GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2024-2025

Data Science for Finance and Insurance (F000944)

Course size *(nominal values; actual values may depend on programme)*

Credits 4.0 **Study time 120 h**

Course offerings and teaching methods in academic year 2024-2025

A (semester 1)	English	Gent	seminar
			lecture
			group work

Lecturers in academic year 2024-2025

Boudt, Kris	EB21	lecturer-in-charge

Offered in the following programmes in 2024-2025	crdts	offering
Master of Science in Teaching in Science and Technology(main subject Mathematics)	4	A
Master of Science in Business Engineering (Double Degree)(main subject Finance)	4	A
Master of Science in Business Engineering(main subject Finance)	4	A
Master of Science in Mathematics	4	A
Master of Science in Banking and Finance	4	A
Exchange programme in Economics and Business Administration	4	A

Teaching languages

English

Keywords

Classification, data, decision analytics, finance, insurance, modeling, prediction, financial risk

Position of the course

The course on data science for finance and insurance is a specialized course within the MBF degree and Msc BE Finance. It discusses in detail several use cases of combining financial modelling and data analysis as input for decision making in finance and insurance. The course requires students to get their hands dirty with programming code and data.

Contents

The course is about the theory and practice of data-driven decision making in finance and insurance. Those decisions involve (i) financial modelling of the future gains and losses associated to the financial decision, (ii) statistical estimation of the model parameters, (iii) optimization of the optimality criterion associated to the estimation or decision problem, (iv) prediction and (v) evaluation. There are four parts.
The first part of the course is about setting up a complete data science analysis in the open source software environment R and Python. It concerns reading economic and financial data, data cleaning, writing functions, optimizing functions, visualizing output via dashboards and implementing and evaluating a first data science pipeline and a machine learning model.

The second part of the course provides a detailed treatment of the non-normal location-scale model. It includes univariate and multivariate GARCH models, the use of Cornish-Fisher expansions, copulas and extreme value theory to account for the non-normality of the distribution. It also discusses the construction of reliable estimators for the model parameters through techniques from robust statistics and shrinkage estimation. The continuous-time analogue of the location-scale model is the Brownian semimartingale with jumps process. The course provides a hands-on introduction to this process and the use of high-frequency price data for estimating the model parameters. Potential applications of part 1 of the course include simulation analysis, risk monitoring and robo-advisory.
The third part of the course is targeted towards prediction in a big data environment using

clustering, generalized linear models and recent advances from machine learning and text mining. Potential applications of part 2 of the course include the modelling of the severity and frequency of insurance claims, fraud detection and automated loan decisioning.
The fourth part of the course is about the limits to modelling and data-driven decisions in finance and insurance. This part discusses (among other things) the origins of endogenous risk in a financial system, as well as ethical aspects within machine learning.

Initial competences

The final competences of 'Investment Analysis' and 'Financial Risk Management' serve as a starting point.

Final competences

1 Translate a decision problem in finance and insurance into a data-driven optimization problem.
2 Understanding sensitivity to modeling assumptions and choices of implementation.
3 Use and modify programming scripts in an open source software environment.
4 Critically evaluate the pros and cons of data-driven decision making in finance and insurance.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

Access to this course unit via an exam contract is unrestricted

Teaching methods

Group work, Seminar, Lecture

Study material

Type: Slides

Name: Data Science For Finance and Insurance
Indicative price: Free or paid by faculty
Optional: no
Available on Ufora : Yes
Online Available : No
Available in the Library : No
Available through Student Association : No

References

Boudt, K., Peterson, B. G., and Croux, C. (2008). Estimation and decomposition of downside risk for portfolios with non-normal returns. Journal of Risk, 11(2), 79-103.
Boudt, K., Ghalanos, A., Payseur, S. and Zivot, E. (2019). Multivariate GARCH models for large-scale applications: A survey. In H.D. Vinod and C.R. Rao (Ed.) Handbook of Statistics, Volume 41.
Embrechts, P., Klüppelberg, C., and Mikosch, T. (2013). Modelling extremal events: for insurance and finance (Vol. 33). Springer Science & Business Media.

Course content-related study coaching

The professor is available for questions.

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment

Examination methods in case of periodic assessment during the second examination period

Written assessment

Examination methods in case of permanent assessment

Peer and/or self assessment, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

Written exam (60%) and group assignment (40%).
Second term: Depending on the deficits for the evaluation components, a written exam and / or an individual work. The score for the component which the student has succeeded are taken

over to the second term.

Calculation of the examination mark

End-of-Term evaluation: 60%, permanent evaluation: 40%.
Students must have passed the group assignment in order to pass the course. If the student does not pass the group assignment and the weighted average yields a score of 10 or more on 20, the final score is reduced to 9/20, the highest score for which the students does not pass the course.