



# Latest Developments: Interest Rate Modelling & Interest Rate Exotic & FX Hybrid Products

London: 24th – 26th November 2008

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## Topics:

### Day 1: Interest Rate Modelling: Pricing, Hedging & Calibration Techniques

- **Managing Smile Risk**
- **The SABR model, vanna, volga and managing smile risk**
- **Levy based models**
- **Managing Exotic Interest Rate Products**
- **Calibration/pricing/hedging cycle**
- **Models for exotics**
- **Practical Pricing of Exotics**
- **Auto-calibration/global calibration**
- **Extension to other callable exotics**
- **Pricing Callable Range Notes**
- **Adjusters and risk migration**
- **Callable range notes**

#### Presenter:

**Pat Hagan:** Head Quantitative Analytics, Chief Investment Office, JP Morgan

### Day 2: Interest Rate Modelling

- **Mathematical Theory of Interest Rate Term Structure Dynamics and Calibration**
- **Markov Functional models (including multi-currency, multi-factor and forward smile)**
- **1-factor Markov Functional Models: the Hunt-Kennedy-Pelsser calibration method**
- **Markov Functional models and forward smile**
- **CMS & CMS spread options**
- **Pricing & modelling of correlation copula models Markovian projection**
- **Swaptions arbitrage**
- **Least Squares Importance Sampling for Libor Market Models**

#### Presenters:

**Dorje C. Brody:** Royal Society University Research Fellow, Imperial College London

**Luca Capriotti:** Vice President, Global Modelling and Analytics Group, Credit Suisse

**Lane P. Hughston:** Professor of Financial Mathematics, King's College London

**Simon Johnson:** Co-head of Credit and Interest Rate Financial Engineering, Commerzbank

**Julien Turc:** Head of Quantitative Strategy, Société Générale

## Topics:

### Day 3: Interest Rate Exotic & FX Hybrid Products

- **Cross Currency Models**
- **History of FX model for long dated structures**
- **Long Dated FX Hybrids**
- **PRDC and FX Tarn payoffs**
- **Exotic Interest Rate Pricing with Trees**
- **Gaussian Model and Extensions**
- **Wavelet Option Pricing**
- **General Pricing using the Green functions**

#### Presenters:

**Messaoud Chibane:** Senior Quantitative Analyst, Bank of America

**Antonio Cosma:** Assistant Professor, Université du Luxembourg

**Dherminder Kainth:** QuARC, Royal Bank of Scotland

**Michael Roehl:** Head of Fixed Income Quantitative Research, Lloyds TSB

# Day 1: Interest Rate Modelling: Pricing, Hedging & Calibration Techniques by Pat Hagan, JP Morgan

## 09:00 – 10:30 / Stochastic Volatility in Interest Rate Models

- Swap market basics and delta trading
- Vanilla interest rate options and managing vega risk
- Theory of Dupire and local vol models
- The SABR model, vanna, volga and managing smile risk
- Levy based models

10:30 – 10:45 Break

## 10:45 – 12:30 / Managing Exotic Interest rate Products

- Key interest rate risks
- Calibration/pricing/hedging cycle
- Models for exotics

- HJM models
- BGM models
- Short rate models
- Markovian models

- Summary

12:30 – 13:30 Lunch

## 13:30 – 15:15 / Practical Pricing of Exotics

- Auto-calibration/global calibration
- LGM model
- Calibration strategy and choice of calibration instruments
- Example: calibration and pricing Bermudan swaption
- Price, risks, hedging and the calibration instruments
- Extension to other callable exotics

**Callable Inverse Floaters, Superfloaters, Range Notes and Captions**

15:15 – 15:30 Break

- **Adjusters and risk migration**
  - The need for risk migration
  - Adjusters
  - Adjusted price
  
- **Callable range notes**
  - Deal definition
  - LGM model (reprise)
  - Convexity adjustment and payoff replication
  - Pricing with adjusters
  - Swaption and caplet risks

## Day 2: Interest Rate Modelling

09:00 – 11:00 / Mathematical Theory of Interest Rate Term  
/ Structure Dynamics and Calibration:  
/ Dorje C. Brody, Imperial College London &  
/ Lane P Hughston, King's College London

- Overview of the pricing kernel methodologies
- Dynamics of discount bonds, HJM equations
- The volatility structure approach: pros and cons
- Conditional variance representation for the pricing kernel
- Parametrisation and calibration of interest rate dynamics
- The role of Wiener chaos expansion in term-structure calibration
- First and second chaos models
- Interest rate options

11:00 – 11:15 Break

11:15 – 12:45 / Least Squares Importance Sampling for Libor  
/ Market Models:  
/ Luca Capriotti, Credit Suisse

- Monte Carlo simulations. Basics
- Importance Sampling and Stratified Sampling
- Least Square Importance Sampling (LSIS) & Effective Stratification
- Simulating Libor Market Models
- Examples & Numerical Results

12:45 – 13:45 Lunch

13:45 – 15:15 / Markov Functional models (including Multi-  
/ Currency, Multi-Factor and Forward Smile):  
/ Simon Johnson, Commerzbank

- Introduction to Markov Functional Models
- 1-factor Markov Functional Models: the Hunt-Kennedy-Pelsser calibration method
- Markov Functional models and forward smile
- Cross-currency Markov Functional models and preserving the driftless condition
- Multi-factor Markov Functional models and generalising the driving process

15:15 – 15:30 Break

15:30 – 17:00 / CMS & CMS Spread Options:  
/ Julien Turc, Société Générale

- Relative value
- Pricing & modelling of correlation copula models Markovian projection
- Swaptions arbitrage
- Wedges

## Day 3: Interest Rate Exotic & FX Hybrid Products

### 09:00 – 10:30 / Cross Currency Models: / Messaoud Chibane, Bank of America

#### Examples of typical products

- Two economy Libor Market Model
- Two economy Hull and White with FX skew

#### History of FX model for long dated structures

- Cross-Currency Libor Market Models
- Modelling the long-dated FX smile

10:30 – 11:00 Break

### 11:00 – 12:30 / Long Dated FX Hybrids: / Dherminder Kainth, Royal Bank of Scotland

- PRDC and FX Tarn payoffs
- The Heston model for stochastic volatility & efficient simulation of the Heston sde.
- FX barriers, stochastic skew and multifactor Heston. Calibrating the stochastic skew.
- Longdated FX models; Extending multifactor Heston model for pricing long dated FX options
- Some results

12:30 – 13:30 Lunch

### 13:30 – 15:00 / Exotic Interest Rate Pricing with Trees: / Michael Roehl, Lloyds TSB

#### Gaussian Model and Extensions

- Parameters and Interpretation
- Skew Modelling
- Instantaneous vs. Terminal correlation
- Approximate Solutions for Calibration

#### Pricing Exotics

- Local vs Global Calibration
- Examples: Bermudans, Inverse Floaters and Range Accruals
- Path Dependency in Trees
- How to do it: Binning
- Smoothing and Examples

15:00 – 15:15 Break

# 15:15 – 16:45 / Wavelet Option Pricing: / Antonio Cosma, Université du Luxembourg

## **General Pricing using the Green functions**

- **The Green function as pricing operator**
- **Projection of the Green operator on a wavelet basis**

## **Implementation:**

- **Black and Scholes case**
- **Heston case**

## **Application to the pricing of bermudan options**

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