
Unless otherwise indicated, all seminars take place at Lecture Theatre 2C, King's College London, The Strand, London WC2R 2LS.

Tuesday 11 October, 5:30 pm  Professor Nizar Touzi
Tanaka Business School, Imperial College London
Optimal investment under capital gains taxes: an asymptotic expansion result

Abstract: We formulate a model of a continuous time financial market consisting of a bank account and one risky asset subject to transaction cost and capital gains taxes. We consider the problem of maximising expected utility of future consumption in infinite horizon.

Tuesday 18 October, 5:30 pm  Dr Diane Wilcox
Department of Mathematics, University of Cape Town
On the estimation of cross-correlations

Abstract: Covariance matrices have enjoyed a prominent place in finance and risk management since Markowitz's mean-variance optimisation method introduced in 1952. As risk measures these objects have since been superseded by VAR, copulas and coherent risk measures. Nevertheless, the estimation of cross-correlation remains a ubiquitous component in derivatives pricing, portfolio optimisation and asset allocation problems. Despite the fundamental simplicity of the problem, covariance matrix estimation is beset with numerous subtleties which are addressed with a broad range of methods. We review some techniques with special attention to the application of Random Matrix Theory to the analysis of cross-correlations in South African market data.

Tuesday 25 October, 5:30 pm  Dr Erik Ekström
Department of Mathematics, University of Manchester
Properties of option prices in a jump-diffusion model

Abstract: It was shown by Bergman, Grundy and Wiener (1996) that the value of a convex claim in a diffusion model is increasing as a function of the volatility of the underlying stock. A main tool in the proof of this is the preservation of convexity for such models. In this talk, we provide a sufficient condition for the preservation of convexity in jump-diffusion models. This enables us to derive monotonicity properties of the option value with respect to different parameters of the model, such as the volatility, the jump size and the jump intensity. The analysis is based on investigations of solutions to certain integro-differential equations. This is joint work with Johan Tysk.

Tuesday 1 November, 5:30 pm  Professor William Perraudin
Tanaka Business School, Imperial College London
Real Options with Mixed Strategies
Abstract: Firms which possess real options to cease production may act strategically if they acquire increased market power when a competitor quits. This paper analyzes the equilibria that arise in a simple real options model when firms are engaged in such a war of attrition game. We show that firms may adopt randomized strategies in which exits are generated by conditionally Poisson jump processes. We generalize the model with incomplete information regarding flow costs and show that as the number of cost types increase the scope for randomized exit decreases. Surprisingly, in the limit of a continuum of types the firms revert to their monopoly exit triggers.

Tuesday 8 November, 5:30 pm  (No Seminar this day)

Tuesday 15 November, 5:30 pm  Dr Andreas Kyprianou
Department of Actuarial Mathematics and Statistics, Heriot-Watt University, Edinburgh

Abstract: We use fluctuation theory and give a new result showing how to establish the exact distribution of the overshoot over a fixed level of any strictly stable process when reflected in its infimum (specifically the case when the Lévy measure is supported on $\mathbb{R}$ is included in the discussion).

Tuesday 22 November, 5:30 pm  Dr Alexander Cox
Department of Mathematics, University of York

Abstract: We are interested in option pricing in markets with bubbles. A bubble is defined to be a price process which, when discounted, is a local martingale under the risk-neutral measure but not a martingale. In a market with a bubble many standard results from the folklore become false. Put-call parity fails, the price of an American call exceeds that of a European call and prices are no longer convex in the underlying. We show how these results must be modified in the presence of a bubble. It turns out that the option value depends critically on the definition of admissible strategy, and that the standard mathematical definition may not be consistent with the definitions used for trading.

Tuesday 29 November, 2:30 pm  Professor Eugene A. Feinberg
Department of Applied Mathematics & Statistics, State University of New York at Stony Brook

Abstract: As is well-known, randomized policies may outperform nonrandomized policies for problems with multiple criteria and constraints. However, in some cases nonrandomized policies may be optimal. For example, for recurrent finite state and action space Markov Decision Processes (MDPs) with average rewards per unit time, the time-sharing policies described in the papers by Ross, Altman, and
Shwartz are optimal. We discuss time-sharing and two other situations when nonrandomized policies are optimal for constrained problems: continuous time MDPs and discrete-time nonatomic MDPs. In each case we describe the corresponding applications. In particular, we apply time-sharing to radar sensor management. For continuous-time MDPs, we discuss queueing control and power management, and for nonatomic MDPs we discuss the link between nonatomic MDPs and the work of Dvoretzky, Wald, and Wolfowitz on nonrandomized statistical decisions. Moreover, the results on nonatomic problems imply the optimality of nonrandomized policies for certain classes of inventory control and financial engineering problems with multiple objectives and constraints.

