INTEREST RATE MODELLING
Calibration and implementation techniques

LONDON, 29 & 30 APRIL 2002
NEW YORK, 13 & 14 MAY 2002

COURSE HIGHLIGHTS:

- An overview of modern interest rate modelling
- Stochastic volatility extension of the LIBOR market model: fitting, calibration and empirical data
- Pricing Bermudan swaptions using market models
- Assessing the latest calibration and implementation techniques
- Appropriate techniques for pricing interest rate derivatives
- Examining a survey of term structure models and derivatives pricing frameworks
- Using local and stochastic volatility models to manage skew & smile risk
- An extension of the LIBOR market model with stochastic volatility
- Validating interest rate derivatives pricing models

COURSE LEADERS:

Dorje C. Brody, IMPERIAL COLLEGE (London)
Riccardo Rebonato, ROYAL BANK OF SCOTLAND (London)
Mark S. Joshi & Jochen Theis, ROYAL BANK OF SCOTLAND (London)
Han Lee, NUMERIX (London)
Philippe Balland, MERRILL LYNCH INTERNATIONAL (London)
Marco Avellaneda, NEW YORK UNIVERSITY (New York)
Patrick Hagan, NOMURA SECURITIES (New York)
Rupert Brotherton-Ratcliffe, GEN RE SECURITIES (New York)
Robert Brooks, FINANCIAL RISK MANAGEMENT, LLC (New York)

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Dear Executive,

INTEREST RATE MODELLING
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London, 29 & 30 April 2002
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Financial institutions often emphasise the importance of mathematical theory when modelling interest rate frameworks, and rightly so. Interest rate models continue to construct the foundation for trading, pricing, structuring, and hedging all types of interest rate securities, though no standard model has yet to come forward.

Risk Training has created an intensive two-day training course through a comprehensive research process that focuses on both the traditional modelling theories and the latest developments and research in the area. Delegates will gain a working knowledge of effective interest rate products and pricing models through a variety of complex interest rate modelling techniques and practical case studies.

DELEGATES WILL HAVE THE OPPORTUNITY TO:
• Assess the latest techniques for using local and stochastic volatility models to manage skew and smile risk
• Review the fundamentals for term structure models and derivatives pricing frameworks
• Evaluate the challenges associated with the implementation of the multi-factor LIBOR market model
• Examine the latest for pricing Bermudan swaptions using market models

Should you have any questions, please do not hesitate to contact me. I look forward to welcoming you to our 2002, Interest Rate Modelling Training Course.

Best Regards,

Megan Bross
Course Producer
INTEREST RATE MODEL
Calibration and implementat

DAY ONE
London, Monday 29 April 2002

8.30 Registration and breakfast

9.00 AN OVERVIEW OF MODERN INTEREST RATE MODELLING
- Discount bond, forward and swap rates
- General theory of derivative pricing
- Discount bond dynamics and HJM formalism
- Short rate models (Vasicek, CIR)
- Positive interest (Flesaker-Hughston) approach
- Beyond positive interest (positive interest HJM)
- Model-independent yield curve calibration using market data

Dorje C. Brody, Royal Society University Research Fellow
IMPERIAL COLLEGE

There will be a 30-minute break during this session

12.00 Lunch

1.00 IMPLEMENTATION OF THE MULTI-FACTOR LIBOR MARKET MODEL
- Introduction to market models
  - class of applicable products
  - the theoretical basis
  - Calibration
  - calibration to caplet volatilities
  - inferring instantaneous volatility curves
  - calibration to swaption volatilities
  - choosing correlation structures
  - Implementing the model

Mark S. Joshi, Head Of Model Evaluation, Quantitative Research Centre,
Group Market Risk
Jochen Theis, Quantitative Analyst in the Quantitative Research Centre
ROYAL BANK OF SCOTLAND GROUP RISK

2.30 Afternoon break

3.00 STOCHASTIC VOLATILITY EXTENSION OF THE LIBOR MARKET MODEL: FITTING, CALIBRATION AND EMPIRICAL DATA
- The different financial causes for IR smiles: how to account for them
- Displaced diffusion, CEV and stochastic volatility
- Fitting to caplet prices, co-terminal European swaptions
- Fast pricing of complex products
- The empirical evidence: what is already good and what remains to be done

Riccardo Rebonato, Head Of Group Market Risk Head & Group Quantitative Research Centre
ROYAL BANK OF SCOTLAND

4.30 End of day one

DAY TWO
London, Tuesday 30 April 2002

8.30 Registration and breakfast

9.00 PRICING BERMUDAN SWAPTIONS USING MARKET MODELS
- Why pricing callable structures using market models is hard
- Lower bounds by Monte Carlo
  - the use of approximate exercise strategies
  - popular choices of parametric forms
  - estimating exercise strategies
- Upper bounds by Monte Carlo
- Rogers method of using hedges
  - choices of hedge when pricing Bermudan swaptions
  - the hedge as a control variate
- The factor dependence of the price
- Other callable products

