The Centre for the Analysis of Risk and Optimisation Modelling Applications

CARISMA

Financial Engineering Workshops

London → **29 NOVEMBER 2005 – 2 DECEMBER 2005**

- # Extreme Value Theory and Copulas
  29 November 2005, London

- # Financial Innovation & Structured Products in the Equity World
  30 November 2005, London

- # Practical Financial Optimisation: Decision Making for Financial Engineers
  1 December 2005, London

- # Hidden Markov Models, Kalman Filters, Robust regression
  2 December 2005, London

Speakers:

Dilip Madan, Robert H. Smith School of Business, University of Maryland/ Consultant to Morgan Stanley

Paul Embrechts, Johanna Neslehova, Rosario Dell'Aquila, Risk Lab, ETH, Zurich

Claudio Romano, Capitalia Bank Holding, Rome

Annalisa Di Clemente, University of Rome

Stavros Zenios, Wharton Financial Institutions University of Pennsylvania/ University of Cyprus

Gautam Mitra, CARISMA, Brunel University

Paresh Date, Rogemar Mamon, Keming Yu, CARISMA, Brunel University

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Extreme Value Theory and Copulas
29 November 2005, London

The Workshop

Extreme Value Theory was originally conceived as the probabilistic theory for studying rare events; copula functions are implemented for measuring and optimising portfolio credit risk.

These three presentations cover the application of these powerful techniques to real world problems of operational and credit risk.

Attendees will gain valuable knowledge and new practical techniques to apply in a variety of scenarios, including portfolio credit risk measurement and management, for example:

- EVT is a valuable tool for managing operational risk
- Basel II for credit risk recommends the use of the Gaussian Copula

Quantitative Models for Operational Risk: Extremes, Dependence, Aggregation and Robustness
Paul Embrechts, Johanna Neslehova and Rosario Dell'Aquila, ETH Zurich
- o   Introduction
- o   Advanced EVT Models: POT Analysis of Operational Risk Data
- o   Dependent Risk Processes
- o   Dependent Aggregated Losses
- o   Aggregating (Operational) Risk Measures
- o   Robust Estimation and Testing

### Applying Extreme Value Theory and Copula Functions to market And Operational Risk
Claudio Romano, Capitalia Bank Holding, Rome
- o   Copula Function
- o   Tail Dependence
- o   Elliptical Copulas
- o   Applying Copula to Risk Management
- o   Estimating Risk Measures for a Portfolio with Copula
- o   An Application of Copula Function to Portfolio Credit Risk Measurement

Measuring and Optimising Portfolio Credit risk: A Copula Based Approach
Annalisa Di Clemente, University of Rome "La Sapienza"
- o   Measuring Portfolio Credit Risk: A Copula-based Approach
- o   Copula Functions
- o   Portfolio Credit Risk Optimization Model
- o   Application to a Hypothetical Loan Portfolio

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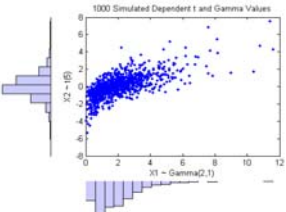
BACKGROUND AND OBJECTIVE:
The objective of the five one-day workshops is to bring together practitioners, academics and PhD students working in the area of risk modelling, financial mathematics, computational finance and optimisation. The workshop will provide an opportunity for participants engaged at the forefront of this area to discuss problems and challenges and suggest fruitful directions for future research, which focus on the emerging requirements of the finance industry.

The speaker panel includes world leaders such as Dilip Madan, Robert H.Smith School of Business, University of Maryland/ Consultant to Morgan Stanley;Paul Embrechts, ETH, Zurich; Gautam Mitra, CARISMA, Brunel University; Stavros Zenios, Wharton School of Business/ University of Cyprus; Claudio Romano, Credit Risk Analyst, Capitalia Bank Holding, Rome. All the speakers have achieved distinction through their research contributions and also possess wide experience of real world applications of highly sophisticated quantitative models.

