ST909: Applications of Stochastic Calculus in Finance (Spring Term 2024)

Gechun Liang

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Module Information

- Lecturer: Gechun LIANG
- Email: g.liang@warwick.ac.uk
- Office Telephone: 024 76528036
- Office Hours: Tue 2:30-3:30pm and Wed 3.30-4.30pm. Students are welcomed to meet with me during office hours with no prior appointments.
- Office Number: 2.07, MS Building.
- Lecture Times and Place: Week 2-10
  - Tue 12-2pm in 1007 WBS for lectures (with 10 minutes break),
  - Wed 1-3pm in 1015 WBS for lectures/seminars (with 10 minutes break).

Module Information

- Preliminary lecture notes will be posted on the Moodle before each lecture. Handwritten notes will also be posted after each lecture. All the lecture materials will be available on the Moodle/MS Teams channel for ST909.
- There are exercises after each chapter. Submission of assignment is NOT required. However, students are encouraged to rewrite lecture notes themselves in the minimal number of pages that is sufficient to remember the essential content of the course.
- Examinations:
  - 2 one-hour class tests (each 10%):
    - Class test 1 : Monday 26 February 14:00 - 14:50 in 1007
    - Class test 2: Monday 11 March 14:00 - 14:50 in 1007
  - 2-hour examination in April/May (80%).
- Aims: To give a thorough understanding of how stochastic calculus is used in continuous time finance. To develop an in-depth understanding of models used for various asset classes.

Course Outline

Part 1 Interest rate models

- Chapter 0 Review of stochastic calculus
- Chapter 1 Interest rates and related contracts
- Chapter 2 Short-rate models
- Chapter 3 Heath-Jarrow-Morton (HJM) Methodology
- Chapter 4 Change of numeriare and forward measure
- Chapter 5 LIBOR market model

G. Liang: Lectures notes on Interest Rates and Credit Risk, KCL. Available on personal website.

D. Filipovic: Term-Structure Models. A Graduate Course. Springer. Available in Warwick library. Chapters 1, 5-7, 11

T. Bjork: Arbitrage Theory in Continuous time, Oxford. Available in Warwick library. Chapters 15, 19-23

Course Outline

Part 2 Credit risk models

- Chapter 6 Credit risk and credit derivatives
- Chapter 7 Structural approach
- Chapter 8 Stochastic calculus for (single) jump processes
- Chapter 9 Intensity-based approach

G. Liang: Lecture notes on Systemic Risk and Contagion Risk, Warwick. Available on personal website.

D. Filipovic: Term-Structure Models. A Graduate Course. Springer. Available in Warwick library. Chapter 12

R. Jarrow: Continuous-Time Asset Pricing Theory, Springer. Available in Warwick library. Chapter 7

Course Outline

Part 3 Stochastic volatility models

Chapter 10 Local volatility models

Chapter 11 Stochastic volatility models

Chapter 12 More volatility models

D. Hobson: Lecture notes on Volatility Models, Warwick. Available on personal website.

E. Alos: Malliavin Calculus in Finance Theory and Practice, Chapman & Hall/CRC. Available in Warwick library. Chapter 2

M. Musiela and M. Rutkowski: Martingale Methods in Financial Modeling, Springer. Available in Warwick library. Chapter 7