Mark S. Joshi, Head Of Model Evaluation, Quantitative Research Centre, Group Market Risk
Jochen Theis, Quantitative Analyst In the Quantitative Research Centre
ROYAL BANK OF SCOTLAND GROUP RISK

10.30 Morning break

11.00 NUMERICAL TECHNIQUES FOR INTEREST RATE MODELS
- From short-rate/forward-rate to LIBOR/forward-LIBOR Models: pros & cons
- Gaussian HJM Models
- Black-Karasinsky and Yksinisar-Kcalb Model
- Calibration of LIBOR Models to caplet and/or swaption vols
- Three simple ways to adjust for interest rate smiles
  - Caplet versus Swaption smiles
  - Simple and accurate lattice methods for pricing/hedging using LIBOR models
  - Calibration of forward LIBOR Models to volatility matrix
  - Adding chaos to Monte-Carlo to price Bermudan
  - Applications of Mallavin Calculus to finance

Philippe Ballard, Director
MERRILL LYNCH INTERNATIONAL

1.30 IMPLEMENTATION & CALIBRATION ISSUES FOR INTEREST RATE MODELS
- Overview of term structure modelling
  - spot, forward, and market models
- General theory
  - HJM and BGM formulations
  - Markov state and functional models
- Numerical implementation
  - trees and lattices
  - Monte Carlo methods
  - fast integration techniques
  - wavelets
- Calibration
  - term structure of vols: exact versus best fit
  - correlation effects
  - efficient numerical methodologies
  - Product examples
  - callable CMS spreads
  - long term FX powered duals

Han Lee, Managing Director Europe
NUMERIX

3.00 Afternoon break

3.30 MANAGING THE SMILE RISK OF EXOTIC INTEREST RATE DERIVATIVES
- Stochastic BGM models
- Using auto calibration to manage the smile risk of exotic deals

Senior representative
GOLDMAN SACHS

5.00 End of course

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DAY ONE
New York, Monday 13 May 2002

8.30 Registration and breakfast

9.00 A SURVEY OF TERM STRUCTURE MODELS AND DERIVATIVES
PRICING FRAMEWORKS
- Forward rate curve, yield curve, stripping, bootstrapping and smoothing
- One factor Markov models: Ho-Lee, Vasicek and Modified CIR
- Pros & cons and numerical implementations of one factor models
- Forward rates and multifactor analysis
- Heath-Jarrow-Morton and Brace-Gatarek-Musiela market models
- Implementation of BMG & HJM: Modeling interest rate correlations

Marco Avellaneda, Professor Of Mathematics
NEW YORK UNIVERSITY

There will be a 30-minute break during this session

12.00 Lunch

1.00 COMPUTER IMPLEMENTATION AND CALIBRATION OF FIXED-
INCOME MODELS
- General principles for implementing fixed-income models: Monte Carlo
  simulation vs. PDEs
- Implementing fixed-income models via Monte Carlo simulation
- Model calibration: fitting forward contracts and volatilities, and computing finite
  sample adjustments
  - Monte Carlo simulation and credit default modeling: Hull-White and Distance-
    to-Default models

Robert Brooks, President
FINANCIAL RISK MANAGEMENT, LLC

4.30 End of day one

DAY TWO
New York, Tuesday 14 May 2002

8.30 Registration and breakfast

9.00 BERMUDAN SWAPTIONS PRICING USING MARKET MODELS
  - Introduction
  - Binomial model
  - Overview of the LIBOR and swap market models
  - Monte Carlo methods
  - the Andersen method
  - the Longstaff-Schwartz method
  - Other new developments

Aurele M. Hounbedji, Financial Analyst, Capital Markets,
OHIO SAVINGS BANK

10.30 Morning break

11.00 AN EXTENSION OF THE LIBOR MARKET MODEL WITH
STOCHASTIC VOLATILITY
- The LIBOR market model with arbitrary skew functions: asymptotics
- Scalar stochastic shifts of volatility surface
- Adding a mean-reverting skewed stochastic volatility process
- Approximate cap and swaption valuation formulas
- Examples and numerical tests
- Algorithms

Rupert Brotherton-Ratcliffe, Managing Director, Research
GEN RE SECURITIES

12.30 Lunch

1.30 USING LOCAL AND STOCHASTIC VOLATILITY MODELS TO MANAGE
SKEW AND SMILE RISK
- Volatility smiles and skews
  - Incorporating volatility smiles and skews into the interest rate model
  - lognormal distributions
  - skew and kurtosis
  - limitations of the CEV model
  - inclusion of stochastic volatilities
- Using local volatility to match market smiles/skews
- dynamics of the smile and hedge stability under local volatility models

Patrick Hagan, Head Of Quantitative Research
NOMURA SECURITIES INTERNATIONAL

5.00 End of course

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COURSE LEADERS

London course

**Dorje C. Brody, IMPERIAL COLLEGE**
Dr. Dorje C. Brody, is a Royal Society University Research Fellow based at Imperial College, London, and he is a Lifetime Fellow of the Cambridge Philosophical Society. His research interest covers a wide range of topics in applied mathematics, including mathematical finance. He is the author of “Modern Mathematical Theory of Finance” published in Tokyo, and has also co-authored several papers on interest rate theory. He has been a speaker at international conferences on finance in Europe, US and Japan, where he presented talks on interest rate theory and the pricing of weather derivatives.

