FIN-474

Advanced risk management topics

Acerbi Carlo

Cursus	Sem.	Type
Financial engineering minor	H	Opt.
Financial engineering	MA1, MA3	Opt.

Language of teaching	English
Credits	2
Session	Winter
Semester	Fall
Exam	Written
Workload	60h
Weeks	14
Hours	**2 weekly**
Lecture	1.5 weekly
Number of positions	

Remark

MA3 only. Special schedule. See the MFE website: https://go.epfl.ch/fe

Summary

The students learn different financial risk measures and their risk theoretical properties. They learn how to design and implement risk engines, with model estimation, forecast, reporting and validation elements. The students will also overview regulation standards for banks and insurance companies.

Content

· Brief overview of financial regulation
o The Basel Capital Accord, from Basel I to Basel III
o Insurance regulation: Solvency I and II
o Asset management regulation overview
· Introduction to risk measures: examples: Variance, Value at Risk (VaR) and Expected Shortfall (ES)
o Definitions
o Estimation properties: statistical error and bias
· Common practices for portfolio risk modelling
o Montecarlo simulation
o Historical simulation
o Parametric distributions
· Coherent measures of risk
o Axiomatics
o Convex measures of risk
o Proofs of coherence for ES
o Spectral measures of risk; construction and characterization
o Stress Testing
o Deviation measures of risk
o Introduction to liquidity risk
· Risk attribution
o The Euler principle
o The Shapley Value
· Introduction to Portfolio Optimization
o Markowitz mean-variance optimization
o Optimization with coherent measures of risk
· Model validation:
o VaR backtesting methods
o Backtesting General Risk measures
o Elicitability and backtestability
o Ridge backtest for ES and Variance

Keywords

Value at Risk, Expected Shortfall, Coherent Measures of Risk, Stress Testing, Backtesting, Basel Regulation, Solvency Regulation,

Learning Prerequisites

Required courses

tbd

Recommended courses

tbd

Important concepts to start the course

Calculus 1 and 2. Statistics and probability. Portfolio theory.

Learning Outcomes

By the end of the course, the student must be able to:

- Demonstrate ,discuss and illustrate relevant properties of common risk measures
- Model profit-and-loss distribution functions, with analytical methods, Montecarlo or Historical Simulation, as appropriate
- Estimate risk measures from iid data samples
- Quantify risk measures exactly from exact specification of the distribution functions
- Optimize portfolio risk and return using either variance or ES
- Contextualise a risk engine design within financial regulation
- Implement model validation (backtesting) procedures for a risk engine
- Construct risk management dashboards for portfolio hierarchies, with risk attribution features

Transversal skills

- Summarize an article or a technical report.
- Demonstrate the capacity for critical thinking
- Write a scientific or technical report.

Teaching methods

Slide presentations
Coding snippets and examples (python and/or matlab)

Expected student activities

(non marked) episodic programming assignments and challenges

Assessment methods

final project (50/100) plus exam (50/100)

Resources

Bibliography

Embrechts, Frey, McNeil, « Quantitative Risk Management, 2nd ed. », 2015

Ressources en bibliothèque

- 9780691166278 / McNeil

Notes/Handbook

Professor's Notes (pdf beamer slides)