

Risk & Stochastics and Financial Mathematics Joint Seminar in 2011

Seminars are listed in reverse chronological order, most recent first.

8 December - Alex Miljatovic (Warwick)

No title or abstract available

24 November - Kees van Schaik (Manchester)

No title or abstract available

17 November - Mete Soner (ETH)

No title or abstract available

10 November - Kevin Warner (Tower Research Capital)

No title or abstract available

3 November - Jordan Stoyanov (Newcastle)

Moment Analysis of Distributions: Classical and Recent Results

The main discussion will be on characterization/properties of distributions in terms of the moments. This turns to be important for stochastic models in many areas, including in finance and risk modelling. Some distributions are uniquely determined by the moments (M-determinate), others are non-unique (M-indeterminate). Along classical criteria, some recent developments will be presented and used to analyze the moment determinacy of distributions of random variables or stochastic processes. All statements and criteria will be well illustrated by examples involving popular distributions (N, LogN, SN, Exp, Po, IG, etc.) Several facts will be reported, some of them are not so well-known, they are surprising and even shocking. It will be shown that the moment determinacy of the distributions is essential in inference problems. Some challenging open questions will be outlined.

27 October - Huy en Pham (University Paris Diderot)

Optimal High Frequency Trading with Limit and Market Orders

We propose a framework for studying optimal market making policies in a limit order book (LOB). The bid-ask spread of the LOB is modelled by a Markov chain with finite values, multiple of the tick size, and subordinated by the Poisson process of

the tick-time clock. We consider a small agent who continuously submits limit buy/sell orders at best bid/ask quotes, and may also set limit orders at best bid (resp. ask) plus (resp. minus) a tick for getting the execution order priority, which is a crucial issue in high frequency trading. By trading with limit orders, the agent faces an execution risk since her orders are executed only when they meet counterpart market orders, which are modelled by Cox processes with intensities depending on the spread and on her limit prices. By holding non-zero positions on the risky asset, the agent is also subject to the inventory risk related to price volatility. Then the agent can also choose to trade with market orders, and therefore get immediate execution, but at a least favourable price because she has to cross the bid-ask spread.

The objective of the market maker is to maximize her expected utility from revenue over a short term horizon by a tradeoff between limit and market orders, while controlling her inventory position. This is formulated as a mixed regime switching regular/impulse control problem that we characterize in terms of quasi-variational system by dynamic programming methods. In the case of a mean-variance criterion with martingale reference price or when the asset price follows a Levy process and with exponential utility criterion, the dynamic programming system can be reduced to a system of simple equations involving only the inventory and spread variables.

Calibration procedures are derived for estimating the transition matrix and intensity parameters for the spread and for Cox processes modelling the execution of limit orders. Several computational tests are performed both on simulated and real data, and illustrate the impact and profit when considering execution priority in limit orders and market orders.

20 October - Ragnar Norberg (LSE and Lyon)

No title or abstract available

13 October - Almut Veraart (Imperial)

Ambit Stochastics with Applications to Energy Markets

This talk gives a brief introduction into the new area of ambit stochastics, which constitutes a general probabilistic framework for tempo-spatial modelling. Certain classes of random fields and stochastic processes within the framework of ambit stochastics will be presented and their applicability to modelling spot, forward and futures prices from energy markets will be discussed.

This is joint work with Ole. E. Barndorff-Nielsen (Aarhus) and Fred Espen Benth (Oslo)

6 October - Roman Muraviev (ETH)

No title or abstract available

9 June - Giulia Di Nunno (Oslo)

Dynamic no-good-deal bounds and no-good-deal pricing measures

We study price systems consistent with no-good-deal pricing measures for given bounds on the Sharpe ratio and we introduce the definition of dynamic no-good-deal bounds and pricing measure. The development of the theory requires a sandwich preserving extension theorem for linear operators, which we present in some generality. We then show how this result can be applied to obtain static and dynamic no-good-deal pricing measures. If time permits, we can also provide other examples of reasonably restricted classes of equivalent martingale measures that can be obtained.

