UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Interest Rate Derivatives

2526-2-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. Knowledge and understanding
   Students will acquire a solid understanding of the theoretical aspects connected with the main topics covered during the course, such as the main types of derivatives written on interest rates.

2. Applying knowledge and understanding
   Students will be able to effectively apply mathematical methods to solve practical problems consistent with the course topics and to simulate the price dynamics of an interest rate. Moreover, they should be able to download financial data and to use Bloomberg for pricing non vanilla interest rate derivatives They should learn how to compute the risk-free curve and the implied default probabilitties dtarting from market contract quotations.

3. Making judgements
   Students will develop logical and analytical skills useful for tackling and solving complex problems, including those interdisciplinary in nature, and for critically evaluating the obtained results.

4. Communication skills
   Students will learn how to correctly use the mathematical language, so as to accurately and coherently express the acquired theoretical notions, as well as to effectively communicate ideas, methods and results.

5. Learning skills
   Students will develop an independent study method, enabling them to approach subsequent, more advanced studies with awareness and success.

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

Classes with classical teaching methods and practical interactive sessions (Excel, Matlab and use of the data provider Bloomberg).

Some of the lectures will be provided remotely (at most 30% of the hours) in streaming or recorded. The teacher will communicate in advance which lessons will be provided remotely.

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

QUALITY EDUCATION | GENDER EQUALITY