Master of Quantitative Finance and Risk Management
2019/2020 Edition

TOPICS IN QUANTITATIVE FINANCE

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1. COURSE OUTLINE/OBJECTIVES

The course is aimed to offer an extensive understanding of financial analytics. Models and topics are chosen in order to offer tools and techniques that can be tailored to face whatever issue in derivative pricing and hedging. Section 1 moves beyond the Black-Scholes-Merton paradigm and explores the analytic machinery that makes possible to use and reconstruct market implied probability distributions. Sections 2 and 3 deal with several classes of stochastic processes in the Lévy framework explored through the mathematical tools of Fourier and Laplace Transforms. Numerical methods based on Newton-Cotes and Gauss quadrature schemes are also fully explored and derived in these sections. Section 4 offers an overview of how risks could be measured and hedged. As regards the measurement task the fundamental theorem of asset pricing is used in order to derive probability measures aimed to determine for any non-equity product the optimal investment time horizon, the degree of risk and the probability scenarios. As far as the risk management is concerned an extensive analysis of Greeks hedging is developed and through concrete case studies it is explained pros and cons of these procedures on a financial desk.

R applications of all these approaches and excel spreadsheets will be shown.

2. DETAILED PROGRAMME AND SCHEDULE

I. BEYOND BLACK-SCHOLES-MERTON PARADIGM
- The CEV process and its applications
- Modelling market implied distributions in continuous and discrete time

II. PURE JUMP MODELS: WHEN TIME IS A STOCHASTIC PROCESS
- The original idea: Barndorff-Nielsen Normal Inverse Gaussian process
- A remarkable improvement: Madan-Seneta Variance Gamma process

III. AFFINE JUMP DIFFUSION MODELS: MIXING CONTINUOUS TIME ANALYTICS WITH JUMPS
- The seminal Merton Jump Diffusion process
- An all-purpose model: Heston Stochastic volatility model

IV. RISK MEASURES AND MANAGEMENT
- Fundamental Theorem of Asset Pricing and Synthetic risk indicators
- Testing the Greeks effectiveness

3. COURSE MATERIALS

- A Guide to Quantitative Finance, Marcello Minenna, Risk Books
- Option Pricing Via Quadrature, Minenna-Verzella, Risk Books
- A Quantitative Framework to Assess the Risk-Reward Profile of Non-Equity Products, Marcello Minenna, Risk Books
- Notes distributed by the Course Tutor.

4. EXAM

Homework assignments/projects
Final written + oral exam