Tuesday 6 December, 5:30 pm
Dr Dorje C. Brody
Blackett laboratory, Imperial College, London
An Information-Based Approach to Asset Pricing

Abstract: A new framework for asset price dynamics is introduced where the concept of noisy information about future cash-flows is used to derive the corresponding price processes. In this framework an asset is defined by its cash-flow structure. Each cash flow is modelled by a random variable that can be expressed as a function of a collection of independent random variables called market factors. The cash flows and market factors are for simplicity taken to be continuous random variables here, but more general situations can be incorporated as well, depending on the context. With each such market factor we associate a so-called market information process, the values of which we assume are accessible to market participants. Each market information process consists of a sum of two terms, one of which contains true information about the value of the associated market factor, and the other of which contains noise. The noise term is modelled by an independent Brownian bridge process that spans the time interval from the present to the time at which the value of the given market factor is revealed. The market filtration is assumed to be that generated by the aggregate of the independent market information processes. For simplicity we assume that interest rates are deterministic, and that the risk neutral measure has been specified. The price of an asset is given by the conditional expectation of the discounted cash-flows in this measure, where the conditional expectation is that arising from the market filtration constructed as indicated. In the case where the cash flows are the random dividend payments associated with equities, an explicit model is thereby obtained for the share-price process. Dividend growth is taken into account by introducing appropriate structure on the market factors associated with the dividends, and various dividend growth models can be considered. The prices of options on dividend-paying assets are derived and, remarkably, the form of the price process of a European-style call option is of the Black-Scholes type. For exponential and gamma-distributed dividend payments a closed-form expression for the share-price process is obtained, and a semi-analytical formula is computed for the value of a European call option. We consider both the case where the rate at which information is revealed to the market is constant, as well as the more general case where the information flow rate varies in time. The latter case is developed in some detail in this paper. The framework has another significant feature: it generates a natural family of stochastic volatility models without the need for specifying on an ad hoc basis the stochastic dynamics of the volatility. (Work carried out in collaboration with L. P. Hughston and A. Macrina, Department of Mathematics, King's College London.)
Tuesday 17  Dr Lutz Schloegl  
January,  Fixed Income Quantitative Research, Lehman Brothers, London  
5:30 pm  Stochastic Recovery Rates and No-Arbitrage in the Tranche Markets

Tuesday 24  (No seminar this day)

Tuesday 31  Dr Wim Schoutens  
January,  Department of Mathematics, Catholic University of Leuven  
5:30 pm  Jump-Driven Intensity Models for Credit Risk Modeling

Abstract: We overview some tractable and popular intensity models in a credit risk setting. Next, we introduce intensity models driven by jumps. In these, so-called Ornstein-Uhlenbeck (OU) models, the intensity is a stationary process driven by a pure jump Levy process (subordinator). We focus on the Gamma-OU and Inverse Gaussian-OU cases, where closed-form formulas for the default probability are available. We make a calibration exercise of the models considered on a whole range of CDS term structures and compare there fitting abilities. Next, we focus on pricing issues. As an exercise, we investigate the model risk by pricing a digital default put. This is joint work with Jessica Cariboni.

Tuesday 7  Dr A. B. Piunovskiy
February,  Department of Mathematical Sciences, University of Liverpool
5:30 pm  Pareto sets for multiple objective Markov Decision Processes

Abstract: First of all, I intend to remind several properties of polyhedral cones and cone-generated orders which will be used for constructing Pareto sets in multiple objective optimisation problems. Afterwards, I will consider multiple objective discounted Markov Decision Process. Methods of Convex Analysis and the Dynamic Programming Approach allow to construct the Pareto sets and study their properties. For instance, I will show that in the unichain case, Pareto sets for different initial distributions are topologically equivalent. Finally, I will present an example on the optimal management of a deteriorating system.

