Thursday, September 20th

Łukasz Stettner - "Portfolio Selection with Transaction Costs, Decision Lag and Execution Delay":
We consider portfolio selection problem in the case when asset prices depend on economic factors and the pair assets plus factors form a Feller Markov process taking values on a locally compact separable metric space. We make decisions concerning our portfolio in the moments which are separated by a deterministic time lag and our decisions are executed with delay. Both time lag and execution delay are different. The problem of maximization of the portfolio over a finite time horizon can be transformed into an impulse control which leads to a sequence of stopping problems with discontinuous functionals. Continuity of the solution to the corresponding Bellman equation (solution to the quasi-variational inequality) is shown and nearly optimal strategies are constructed. The result generalizes a paper by B. Bruder and H. Pham and written jointly with Dr. J. Palczewski. Further generalizations and other aspects of the problem will be also presented.

Christoph Schwab - "Numerical Derivative Pricing in Non-BS Markets":
We report on deterministic solution methods for Kolmogoroff equations.
Admissible processes are strong Markov processes, possibly nonstationary, of jump-diffusion and pure jump type, including in particular Lévy and additive processes. Multivariate models with copula models for the dependence in the marginals' jump structure are allowed.
Our approach is based on stabilized Galerkin discretization of the process' infinitesimal generator resp. its Dirichlet form in a wavelet basis. The methods allow to analyze single period and multiperiod contracts of European, American or exotic style, in single or multiple periods and on single underlyings or on baskets in a unified fashion. We address the superconvergent extraction of Greeks and model calibration, validation and verification. Numerical analysis in the domains of Dirichlet forms of the price processes is briefly addressed. Examples include American and exotic contracts on Lévy copula dependence models, single or multiscale stochastic volatility models of BNS and coGARCH type. (Joint work of the CMQF group in the Seminar for Applied Mathematics, ETH Zurich.)

Ole E. Barndorff-Nielsen - "Matrix Subordinators and Multivariate OU-based Volatility Models":
The concept of matrix subordinators is introduced and exemplified. A brief account of the relation to Upsilon transformations will be given. The second part of the talk discusses the use of matrix subordinators in multivariate generalisation of the one-dimensional OU-based stochastic volatility models.

Damien Lamberton - "Optimal Stopping Problems with Irregular Payoff Functions":
We consider an optimal stopping problem with finite horizon for a general one-dimensional diffusion, without any regularity assumption on the payoff function. We prove that the value function is continuous and can be characterized as the unique solution of the variational inequality in a weak sense. This talk is based on joint work with M. Zervos.

Wolfgang Runggaldier - "Contagious Default: Application of Methods of Statistical Mechanics in Finance":
Default of a firm is in general contagious (infectious). Taking contagion into account is therefore important for an institution holding a large credit portfolio. We approach the study of contagion by using interacting particle methods. In particular, we study limit distributions when the number of firms goes to infinity as well as their approximations when the number of firms is finite but large. This allows to explain various phenomena like default clustering and, in general, it allows to view a credit crisis as a microeconomic phenomenon driven by endogenous financial indicators. Finally, we apply the results to large portfolio losses. (Based on joint work with P. Dai Pra, E. Sartori, M. Tolotti).

Session 1

Nicole Bäuerle - "Dependence Properties and Comparison Results for Lévy Processes with Applications to Option Prices and Credit Risk":
We investigate dependence properties and comparison results for multidimensional Lévy processes. Association, positive orthant dependence and positive supermodular dependence of Lévy processes are characterized in terms of the Lévy measure as well as in terms of the Lévy copula, a concept which has been introduced recently. As far as comparisons of Lévy processes are concerned we consider the supermodular and the concordance order and characterize them by orders of the Lévy measures and by orders of the Lévy copulas respectively. These results can be applied to compare option prices or default time points of credit risks and credit swap rates. (The talk is based on joint work with A. Blatter, A. Müller and U. Schmock.)

Griselda Deelstra - "Bounds for Asian Basket Options":
In this paper we propose some pricing methods for European-style discrete arithmetic Asian basket options in a Black-Scholes framework. An Asian basket option is an option whose payoff depends on the average value of the prices of a portfolio (or basket) of assets (stocks) at different dates. Determining the price of the Asian basket option is not a trivial task, because we do not have an explicit analytical expression for the distribution of the weighted sum of the assets. By assuming that the assets follow correlated geometric Brownian motion processes, one can use Monte-Carlo simulation techniques to obtain a numerical estimate of the price. In literature, other techniques are suggested with as main goal to approximate the real distribution of the payoffs by another one which is easier to treat mathematically (see e.g. Beisser (Ph.D. Thesis, Johannes Gutenberg University Mainz , 2001) and references therein). In this paper, we start from methods used for basket options and Asian options. First we use the general approach for deriving upper and lower bounds for stop-loss premiums of sums of dependent random variables as in Kaas et al. (IME, 2000) or Dhaene et al. (IME, 2002). We generalize the methods in Deelstra et al. (IME, 2004) and Vanmaele et al. (JCAM, 2006). Afterwards we show how to derive an analytical closed-form expression for a lower bound in the non-comonotonic case. Finally, we derive upper bounds for Asian basket options by generalizing techniques as in Thompson (Working paper, University of Cambridge, 1999) and Lord (JCF, 2007). Numerical results are included and on the basis of our numerical tests, we explain which method we recommend depending on moneyness and time-to-maturity. (Joint work with Ibrahima Diallo and Michèle Vanmaele)

Jens Jackwerth - "Are Options on Index Futures Profitable for Risk Averse Investors?":
American call and put options on the S&P 500 index futures that violate the stochastic dominance bounds of Constantinides and Perrakis (2007) are identified as potentially profitable investment opportunities. In out-of-sample tests over 1983-2006, trading strategies that exploit these violations are shown to increase the expected utility of any risk averse investor, net of transaction costs and bid-ask spreads.

