SF2942: Portfolio theory and risk management
Fall 2016

Contact information:

Pierre Nyquist
Department of Mathematics
Office: Room 3432, Lindstedtsv. 25
Email: pierren@kth.se

Carl Ringqvist
Department of Mathematics
Office: Room 3417, Lindstedtsv. 25
Email: carrin@kth.se

What is this course about?

What is this course about?

"all the eggs should not be in the same basket"

(1990 Alfred Nobel Memorial Prize in Economics press release, regarding the work of H. Markowitz)

I Interest rates and cash flows.

II Financial derivatives and no-arbitrage.

III Convex optimization.

IV Quadratic hedging principles.

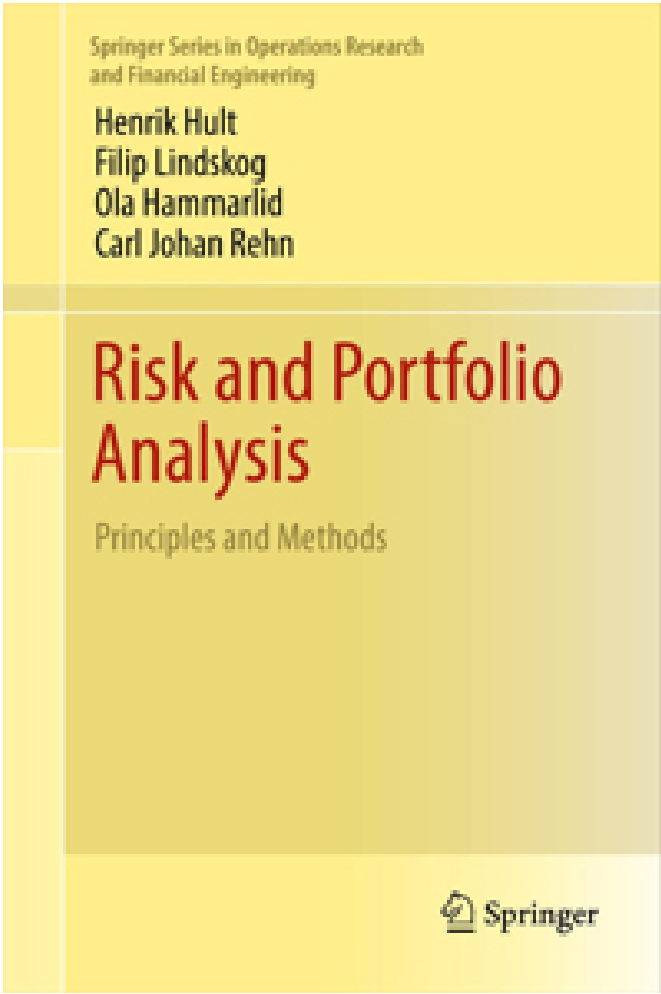
V Hedging of insurance liabilities.

VI Immunization of cash flows.

VII Quadratic investment principles.

VIII Utility-based investment principles.

IX Risk measurement principles.



Example of other topics in which you will benefit from a course like this:

- Financial mathematics
- Financial derivatives
- Risk management
- Actuarial science
- ...

Objectives

By the end of the course you should

- be able to rigorously define and explain fundamental concepts within interest rate theory, portfolio theory and risk management.
- be familiar with common instruments for risk management.
- be able to define different frameworks and criteria for portfolio choices and explain their strengths and weaknesses.
- be able to construct optimal portfolios using common financial instruments.
- be able to give examples of some standard risk measures.
- ...

Motivating examples

An insurance company faces known and unknown liabilities far into the future. How should they invest their money to remove risk due to, e.g., changes in interest rates?

Motivating examples

An insurance company faces known and unknown liabilities far into the future. How should they invest their money to remove risk due to, e.g., changes in interest rates?

A market participant wants to invest in a collection of stocks to maximize potential return, but is risk averse and wants to restrict to portfolios with "not too much risk". Is it possible to find an optimal portfolio? What if instead she wants to minimize risk while being guaranteed a certain (expected) return?

Motivating examples

An insurance company faces known and unknown liabilities far into the future. How should they invest their money to remove risk due to, e.g., changes in interest rates?

A market participant wants to invest in a collection of stocks to maximize potential return, but is risk averse and wants to restrict to portfolios with "not too much risk". Is it possible to find an optimal portfolio? What if instead she wants to minimize risk while being guaranteed a certain (expected) return?

Financial institutions often have to report the risk associated with their aggregate positions to a regulatory agency (e.g., Finansinspektionen). But how can we quantify "risk" in a meaningful way?

Syllabus overview

Course logistics

Meeting times: TuThF 8:00-10:00 + additional times weeks 1-3; B1.

Office Hours: Tue 10:30-11:30, .

Webpage: www.math.kth.se. Visit the webpage for all course announcements, policies and guidelines and an up-to-date schedule.

Prerequisites: Single and multi-variable calculus linear algebra, differential equations, mathematical statistics and numerical analysis. Knowledge of optimization theory is helpful but not required.

Course logistics cont'd

Lectures divided into two types: Theory and problem sessions. The former covers basic theoretical concepts, as well as examples and applications that highlight the theory. Problem sessions: Exercises from the book.

Instruction will be a mixture of blackboard and electronic presentations. In particular, we will try to incorporate presentations in R when suitable.

The main text is "Risk and Portfolio Analysis: Principles and Methods" by Hult et al. Additional texts that may be of use: "Fundamentals of Futures and Options Markets" and "Options, Futures and Other Derivatives" by John C. Hull (by no means required).

Examination

Grades decided by a written exam, possible to obtain bonus points from assignments.

Exam:

- Final exam scheduled for Thursday October 27.
- Cumulative exam.
- For questions regarding the proceedings of the exam, please contact the Student Affairs Office.

Assignments:

- Two voluntary assignments.
- Second assignment will involve real market data using Quantlab.
- Collaboration is encouraged. However, solutions must be written up and submitted in groups of at most three..
- See course webpage for guidelines regarding late homework etc.

Preliminary outline

There will be a total of 24 classes (excluding final exam). The following is a preliminary list of important dates throughout the course.

- Week 2
  - Fri 9/9: Assignment 1 available.
- Week 4
  - Fri 9/23: Deadline Assignment 1. Assignment 2 available.
- Week 7
  - Fri 10/14: Summary. Deadline Assignment 2.
- Week 8: **No classes**.
- Week 9
  - Thu 10/27: **Final exam, 08:00-13:00.**

Next: Interest rates and cash flows.

Any questions - send me an email or stop by my office (Thu 10:30-11:30 this week, or some other agreed upon time).