

Topics in Actuarial Science
Risk Measurement
ACTSC 991, Spring 2015

This syllabus focuses on the first half of the course

Instructors:	Ruodu Wang, M3 3122, ext.31569, wang@uwaterloo.ca Daniel Linders, daniel.linders@kuleuven.be
Lectures:	12:00 – 1:20 Tuesdays and Thursdays, M3 3103.
Tutorials:	N/A.
Office hours:	Tuesdays 4:00-5:00 and Thursdays 5:00-6:00, or by appointment. (R. Wang) You are welcome to drop by my office at any time, and if I am not occupied I will be happy to answer your questions.
Target audience:	Ph.D. students and Master's students who are interested in research

Structure of the course

The course consists of 12 weeks of lectures. It has a special structure: taught by two instructors.

- I (R Wang) will teach for the first 6 weeks. This part will focus on the mathematics of risk measures and the practice of regulatory risk measures.
- Dr. Daniel Linders (Faculty of Economics and Business, KU Leuven) will take over from June 16th and teach for the second 6 weeks. D Linders has expertise in economic and financial risk measurement.
- There may be a small portion of overlap of the two parts and they will be taught from different perspectives.

This syllabus focuses on the part which I teach, which is the first half of the course.

References

The (first half of the) course will be mainly based on the instructor's personal research experience. Many results are from recently published research papers and the materials will not follow a particular book.

The main reference books are

- (i) Föllmer, H. and Schied, A. (2011). *Stochastic Finance: An Introduction in Discrete Time*. Walter de Gruyter, Third Edition.
 - (ii) Delbaen, F. (2012). *Monetary Utility Functions*. Osaka University Press.
 - (iii) McNeil, A. J., Frey, R. and Embrechts, P. (2005). *Quantitative Risk Management: Concepts, Techniques, Tools*. Princeton, NJ: Princeton University Press.
- You are not required to purchase those books.
 - You are encouraged to read some regulatory documents for financial and insurance institutions. References will be provided in the lectures.

Main objectives of the course

In the first half of the course, we will study

- general framework of risk measurement and capital requirement
- Value-at-Risk and Expected Shortfall
- the current (2013-2015) debates and developments on regulatory risk measures
- monetary risk measures: coherent and convex risk measures, distortion risk measures, utility-based shortfall risks
- mathematics of risk measures: axiomatic theory and representation
- statistical and computational issues of risk measures: estimation, simulation, robustness, forecasting
- some recent research developments
- current challenges

The depth of the topics will be at the level of recent research advances. Some tools in functional analysis and topology will be involved.

Assignments

There will be two assignments for the first half of the course.

Exams, projects and presentations

For the first half of the course, there will be no exams, projects, or presentations. However, D Linders may choose to hold a final exam or projects for the second half or the entire course.

Course Evaluation Breakdown

(1) R Wang 50%

– Evaluation will be based on assignments

(2) D Linders 50%

– Evaluation will be based on one assignment and one regular exam

Tentative Schedule

	Time	Topics
Part I Risk measures, regulatory capital and risk management	Lectures 1-2	Risk measures and capital requirement Value-at-Risk and Expected Shortfall Estimation and modeling issues Current debates in the regulation
Part II Axiomatic theory of risk measures	Lectures 3-8	Monetary risk measures Acceptance sets and duality Coherent and convex risk measures Distortion risk measures Utility-based shortfall risks Risk measures and stochastic orders
Part III Recent research developments on risk measures	Lectures 9-12	Capital allocation and collaborative game Robustness issues Aggregation of risk measures Forecasting and elicibility Change of currency Comparison of regulatory risk measures

This is an ambitious schedule: Part II alone can stand for an entire course. I may not be able to cover all proposed topics. The details of some topics will not be covered but may be complemented from the second half of the course.