# FIN-416 Interest rate and credit risk models

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Cursus	Sem.	Туре	Language of	English
Financial engineering minor	Н	Opt.	teaching	Linglish
Financial engineering	MA1, MA3	Obl.	Credits Session	6 Winter
			Semester Exam	Fall Written
			Workload Weeks	180h 14

# Remark

MA3 only

### Summary

This course gives an introduction to the modeling of interest rates and credit risk. Such models are used for 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**

- Probability and stochastic calculus
- Derivatives
- Econometrics
- Introduction to finance

### Learning Outcomes



5 weekly 3 weekly

2 weekly

Hours

Lecture Exercises

Number of positions

- 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**

- 40% Midterm examination
- 60% 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

## **Moodle Link**

• https://go.epfl.ch/FIN-416