This presentation is based on a paper with Dr. Jocelyn Bion-Nadal (CNRS-Ecole Polytechnique, France).

19 May - Bernt Oksendal (Oslo)

Optimal pricing strategies and Stackelberg equilibria in time- delayed stochastic differential games

In the classical newsvendor problem there are two agents: (i) The manufacturer, who today (i.e. at time $t-\delta$) decides the unit price to sell the manufactured goods for to the retailer, with delivery tomorrow (at time t); (ii) The retailer, who then today (at time $t-\delta$) decides the quantity to order from the manufacturer and the price to sell each item for to the public the next day. What is the optimal price set by the manufacturer and the optimal quantity to order and the optimal retailer price? The problem is that neither of these agents know what the demand will be the next day, only its probabilistic distribution. This is a problem that occurs in many situations, for example in the pricing of electricity in a liberated electricity market. We generalize this classical newsvendor problem to continuous time and a jump diffusion setting, and formulate it as a problem to find the Stackelberg equilibrium of a stochastic differential game with delayed information flow. We find a maximum principle for this type of control problem, and use it to solve the optimal pricing problem in some specific cases.

Presentation is based on recent joint work with Leif Sandal and Jan Ubøe, both at NHH, Bergen, Norway.

24 March - Peter Bank (Technische Universität Berlin and Quantitative Products Laboratory)

Market indifference prices

We discuss the pricing and wealth dynamics in a market where a large trader's orders are filled at indifference prices. As we will see, this indifference principle is mathematically best described by a nonlinear SDE for the market makers' utility process. We will derive this SDE and discuss its solvability in terms of Malliavin derivatives and Sobolev embedding results for stochastic integrals.

10 March - Lioudmila Vostrikova (Université d'Angers)

F-divergence minimal martingale measures and optimal portfolios for exponential Levy models with a change-point

We study exponential Levy models with change-point which is a random variable, independent from initial Levy processes. On canonical space with initially enlarged filtration we describe all equivalent martingale measures for change-point model and we give the conditions for the existence of f -minimal equivalent martingale measure. Using the connection between utility maximisation and f -divergence minimisation, we obtain a general formula for optimal strategy in change-point case for initially enlarged filtration and also for progressively enlarged filtration when the utility is exponential. We illustrate our results considering the Black-Scholes model with change-point.

3 March - Carlos G. Pacheco González (CINVESTAV)

The Kac semi-group and applications to stochastic control

In this talk we present the Kac semi-group within the context of Markov processes, and we show applications in stochastic control problems with non-constant discounted criteria. In particular we set a Hamilton-Jacobi-Bellman equation for a problem where the discounted process is the Cox-Ingersoll-Ross model.

24 February - Sergey Nadtochiy (Oxford)

An approximation scheme for the optimal investment strategy in incomplete market

Characterizing and constructing the solutions to stochastic optimization problems of optimal portfolio choice is a long standing problem. In this talk, I will discuss a new method based on a splitting scheme for the associated Hamilton-Jacobi-Bellman equation in a two-factor stochastic volatility model for the stock price. The scheme converges to a solution of the corresponding PDE, and yields an explicit uniform approximation of the optimal investment strategy. This solution approach offers, among others, insightful observations on how market incompleteness is

processed and how it affects the 'infinitesimal' investment preferences. This is joint work with Thaleia Zariphopoulou.

3 February - Chris Rogers (Cambridge)
Diverse beliefs and market selection

This talk presents the basic framework for equilibrium pricing where agent heterogeneity is characterized by diverse beliefs. This turns out to be a tractable and sensible modelling framework in which to study various phenomena, which we will illustrate with several examples, drawn in the main from the literature on market selection. The Market Selection Hypothesis loosely speaking proposes that agents with 'inferior' beliefs will eventually be 'eliminated' from the market, but these terms need to be defined. Once they are, we are able to prove some results about when agents are indeed eliminated from the market; these results only partly confirm the intuition of the Market Selection Hypothesis. We have some surprising examples which show that some very unexpected phenomena may occur.