BENEFITS OF ATTENDING:
You will learn about the latest developments in the field from acknowledged research leaders, gathered together in London. By networking and listening to the presentations, you will gain valuable knowledge and practical techniques to apply your own area of practice or research. You will gain first hand experience of the innovative thinking and best practices currently being developed in some of the world's leading educational institutions.

WHO SHOULD ATTEND:
Academics and Researchers in the filed of Quantitative Finance Industry Area:
Risk Management, Quantitative Analytics, Hedge Funds, Asset Management, Equity, Derivatives, Capital Management, Credit, Corporate Banking, Investment Banking, Investment Consulting, Operations, Debt/Fixed Income, Insurance, Pensions, Commodities, Trading, Information Technology,

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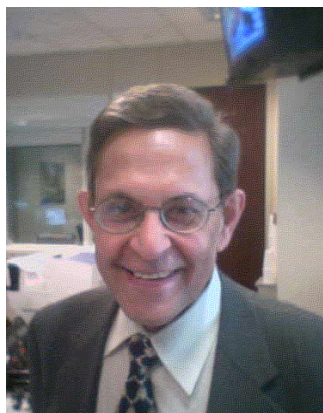WEB: www.unicom.co.uk/finance

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CARISMA

Financial Engineering Workshops

Financial Innovation & New Structured Products in the Equity World
30 November 2005, London

Presenter

Dilip B. Madan

Robert H. Smith School of Business, University of Maryland / Consultant to Morgan Stanley

Ph.D. in Economics (1971), University of Maryland and Ph.D. in Mathematics (1975), University of Maryland

Dilip Madan works on improving the quality of financial valuation models, enhancing the performance of investment strategies, and efficient risk allocation in modern economies. His current research deals with the theory of stochastic processes' applications to risk management in economic and financial spheres. Madan has published extensively in the field of financial engineering and innovation. He is the ex- president of the Bachelier Finance Society.

Workshop Programme:

We will survey the broad range of products now being traded and created in the market for equity investments. These include what are now called vanilla cliquet products and the more recently developed swing and reverse swing cliquet trades. Multiasset structures and dispersion products will also be discussed. A theoretical discussion of the rationale for the creation of these products will be presented. The structure of risk exposures to be managed in the creation of such liabilities will then be enumerated. We shall discuss concepts like the volgamma, the skewgamma and crossgamma effects. This will be followed by a theoretical discussion of the implications of the technology of hedging to acceptability. Concepts of coherent risk measures and coherent utilities are employed to define risk acceptability. We will then survey a collection of models ranging from the traditional jump diffusion, to a number of stochastic volatility models, the local volatility model and a recent extension to local Lévy models, used by industry in the valuation and regular marking to market of these product liabilities. The results of applying a variety of models to the valuation of a variety of products will conclude the presentation.

Overview of the New Equity Structured Products
- A Survey of the Products
  - Common Components for the Products
  - Classification of Products
  - Trigger Redeemable Notes / Vanilla Arithmetic and Product Cliquets / Swing Cliquets / Napoleonic Features / Incorporating Lock-Ins / Intermediate floors and cap / Melting Baskets / Dispersion Trades / Correlation Trades
- Rationale for the Products
  - Rationale for the Products
  - The Answer from Utility Theory
- A Unified view of the Products and their Rationale
  - Log Gaussian Products
  - Consequences of differences in volatilities
  - Estimated Products
  - Down and In Trigger Reedemable Notes
  - Path Dependent Products
  - Correlation Trades

Risks Involved in Equity Structured Products
- Risk exposure of products
  - Describing the Risks
  - Enumeration of Risks
  - Assessing the Risks
  - Surface Exposure of Products
  - Remarks on Cliquet Volgamma/ Reverse Cliquet Volgamma/ Swing Cliquet Skewgamma
  - Skew gamma in variance swaps
  - Importance of Forward Skews
  - Cross Gamma Effects
  - Cross Gamma in Basket Option Trades
  - Structures Exposed to Digital Risk
  - Correlation between Equity and Interest Rate Risks
- Supply side of structured products
  - Supply Side of Structured Products
  - The Relatively Liquid Hedging Assets
  - Acceptable Risks
- Modelling the bid and ask prices
  - The Ask Price Problem/ The Bid Price Problem
  - Implications of the Dual Problems
  - Acceptability, Hedging, and Arbitrage

