Fixed Income and Credit Risk

Gianluca Fusai

Università degli Studi del Piemonte Orientale

Cass Business School City, University of London

Hours: 35

Course objectives

The purpose of the course is to present the latest achievements in the term structure modeling for pricing and hedging interest rate derivatives. Emphasis will be devoted to the theoretical and practical implementation of the models, and the suitability of different models in complex valuation and hedging problems of interest rate options, equity-linked fixed income securities and structured products. Particular emphasis will also devoted to credit risk issues, such as assessment of counterparty credit risk. On completing the course the participants will have a clear and thorough understanding of the different methodologies in the pricing and hedging of interest rate options. The course is quantitatively oriented, but financial and practical issues are greatly discussed.

Syllabus

1. Introduction to Fixed Income World.
2. Examples of Structured products and Financial Engineering.
3. Review of Basic elements of financial math and Interest Rate Conventions.
4. Building Blocks: LIBOR, FRA, Eurofutures, Swap.
5. Yield Curve Stripping: the Bootstrapping Procedure. Interpolating the yield curve: parametric and non-parametric methods.
6. Pricing Floating Rate Notes.
7. Interest Rate Options: Caps, Swaptions and Bond Options.
8. The Black Model and the volatility surface
9. Allowing for negative rates: Bachelier and Shifted Black model.
10. Pricing structured products
11. The change of numeraire and pricing of interest rate derivatives.
12. Short rate models. Merton, Vasicek, CIR.
13. The Heath-Jarrow-Morton (HJM) Model. Gaussian HJM Models. Multivariate HJM models.
14. Comparing different Term Structure Models: Market Models, Short Rate Models, HJM.
15. Empirical features of interest rate dynamics. Interest Rate Risk. PCA analysis of the term structure.
16. Lab session: Yield curve stripping, Calibration of short rate models; Pricing Floating Rate Notes;
17. Counterparty Credit Risk: Recovery ratio and Default/survival probability, Pricing a risky zero-coupon bond; Pricing risky coupon bonds
18. Estimating default probability using bonds and CDS
19. Credit value adjustment for derivatives: Unilateral and Bilateral adjustment. Wrong-way-risk.
20. Mitigating counterparty exposure: Netting & Collateral

Software needed

Excel (with VBA) & Matlab

Prerequisites

Good knowledge of: financial calculus; basic derivatives (forwards and options) and their pricing (cash-and-carry & Black-Scholes formula); stochastic calculus (Brownian motion and its properties, Ito's lemma, ABM & GBM, isometry property of the Brownian motion, martingale).

Textbook and course material

1. Lecture Slides
2. Brigo, D. and F. Mercurio, Interest Rate Models - Theory and Practice: With Smile, Inflation and Credit, Springer Finance, 2nd ed, 2007.
3. Veronesi P., Fixed Income Securities: Valuation, Risk, and Risk Management, Wiley, 2009.
4. Ballotta, Laura and Fusai, Gianluca and Marena, Marina, A Gentle Introduction to Default Risk and Counterparty Credit Modelling (July 30, 2016). Available at SSRN http://ssrn.com/abstract=2816355 or

A complete suggested reading list will be distributed at the beginning of the course

Exam type

The exam will have the following modalities:

1. Quiz at the beginning of each lecture (15 minutes). Marked 0-30. They will account for 30% of the final grade.
2. Written examination (closed books) at the end of the course is planned. This will account for 40% of the final grade.
3. Compulsory take home homework will account for 30% of the final grade.