MATH0095 Topics in Financial and Insurance Mathematics

**Year:** 2019-2020
**Code:** MATH0095
**Value:** 15 UCL credits (= 7.5 ECTS)
**Term:** 2
**Structure:** 3 hour lectures
**Assessment:** Final examination (100%). To pass the course, students must obtain an overall mark of at least 50%.
**Pre-requisites:** None
**Lecturer:** Dr C Garcia Trillos

Course description and objectives

This module aims at offering an introduction to mathematical, statistical and financial concepts, techniques and methods necessary to get familiar with state-of-the-art research topics in Financial and Insurance Mathematics as found in academia but also in industry practice.

This term we study: **Stochastic volatility models**

Despite its great success, the Merton price model presents several shortcomings. In particular, it has limited applicability to price assets that go beyond simple European call/put options. This is a consequence of the rigid constant volatility term. Hence, for many applications, dynamic volatility models are required.

In this topic we focus on stochastic volatility models, that is, models where the volatility term is assumed to be itself driven by additional randomness. We study the main empirical features of such models and highlight the consequences of introducing additional 'noise sources' for completeness, pricing, hedging and calibration. As an important example we study the Heston model and consider the above problems in its context. The discussion is then extended to recent advances in rough volatility models and their main properties and limitations.

**Recommended texts**

Detailed syllabus

1. Introduction: spot, realised and implied volatility; VIX and volatility indices; volatility surface, stylised facts; local volatility models and Dupire’s formula

2. Stochastic volatility: general expression, market completeness, dynamic and semi-static hedging with options.

3. The Heston model: formulation, European option pricing and Fourier methods, calibration.

4. Rough Volatility: back to empirical facts; fractional Brownian motion, main examples (RFSV and rough Heston models), pricing, calibration, limitations.