

FIN-416

Interest rate and credit risk models

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

Language of teaching	English
Credits	6
Session	Winter
Semester	Fall
Exam	Written
Workload	180h
Weeks	14
Hours	5 weekly
Courses	3 weekly
Exercises	2 weekly
Number of positions	

Remark

Only in MA3

Summary

This course gives an introduction to the valuation of interest rate securities with and without credit risk, the management and hedging of bond portfolios and the valuation and usage of interest rate and credit derivatives.

Content

Topics include:

- Introduction to interest rate and credit markets
- Estimating the term structure
- Short rate models
- Heath-Jarrow-Morton (HJM) framework
- Forward measures
- Forwards and futures
- Structural credit risk models
- Reduced-form credit risk models
- Credit default swaps (CDS)

Keywords

interest rate risk, credit risk, term structure, bonds, interest rate swaps, caps and floors, short rate models, HJM models, bankruptcy, ratings, CDS, structural models, reduced-form models

Learning Prerequisites**Required courses**

- Derivatives
- Econometrics
- Introduction to finance
- Stochastic calculus

Learning Outcomes

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

- Describe the various notions of interest rates and related basic products
- Apply the basic tools duration and convexity for interest rate risk management
- Derive an estimated term structure from market data
- Reconstruct the implied volatility surface for caps, floors, and swaptions from market data
- Implement some basic stochastic interest rate models, including the Vasicek and CIR short rate models
- Apply the industry standard Black and Bachelier models for pricing and quoting caps, floors, and swaptions
- Differentiate between structural and reduced-form models
- Assess / Evaluate Credit Default Swaps (CDS)

Transversal skills

- Use a work methodology appropriate to the task.

Teaching methods

Lectures, exercises, homework

Expected student activities

attendance at lectures, completing exercises

Assessment methods

- 20% Homework assignments
- 30% Midterm examination
- 50% Final examination

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

L. Andersen and V. Piterbarg, Interest Rate Modeling, Atlantic Financial Press, 2010.
D. Brigo and F. Mercurio, Interest rate models: Theory and practice, 2nd Edition, Springer Verlag, New York, 2007.
D. Filipovic, Term-Structure Models, Springer Verlag, 2009.
D. Lando, Credit Risk Modeling: Theory and Applications, Princeton University Press, 2004.
A. McNeil, R. Frey, P. Embrechts, Quantitative Risk Management, Princeton University Press, 2015.

Ressources en bibliothèque

- [Quantitative Risk Management / McNeil](#)
- [Interest Rate Modeling / Andersen](#)
- [Interest rate models: Theory and practice / Brigo](#)
- [Credit Risk Modeling: Theory and Applications / Lando](#)

- [Term-Structure Models / Filipovic](#)