- extend portfolio-selection models to account for real-world constraints such as for example transaction costs
- evaluate the performance of portfolios based on quantitative methods
The students are able to:

- implement various rebalancing strategies and discuss their pros and cons
- analyze structural properties of market indices
- implement index-tracking models in Python and compute optimal tracking portfolios for real-world data
- explain the structure and the mechanics of exchange traded funds
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Literature (textbooks)


Literature (papers on portfolio selection)

Literature (papers on index tracking)