Best Practice Modelling for Pricing and Hedging Equity Structured Products
- Description of models and their properties
  - Local Volatility Model
  - Local Lévy Models
  - Heston Stochastic Volatility
  - Merton Jump Diffusion with stochastic volatility
  - Stochastic Volatility for Lévy Processes
  - Stochastic Jump Arrival Rates
- Results of market calibration
  - Results of Calibration on SPX for 20040706
  - HSV Calibration / SVJ Calibration / VGSA Calibration
  - SVDNE / SVVG / SVCGMY / SVADNE / SVAVG / SVACGMY
  - Common Features of Models
- Model prices for equity structured products
  - The Products Priced by the Models
  - Model Pricing
  - Locally Floored Globally Capped Cliquet Model Rankings
  - Locally Capped and Globally Floored Cliquet
  - Locally Capped and Globally Floored
  - Capped Swing Cliquet / Capped Swing Cliquet / Capped Reverse Swing Cliquet
  - Reverse Swing Cliquet
  - Uncapped Swing Cliquet with Lock In / Swing Cliquet with Lock In
  - Trigger Autocancellable Redeemable Note
  - Model Rank Correlations
  - Volatility Options
- Spot and option risks to be hedged in equity structured products
  - Risks in Equity Structured Products
  - Forward Spot Slides and Option Trades
  - Implicit Hedge Costs
  - Conclusion

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Financial Engineering Workshops

Practical Financial Optimisation: Decision Making for Financial Engineers,
1 December 2005, London

Presenter

Prof. Zenios is known internationall y for his work in computation al finance and financial services, high-performance and parallel computations, and operations research. In his career he authored t wo books, edited twelve book s and journal issues, and (co)authored over 130 scholarly art icles in some of the premier journals in the field. He holds two US patents on financial engineering methods. His book with Yair Censor Parallel Optimizatio n received the 1999 ICS prize o f the Institute of Operations Research and the Management Sciences. His article with A. Soteriou in Management Science on banking services received a Best Paper Award from the Decision Sciences Institute at the 19 99 Internation al Meeting. In 2000 he was a Marie Curie Fell ow of the European Commission.

Forthcoming Book:
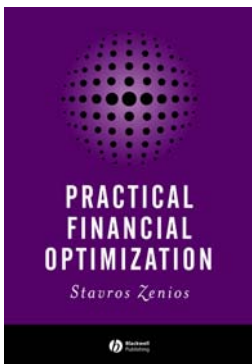
PRACTICAL FINANCIAL OPTIMIZATION

Stavros Zenios

Workshop Programme:

Optimisation, as a normative model for portfolio diversification, was proposed as early as 1952. But it was in the 1980s that we saw the proliferation of optimisation models in financial decision making. The catalysts for this development have been the emergence of *financial engineering* and the move towards *enterprise-wide risk management.*

The need to integrate multiple interrelated risk factors of the global enterprise brought to the fore the power of optimisation models. At the same time developments of large-scale numerical optimization techniques, advances in optimisation models for planning under uncertainty, and the availability of user-friendly modelling languages, put optimisation tools in the hands of researchers and practitioners with little background in optimisation theory. Thus, the synergies between optimisation tools and financial decision-making have flourished. And the symbiosis between these two disciplines is becoming more fertile as we enter the 21st Century marked by business globalisation, rapid technological changes, financial innovations, and increased volatility in the financial markets.

This short course will give an introduction to financial optimisation models as used to support decision-making for financial engineers. It will highlight the significance of enterprise wide risk management and review the disparate sources of risk faced by today's global institutions. Scenario analysis will be introduced as a flexible and powerful tool for dealing with uncertainty. Scenario based optimisation models will be discussed, paying particular emphasis to the optimisation of Value-at-Risk and Conditional Value-at-Risk.