**Han Lee, NUMERIX**
Dr. Han Lee is the Managing Director of NumeriX’s European subsidiary. Han is responsible for all commercial activity throughout Europe and has global responsibility for the strategic direction of their fixed-income tools and applications. Prior to his position at NumeriX, Han was a Director at Reech Capital in London. Previously, he managed the quantitative research group for global fixed income structured products at Commerzbank, and headed the quantitative model development team on the exotic derivatives trading desk at Tokyo-Mitsubishi International. Han is an Associate Editor of the Journal of Theoretical and Applied Finance and received his Ph.D. in Theoretical Physics from the University of Cambridge.

**Mark S. Joshi, ROYAL BANK OF SCOTLAND**

**Riccardo Rebonato, ROYAL BANK OF SCOTLAND**
Dr. Riccardo Rebonato is Head of Group Market Risk for the Royal Bank of Scotland Group, and Head of The Royal Bank of Scotland Group Quantitative Research Centre (QUARC). He is also a Visiting Lecturer at Oxford University for the Mathematical Finance Diploma and Visiting Fellow at the Applied Mathematical Department of Oxford University. He holds Doctorates in Nuclear Engineering and Science of Materials/Solid State Physics. Prior to joining the Royal Bank of Scotland, he was, at the same time, Head of the Complex Derivatives Trading Desk and of the Complex Derivatives Research Group at Barclays Capital, where he worked for nine years. Before that he was a Research Fellow in Physics at Corpus Christi College, Oxford, UK.

**Jochen Theis, ROYAL BANK OF SCOTLAND**
Jochen Theis is a Quantitative Analyst in the Quantitative Research Centre at the Royal Bank of Scotland (Group Market Risk). He researches derivative pricing and model risk across all areas. He joined the group in April 2001 from Dresdner Kleinwort Wasserstein, where he was a quantitative analyst on the Global Debt trading floor in London from October 1999. Jochen studied Mathematics at Mainz, Bonn and Cambridge, receiving a Diplom at Mainz in 1994. He then studied for a PhD in Mathematics at the Department of Pure Mathematics and Mathematical Statistics at Cambridge from 1994 to 1998, concentrating on geometric aspects of quantum field theories. He also tried his hand at management consulting for a year before finding his way into mathematical finance.

New York

**Professor Marco Avellaneda, NEW YORK UNIVERSITY**
Professor Marco Avellaneda is currently Director and Professor at the New York University, Courant Institute of Mathematical Sciences. Prior to this he was Vice President as part of the Derivative Products Group at Morgan Stanley Dean Witter, where he was involved with the quantitative research team supporting the US dollar interest rate derivatives, Brady Bond options and exotic interest rate options. Professor Avellaneda holds a Ph.D in Mathematics (probability) from the University of Minnesota and B.S./M.S. Licenciado en Ciencias Matematicas from the University of Buenos Aires. Professor Avellaneda has published over 80 research papers in Applied Mathematics and over 15 in quantitative finance.

**Patrick Hagan, NUMERIX**
Patrick Hagan received his Ph.D and B.S in Applied Mathematics from the California Institute of Technology. For the last six years he has worked at Nomura, Numerix, Banque Paribas, and Morgan Stanley designing trading systems for fixed income, credit, and foreign exchange derivatives, as well as developing the component models, calibration methods, and numerical algorithms. He is currently a Managing Editor of Applied Mathematical Finance and on the Advisory Boards for Numerix and SIAM. Before entering finance he worked in the Exxon Science Laboratories and the Computer Research and Applications group at Los Alamos National Laboratory. In the past he has taught at the California Institute of Technology, at the Institute for Mathematics, and at Stanford University.

**Aurele M. Houngbedji, OHIO SAVINGS BANK**
Aurele M. Houngbedji is a Financial Analyst in the Capital Markets Department at Ohio Savings Bank, where he has provided analytical, quantitative, statistical, and risk management supports for the capital markets division since June 2000. His research interests include: Mortgage Backed Securities risk management, interest rate derivatives valuation and hedging, the Martingale model for interest rates, transaction costs models and pricing and hedging under jump diffusion. He was awarded a Master degree in Applied Mathematics from Indiana University of Pennsylvania in 1996, and holds a Ph.D. in Statistics from the University of Pittsburgh.

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Registration details

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