UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Interest Rate Derivatives

2324-2-F1601M064-F1601M075M

Learning objectives

The course is about the valuation of derivative products (linear, plain vanillas, and exotics) and presents the main Interest Rate and Credit models, with special emphasis on rate/credit curve construction and collateralization issues. The main targets are:

1. Knowing the types of derivatives written on interest rates .
2. Being able to simulate the dynamics of am nterest rate,
3. Being able to download financial data and to use Bloomberg for pricing interest rate derivatives.
4. Bootstrapping of the interest rate curve and extrapolating of the probability of a default from market data.

Contents

The course is about the valuation of derivative products (linear, plain vanillas, and exotics) and presents the main Interest Rate and Credit models, with special emphasis on rate/credit curve construction and collateralization issues.

- FRA, Futures, and Swaps
- Rate curve bootstrapping in multi-curve regimes
- Black Model and its shifted log-normal variants
- Interest rate volatility: par, forward, no-arbitrage, and SABR model
- Term structure models: equilibrium, no-arbitrage, short rate, and market models
- Caps and Floors, Swaptions, and Bermudan Swaptions
- Credit Default Swaps
- Credit curve bootstrap
- Counterparty risk: clearing, collateralization, and XVA valuation adjustments
- Market risk management: greeks and static replica of structured products

Detailed program

- Interest Rate Basics
- Rate Curves Calibration
- Black Model
- Volatility
- Caps and Floors
- Swaptions
- Structured Products
- Pricing of structured products in Bloomberg
- Greeks and Hedging
- Interest Rate Models
- Bermudan Swaption
- Credit Derivatives
- Counterparty Risk, Collateral Protection and Central Clearing
- Credit Default Swaps
- Credit Curve Bootstrapping
- XVAs: Introduction to Valuation Adjustments
- The Reform of Benchmark Interest Rate Indexes and Its Impact on Derivative Pricing

Prerequisites

Good knowledge of financial math, derivatives and coding.

Teaching methods

Standard classes (theoretical aspects and practical implementations in Matlab using data downloaded from the data provider Bloomberg)

Assessment methods

Project work and subsequent oral examination

Final grade=0.4*Grade of the project work+0.6*Grade of the Oral Examination

Project work

-Students will be organized in small groups and each group will receive an assignment related to some of the topics seen during the course. Data used will be downloaded from Bloomberg.

- Each group should produce a report on the assigned project work. Matlab codes used to produce the report should also be included.

Oral examination

-The oral exam and the final grade are individual.

-During the oral examination there be a discussion on the project and on the topics covered in the course.

Textbooks and Reading Materials

- John Hull, Options, Futures and Other Derivatives, 10th edition
- Oosterlee, C. W., & Grzelak, L. A. (2019). Mathematical Modeling and Computation in Finance: With Exercises and Python and Matlab Computer Codes. World Scientific.

Semester

First semester

Teaching language

Italian

Sustainable Development Goals