Tuesday 14  Dr Nick Webber
February,  Warwick Business School
5:30 pm  Valuing American options on a lattice

Abstract: American style options are of considerable importance in the financial markets but in general no explicit solutions for their value exist. Typically convergence to the true option value is slow resulting in inaccurate prices. In this paper we describe a valuation method for American options using a novel lattice method. Although convergence is not dramatically improved, the method opens a fresh approach that may have repercussions elsewhere.
Dr Sam Howison  
*Mathematical Institute, Oxford*

Old wine in new bottles: an asymptotic expansions approach to discretely-sampled Brownian Motion and the BGK correction for barrier and Bermudan options.

**Tuesday 28 February, 4:15 pm**

**Professor T. R. Hurd**  
*Department of Mathematics and Statistics, McMaster University, Canada*

Indifference pricing of variance swaps and other derivatives in stochastic volatility models

Abstract: Utility based indifference pricing is now considered to be the economically natural method for valuing contingent claims in incomplete markets. However, acceptance of this concept by the wide financial community has been severely delayed by the computational and conceptual difficulty of the approach. In this talk I will focus on the problem of computing indifference prices for derivative securities in incomplete stochastic volatility markets. As an alternative to the now standard approach by partial differential equations, I present a new approach to indifference pricing which leads to similar results by identifying the natural martingales in the model. The resulting nonlinear Feynman-Kac representations show a striking connection to formulas from interest rate theory. Capitalizing on this we are able to provide closed form solutions for the indifference price of a variance swap in both the standard Heston model and a new model we call the ‘reciprocal Heston’ model. Indifference pricing and hedging for general European style claims written on integrated variance can be efficiently computed by applying the fast Fourier transform to the above formulas. To the best of my knowledge, these are the first known nontrivial closed formulas for the indifference price of a widely traded class of derivatives. Joint work with Matheus Grasselli, McMaster, Canada

Dr Saul Jacka  
*Department of Mathematics, University of Warwick*

Stochastic Representation and Markets with Costs

Abstract: The relation between stochastic integration, martingale representation and complete markets is now well-known. This talk will discuss (in a discrete time context) some of the analogous results available to connect markets with transaction costs, stochastic control, coherent risk measures and forms of stochastic representation

**Tuesday 7 March, 5:30 pm**

*(No seminar this day)*

**Tuesday 14 March, 5:30 pm**

**Dr Angelos Dassios**  
*Department of Statistics, London School of Economics*

Quantiles of Levy processes and applications in finance

Abstract: We will present a survey of results on the quantiles of a Brownian motion
with drift as well as a general Levy process. The motivation is to calculate the price of related financial options. At the end of the talk some new results on variability orderings between various quantities associated with path dependent and European options are presented. This survey is not exhaustive, but intends to provide a flavour of research carried out in the area.

Tuesday 21 (No seminar this day)
March, 5:30 pm

Tuesday 28 Dr Christopher J. Hunter
March, BNP Paribas
5:30 pm Aspects of Correlation in the Pricing of Hybrid Derivatives

Tuesday 16 Dr Xin Guo
May, Cornell University
5:30 pm Credit Risk With Incomplete Information: A Unified Probabilistic Approach

Given the well-known drawbacks in the two leading paradigms (the structural models and the reduced-form models), information-based credit risk study has gained its popularity, starting from the important paper by Duffie and Lando (2001). However, there are a number of fundamental issues with this approach. The first is the mathematical ambiguity about incomplete information such as the noisy information and the delayed information; The second is the inconsistency of different filtration expansion approaches: the minimal filtration expansion in Duffie and Lando (2001) and Lando (1998), and the progressive filtration expansion in Elliott, Monique and Yor (2000), B'{e}langer, Shreve, and Wong (2004); And the last issue is the inconsistency of intensity process in finance and mathematics: in the former it is the instantaneous likelihood of default while in the latter the Radon-Nikodym derivative of a compensator. In this talk, we shall show how these issues are resolved in a unified filtration framework. More importantly, this framework allows us to extend the simple pricing scheme in reduced-form models to structural models, without however the conditional independence assumptions.

Tuesday 6 Dr Martin Baxter
June, Nomura
5:30 pm Dynamic modelling of single-name credits and CDO tranches

This talk will present a new family of models of the evolution of each credit within a portfolio basket. The models aim to have dynamics which are intuitive, which capture the heavy tails of credit distributions; and which have a correlation structure consistent with CDO market prices. From a practical point of view, it is also important that the models are tractable to implement. The model is based on general Levy processes, which are both mathematically interesting and well suited to the problem.