Finally we will build towards multi-period dynamic portfolio optimisation models. Such state-of-the-art models can be used to optimise the risks exposure of an enterprise over long planning horizons, taking into account both assets and liabilities, and allowing for dynamic strategies.

The lectures will conclude with the analysis of two large-scale real world applications: Managing credit risk in the corporate bond portfolio market, and managing insurance products with minimum guarantees for the UK and the Italian markets.

Lecture 1: Enterprise wide risk management and the sources of financial risk
Lecture 2: Scenario analysis and scenario optimisation; Conditional Value-at-Risk
Lecture 3: Multi-period stochastic programming and the optimisation of dynamic strategies
Lecture 4: Case Studies:
- Credit risk portfolio management
- Endowments with minimum guarantees

Guest Lecture:
Portfolio Optimisation Models and Properties of Return Distributions
- Construction a portfolio whose return distribution has specified desirable properties
- Different aspects and measures of risk considered
- Decisions made in respect of a reference distribution

-- Professor Gautam Mitra, CARISMA, Brunel University

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Financial Engineering Workshops

Hidden Markov Models; Kalman Filters, Robust Regression

2 December 2005, CARISMA, Brunel University

The Workshop

Kalman Filtering in Mathematical Finance
- **Paresh Date, CARISMA, Brunel University**
For modelling evolution of variables, which are not directly observable (such as short rate, stock price volatility and spot prices in energy markets), the use of Kalman filter is becoming increasingly common in mathematical finance. The first half of this short tutorial will outline the basic theory behind Kalman filter and discuss its use in calibration of dynamic state space models as well as in prediction of unobservable variables. The second half of the tutorial will focus on a specific application, viz. calibration of stochastic volatility model from high frequency asset price data. Results of numerical experiments in calibration of model and prediction of future volatility will be reported.

Hidden Markov Models in Quantitative Finance
- **Rogemar Mamon, CARISMA, Brunel University**
The tutorial is aimed to demonstrate the change of measure techniques in estimating optimally the parameters of an asset price model. We shall use hidden Markov model filtering techniques to process the signals received in the financial market. Recursive estimation of model parameters will be provided and discussed within the framework of a regime-switching model designed to capture the "quiet" and "turbulent" periods of the market. We shall illustrate an application to a data set of market prices and present statistical analysis of the results.

Robust Statistics, Robust Regression and Quantile Regression
- **Keming Yu, CARISMA, Brunel University**
This talk provides a brief review to robust statistics, robust regression and quantile regression. We begin with an introduction to and motivation for these techniques. We then outline various approaches to the techniques and discuss some typical application areas.

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29 November 2005 – 2 December 2005
VENUE: London

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- ☐ **Extreme Value Theory and Copulas** 29 Nov. 2005
- ☐ **Financial Innovation and New Structured Products in the Equity World** 30 Nov. 2005
- ☐ **Practical Financial Optimisation: Decision Making for Financial Engineers** 1 Dec. 2005
- ☐ **Hidden Markov Models, Kalman Filters, Non-linear Time Series Analysis, Robust Regression** 2 Dec. 2005

Related Events

- ☐ Workshop: Optimisation and its use in Business Applications, 3-4 Oct. 2005
- ☐ Decision Making Under Uncertainty: Stochastic Programming Workshop, 5-6 Oct. 2005
- ☐ Financial Planning using Integer Quadratic Programming, 7 Oct. 2005   Fin ☐   SC ☐

Registration Fees

	1	2	3	4	5 days
PhD Student	£60	£120	£180	£240	£300
Academic and researchers	£95	£190	£285	£380	£475
Industry	£300	£550	£795	£1000	£1190

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Registration Details

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Please note that payment is required in advance of the event.

It is a condition of booking that all fees are paid before the date of the event. All invoices carry surcharges which are payable if the fee remains unpaid on the day of the event

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person /day, payable within one week of invoice. As we cannot guarantee that exactly the same course will be available, the transfer will be open to any other event taking place within six months from the date of the original event. The organisers reserve the right to amend the programme if necessary.

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