

# MathFinance Training

## Interest Rate Derivatives – Pricing, Hedging, Structuring and Risk Management

### Who should attend?

This course is designed for anyone who wishes to understand, price, hedge, structure and risk manage interest rate derivatives, in particular:

- ▲ Trading: Flow, proprietary, arbitrage, structured products
- ▲ Customer trading
- ▲ Interest Rate Derivative Trading
- ▲ Portfolio Management & Strategy
- ▲ Market Risk
- ▲ Alternative Investments
- ▲ Quantitative Analysis and Research
- ▲ Derivatives Research
- ▲ Structuring
- ▲ Risk Analysis and Control
- ▲ Data monitoring & Analysis
- ▲ Model Risk and Model Validation
- ▲ Corporate Treasury

### Why this course?

This course is a rapid and comprehensive introduction to interest rate derivatives. The course is focused on pricing, hedging, structuring and risk managing interest rate derivatives. Exotic interest rate derivatives is a developed market and a significant component of financial markets.

Learn how the interest rate derivatives market works from an extremely experienced practitioner, get the market view that you cannot get from a textbook, and benefit from in class case studies and exercises which will enable you to immediately put theory into practice. Also learn about yield curve construction and IR volatility surface parameterization and gain insights into the pros and cons of financial models. In addition, you will understand pricing and structuring so you can do it yourself.

### Learning Objectives:

- ▲ Gain an understanding of standard IR volatility surface and yield curve construction techniques and their respective advantages and disadvantages
- ▲ Appreciate pricing and risk of vanilla and exotic interest rate derivatives
- ▲ Learn about the key considerations in managing a trading book of exotic derivatives
- ▲ Understand how to hedge which product, market price of hedging strategies and main interest rate derivative pricing models

### Your instructor



Rubin Rajendram is a senior finance professional with two decades of investment banking experience across major financial centres (Sydney, Singapore, New York, London, Hong Kong). His subject matter expertise spans market risk management, exotic derivative trading and structuring, and also quantitative research/risk analytics.

Rubin Rajendram's most recent prior position was Global Head, Price and Risk Analytics at the FinTech firm Calypso Technology where he ran derivative research, risk analytics and model validation globally. Prior to this, Ruben Rajendram's previous positions were: European Head of Rates Market Risk at Deutsche Bank, EMEA Head of OTC Clearing Market Risk at JP Morgan, Head of Rates and FX Proprietary Index Trading at the Royal Bank of Scotland, Head of EUR and USD Rates Exotic Derivative Trading at the Royal Bank of Scotland. Prior to this, he was a senior interest rate and FX exotic derivative trader at Credit Suisse First Boston and a senior interest rate exotic/hybrid derivative trader at BNP Paribas. Rubin Rajendram spent the infancy of his banking career in quantitative research/risk analytics at a number of different derivative houses.

Rubin Rajendram holds the following academic qualifications: Master of Arts (Statistics) from Harvard University, Master of Science (Mathematics) from New York University; Master of Commerce (Finance) from University of New South Wales; Bachelor of Economics (Actuarial Science) from Macquarie University.

Rubin Rajendram is an international expert on exotic derivative trading, pricing, analytics and risk management and is frequent speaker at international conferences on these topics.

### Pricing

Regular: EUR 1750 p.p.\*  
 Group discount (2 or more): 20% off at EUR 1400 p.p.\*  
\* 19% VAT will be added

The rate includes course material, refreshments and lunch on all days.

<http://www.mathfinance.com>

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## Interest Rate Derivatives – : Pricing, Hedging, Structuring and Risk Management

### DAY 1

#### Fixed Income Basics

- Money Markets Instruments Overview
- Repurchase agreements
- LIBOR
- Interest rate conventions
- The Yield Curve
- Forward Interest Rates
- Government Bond Markets
- Bond Pricing

#### Linear Interest Rate Derivatives

- Fixed Income Market Overview
- Libor Instruments
- Interest Rate Swaps
- Cross Currency Basis Swaps
- LIBOR vs OIS Basis Swaps
- Tenor Basis Swaps
- Yield Curve Construction

#### Vanilla Interest Rate Volatility

- Introduction to Swaptions
- Swaptions pricing
- Swaptions Risk Parameters
- Caps, Floors and Eurodollar options
- Supply and Demand for Interest rate volatility
- Beyond Black Scholes model
- Empirical dimensions of ATM Swaption matrix

#### Interest Rate Implied Volatility Surface

- Term Structure and Smile
- Vanilla interest rate instruments: European Caps/Floors, European Swaptions
- ATM and Delta Conventions including sticky strike/sticky delta/SABR implied delta/shadow delta
- Risk reversals, butterflies, smiles, strangles
- Case Study: IR delta under different assumptions under different IR volatility dynamics, IR volatility, hedging

#### Interest Rate Derivatives – The Greeks

- Delta
- Gamma
- Rho
- Vega
- Theta
- 2<sup>nd</sup> order Greeks
- How interest rate option traders manage their books in practice

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## Interest Rate Derivatives – Pricing, Hedging, Structuring and Risk Management

### DAY 2

#### Interest Rate Smile/Skew Construction (Advanced)

The vanilla interest rate smile/skew surface is crucial in being able to price interest rate vanillas and exotics consistent with market prices. Common pitfalls in IR vanilla surfaces: Intertemporal arbitrage, negative probability densities, overpricing of the wings of the density.

- Mathematical Construction of the SABR Model
- Calibration of the SABR Model to IR vanilla market prices
- SABR expansion
- Intuition of the SABR model parameters and impact on model implied volatility smile/skew
- Weakness of the SABR model
- How well does your IR volatility surface model price CMS swaps?
- How to interpolate IR volatility surface model parameters? What is the rationale and the pros/cons?
- Extensions of the SABR model to overcome the weakness of SABR
  - i) Mixture of displaced lognormal processes with SABR mapping
  - ii) Local SABR parameters
  - iii) Arbitrage- Free SABR (SABR – AF)
- How can the vanilla IR volatility surface account for trade events?

#### Case Study: SABR model in practice

- Implementation of the SABR expansion
- Calibration of the model to market volatility instruments
- Demonstration of SABR model weaknesses
- SABR Greeks

#### Key Pricing Models for Interest Rate Semi-Exotic and Exotic Derivatives

- LGM1F + SV, LGM 2F + SV, LGM 3F + SV
- LMM (Libor Market Model)
- Cheyette model
- FX LSV Model

#### Pricing, Risk Management and Structuring of Semi-Exotic Interest Rate Derivatives (examples)

- Libor in Arrears Swaps
- Quanto Interest Rate Swaps
- CMS Swaps
- Capped and floored floaters
- Range Floaters and leveraged floaters
- Reverse Floating Rate Notes
- And more...

#### Pricing, Risk Management and Structuring of Exotic Interest Rate Derivatives

- Callable CMS/VMS/Libor and CMS Spread range accruals
- Callable Capped/Floored Floaters
- Callable Inverse Floaters
- Callabe Leveraged Steepeners
- Knock-out Swaps
- Callable Ratchet Floaters
- Volatility Bonds
- Target Redemption Swaps
- Inflation Exotics: LPI Swaps in GBP
- Credit Linked Interest Rate Derivatives
- And more...

#### Mortgage Derivatives

- Mortgage Backed Securities
- Balance Guaranteed Swaps