

New York University Tandon School of Engineering
Department of Finance and Risk Engineering
Course outline FRE6123 Financial Risk Management
Spring 2020
Professor Roza Galeeva
Wednesday, 2pm – 4.30 pm, location Rogers Hall, 214

Course Description:

The recent financial crisis and its impact on the broader economy underscore the importance of financial risk management in today's world. Risk management is a unique domain, proving the importance of power of mathematics in real world and constantly posing new challenges in view of increasingly complex products and strategies.

The course teaches risk management from scratch, with business practice in mind. In each class we will introduce the necessary theory and discuss typical examples and cases.

We will start by surveying pre-VaR risk management, introduce main financial markets and instruments.

We will cover Value at Risk and computational techniques in detail as this is still the predominant risk measure used in practice. We consider calculation of Greeks for main financial instruments, historical simulation for VaR portfolio. Coherent risk measures like Expected Shortfall are also being increasingly considered and used.

We will review basic multivariate models, such multivariate normal distributions and introduce their generalizations, as normal mixture models. Using these tools, we will analyze portfolio VaR.

Other topics include introduction to copulas, credit risk and counterparty risk.

Course Objective:

- Anyone, who considers a career in business to become a trader, quant or project manager, must have a good understanding of risk management.
- At the end of the course students will get better understanding of applications of mathematical tools in financial risk management and will be able to apply their risk management knowledge in real life.
- The considered practical problems should also prepare you for interviews for internships and jobs.

Course Structure

Most weeks, a lecture will be delivered, followed by a discussion of the previous homework and Q&A. We might have guest speakers, which will be announced later. I will give occasional 5-10 min quizzes to test the knowledge.

Suggested reading

I don't require to buy any books. The lecture notes will be posted on NYU classes each week prior to the class. There are though some books, which I would recommend...

- *Risk Management (my favorite)*
 - Quantitative Risk Management, concepts, techniques and tools, A. McNeil, R. Frey and P. Embrechts (advanced, theoretical, goes beyond this course)
- *Books on derivatives:*
 - Options, futures & other derivatives, John Hull, Prentice Hall (classic)

- *Data analysis*
 - Statistics and Data Analysis for Financial Engineering, David Ruppert, Springer (nice, practical book, with lot of examples and R code)
- GARP
 - Financial Risk and Regulation Series: Market Risk Management, Credit, Operational and Bank risk management, can be picked up from Prof. Shimko (qualitative , general introduction to various aspects of Risk Management)
- *Additional sources :*
 - I will provide additional references to research papers during the course

Recommended software for classwork and homework:

Most of work will be done in Excel. Using other programming tools, as Python or R is strongly encouraged, but not required.

Course requirements:

The students are expected to attend the classes and participate actively. You need to bring your laptops to the class, as we will be doing often work in the class. If for any reason you can't come to lecture, please inform me by email in advance. There will a midterm exam, final exam, home assignments and short quizzes.

Midterm exam will count for 30% of the grade.

The exam will be held in the classroom, on the scheduled class time, week 7 (March 11).

Final exam will count for 35% of the grade, week 15, at the usual scheduled class time. (May 13)

In both exams, the students will be required to solve questions, based on the previous material, homework questions and class discussions.

Weekly home assignments, due on weeks 2, 3, 4, 5, 6, 9, 10, 11, 12, 13 count for 30% of the final grade. Home assignments are due by 2pm, our class time and have to be uploaded on NYU site. No extensions on home assignments. The homework is very important for the learning process. You can work together on home assignments (in this case please point who you worked with), but you need to submit your own version and fully understand the solution.

Participation and quizzes will count for 5% of the final grade.

Calendar

We will have 12 lectures + 2 exams. [NYU calendar](#)

Contact

The best way to contact me is by email, I monitor my emails regularly. You can always talk to me before and after the class. If you need to talk to me outside the class hours, send me an email and we will find a suitable time.

Tentative program:

- Week 1 Introduction to Risk Management, calculation of volatility, confidence intervals and distribution tests, Univariate VaR
- Weeks 2- 3 Main financial markets and financial instruments
- Week 4 Multivariate distributions, Portfolio VaR
- Week 5 Risk factors, stress scenarios and Linear Approximations for Losses
- Week 6 VaR by historical simulation, Review before midterm
- Week 7 Midterm
- Week 8-9 Heavy tails distributions, ES and VaR, Coherent Risk Measures
- Week 10 Introduction to Credit Risk
- Week 11 Credit analytics, hazard rates, spreads, Merton model
- Week 12 Introduction to Copulas
- Week 13 Counterparty Risk
- Week 14 Review before final, problem solving session
- Week 15 Final exam

This is only a *tentative* schedule, subject to revisions and changes, depending on the speed of the process, having guest lectures and other factors.