SF2942 - PORTFOLIO THEORY AND RISK MANAGEMENT
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Office hours: Tue 10:30-11:30; week 1 Thu 10:30-11:30.

Basic course information
Meeting times: TuThF 8:00-10:00 + additional times weeks 1–3.
Location: B1.
Webpage: http://www.math.kth.se/matstat/gru/sf2942/.

Course description

Although always present, in recent years the demands on financial institutions and insurance companies to to quantify and report their risks have become increasingly stringent. This requires taking a quantitative approach to dealing with questions on investments and risk management, which is the topic of this course. Indeed, the course gives an introduction to some of the principles involved when making decisions in the presence of hedgeable and non-hedgeable risks. It is intended to provide advanced undergraduates a solid understanding of some essential features of investment and risk management problems.

The following is a coarse list of the general topics that will be discussed in the course and the corresponding chapters in the textbook.

I Interest rates and cash flows. [Ch 1]
II Derivatives and no-arbitrage. [Ch 1]
III Convex optimization. [Ch 2]
IV Quadratic hedging principles. [Ch 3]
V Hedging of insurance liabilities. [Ch 3]
VI Immunization of cash flows. [Ch 3]
VII Quadratic investment principles. [Ch 4]

VIII Utility-based investment principles. [Ch 5]
IX Risk measurement principles. [Ch6]

There will be a total of 24 classes (excluding final exam). The following is a preliminary list of important dates throughout the course. For an up-to-date account please visit the course webpage.

- Week 2
  - Fri 9/9: Assignment 1 available.
- Week 4
  - Fri 9/23: Deadline Assignment 1. Assignment 2 available.
- Week 6
  - Fri 10/7:
- Week 7
  - Fri 10/14: Summary. Deadline Assignment 2.
- Week 8: **No classes**.
- Week 9
  - Thu 10/27: **Final exam, 08:00-13:00.**

Prerequisite. Courses in single and multivariable calculus, linear algebra, differential equations, mathematical statistics and numerical analysis. Knowledge of optimization theory is helpful but not required.

Instructional method. Lectures can be roughly divided into two types: Theory and problem sessions. Theory sessions will cover the basic theoretical concepts of the course, as well as relevant examples and applications that highlight the theory. At roblem sessions exercises from the book, and potentially other sources, will be presented.

The instructional method will be a mixture of blackboard presentations and electronic presentations when appropriate. In particular, when discussing examples "live" presentatitions in R will be used to illustrate computational aspects of the topics covered in the course.

Assignments are meant to complement what is presented in class, covering both theoretical and practical questions related to key concepts. The bonus assignmnets also provide you with an opportunity to work with real market data and apply the methods learned in class to such data. You are encouraged to collaborate on both the assignments and examples/exercises in the book.

Course materials. The main text for the course is "Risk and Portfolio Analysis: Principles and Methods" by Hult et al. [1]. The course will cover the first part of the book, labelled "Principles", consisting of the first six chapters. Additional texts that can be helpful are lecture notes from SF2701 (either by Harald Lang or Camilla Landén) and (any edition of) either [2] or [3]. However, the main text is self-contained and is the only required reading for the course.

Course goals and objectives. By the end of the course students 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.

Examination

There will be a written exam on Thursday Oct 27, 08:00-13:00. The exam will consist of five questions on both theory and specific examples discussed in class. **Registration for the exam is required** and can be done at MyPages. Grades are based on the final exam and given in the range A-F, and Fx. The grade Fx gives you the right to a complementary examination to reach the grade E. The criteria for Fx is F and that an isolated part of the course can be identified where you have shown particular lack of knowledge and that the examination after a complementary examination on this part can give the grade E. A request for a complementary examination must be received within six weeks.

As part of the examination there will also be two sets of **voluntary** home assignments that can give bonus points on the final exam. These will be announced in class and online, and posted on the website along with the deadline for submissions.

The rules regarding home assignments are as follows:

- At most three students in each group.
- If called upon, members of a group must be able to explain their work. Failure to do so may result in a reduction in awarded bonus points.
- Groups may collaborate but must hand in separate solution sets. If two (or more) groups' solutions look too similar without an apparent explanation, both (all) may loose any bonus points awarded for that assignment.
- Late submissions will not be accepted other than under special circumstances (with verification). If something comes up and the group feels a late submission is warranted please contact the instructor or TA as soon as possible.
- Electronic submissions are not allowed. Please hand in your solutions either in class or to the instructor or TA (in person or in respective mailbox), adhering to the deadlines.

Any bonus points are valid only for the ordinary exam and the first available re-exam.

Expectation of students

There is no official requirement to attend class. However, those who attend are asked to show up on time and be respectful of the classroom environment. If you arrive late, please enter in a way so as to not disrupt the class. If a student is disrupting the class in a continuing way, instruction will stop and the student in question will be asked to leave. Students who elect to not attend class are themselves responsible for knowing what is being

covered in class and to obtain the relevant material (lecture notes etc.). In addition to what is available on the course webpage and to all participating students, written lecture notes or similar will not be provided except under special circumstances.

Any requests regarding the final exam must go through the Student Affairs Office.

Feedback. In order to make the course as good as possible for all participants, students may be asked to provide feedback on certain aspects during the semester, either in class or using the course webpage. If at any time you feel that course is not meeting your expectations or you want to share your thoughts on how it is progressing you are welcome to contact the instructor directly.

At the end of the course, before the final exam, all students will be asked to fill out a course evaluation. All evaluations will be anonymous.

References

[1] Hult, H., Lindksog, F., Hammarling, O. and Rehn, C. J. (2012). *Risk and Portfolio Analysis: Principles and Methods*. Springer-Verlag, New York.

[2] Hull, J. C. (2013). *Fundamentals of Futures and Options Markets*, Pearson Prentice Hall, Upper Saddle River, NJ.

[3] Hull, J. C. (2015). *Options, Futures, and Other Derivatives*, Pearson Prentice Hall, Upper Saddle River, NJ.