Umut Cetin - "Joint Conditional Density of a Markov Process and Its Local Time with Applications to Default Risk Modelling":
The stochastic partial differential equation satisfied by the conditional joint density of a Markov process and its local time given a Markovian observation process is found. The results are applied to a credit risk model in order to price a defaultable bond. In particular it is shown that the H-Hypothesis assumed in some credit-risk literature does not hold in general.

Laszlo Gyorfi - "Growth Optimal Portfolio Selection Strategies with Transaction Costs":
Discrete time infinite horizon growth optimal investment in stock markets with transaction cost is considered. The stock processes are modelled by homogeneous Markov processes. If the distribution of the market process is known then we show two recursive investment strategies such that, in the long run, the growth rate on trajectories (in "liminf" sense) is larger or equal to the growth rate of any other investment strategy with probability 1.

Session 2

Irina Slinko - "Approximation of Good Deal Bound Solutions":
The paper shows how to find approximate “good deal” bounds for European claims in incomplete markets. We consider incomplete markets where the incompleteness is caused by presence of jumps or a non-traded factor. The “good deal” bound solutions were first introduced by [5], who suggested to rule out not only prices which create arbitrage opportunities but also price processes with “too high” Sharpe ratios. Imposing a uniform bound B on Sharpe ratios of all the derivatives and portfolios in the market, they find highest and lowest prices subject to the imposed constraints. The theory was extended by [2] on the models where the incompleteness is caused by jumps in the underlying asset’s price process. The bounds are shown to be the solutions of the appropriate stochastic optimal control problems. In a general case, good deal bounds cannot be computed explicitly, which enables us to use numerical finite-difference methods. The procedure would require even more computational time if we would like to compute solutions for several values of the bound B. Thus, to simplify the numerical procedure, we find a linear approximation of the good deal bound price, writing Taylor expansion of the upper (lower) good deal bound price around the price given by the minimal martingale measure (MMM). We expand the good deal prices in the new variable y, which is defined as a square root function of the good deal bound B and some parameters of the model. The MM measure provides us with a canonical benchmark for pricing any derivative, it has simpler structure than good deal bound prices and is much easier to compute. In order to compute the approximated bounds we find PDEs to which the MMM price and the sensitivity of the option prices with respect to the new parameter y (evaluated at the MMM solution) satisfy. We show that the linear approximation works extremely well for the small deviations of the bound value from bound value which corresponds to the MMM solution.

Ilse Schoeman - "Modeling of the Bank’s Profitability via a Lévy Process-Driven Model and a Black-Scholes Model":
We model the profitability of banks in a stochastic manner by means of a Lévy process-driven model (Heston’s model) and a Black-Scholes model (Euler-Maruyama method). In this regard, we highlight two measures of bank profitability, viz., the return on assets (ROA; measure of the operational efficiency of the bank) and the return on equity (ROE; measure of the owner's returns on their investment). Banks manage the amount of capital they hold to prevent bank failure and to meet bank capital requirements set by the regulatory authorities. However, they do not want to hold too much capital because by doing so they will lower the returns to equity holders. In order to accomplish this, we derive stochastic differential equations that provide information about the dynamics of the value processes of net profit after tax, equity capital and total assets. We also provide appropriate numerical examples and simulations of the ROE and the ROA.

Xinzheng Huang - "Adaptive Integration for Multi-Factor Portfolio Credit Loss Model":
We propose algorithms of adaptive integration for calculation of the tail probability in multi-factor credit portfolio loss models. We first devise the Genz-Malik rule, a deterministic multiple integration rule suitable for portfolio credit models with number of factors less than 10. Later on we arrive at the adaptive Monte Carlo integration, which simply replaces the deterministic integration rule by pseudo-random numbers. The latter not only can handle higher dimensional models but also is able to provide reliable probabilistic error bounds. Both algorithms are asymptotic convergent and consistently outperform the plain Monte Carlo method.

Pauline Sculli - "Contagion in Affine Default Processes":
We present a new framework for the construction of contagion in reduced-form models of credit risk, originating from piecewise deterministic Markov process theory, which allows the credit dynamics of a large number of firms to be looped together in a mathematically tractable way. Furthermore, rather than working in the classical “single-default” framework, we model credit event arrival processes, which are often of greater contractual interest. We let the number of credit events occurring for each firm be a Poisson counting process with Lévy intensity dynamics characterised by two classes of jumps, the origins of which can be self-infecting or contagious. Self-infectious shocks arise in reaction to a firm’s own credit events, whereas contagious jump shocks arise in reaction to counterparty credit events. Alongside, we can also allow for background jump shocks that arrive but are not, ex-post, drivers of credit events. We present an exponential affine martingale which facilitates the analytical construction of survival probabilities via the probability generating function and the construction also of intensity moments, which we find as functions of the Laplace transforms of contagion distributions.

Withanage Ajith Raveendra De Mel - "Some Politics and Statistical Physics Behind Sri Lankan Stock Market Crashes":

We investigate the mechanism of how the so called critical crashes happen in the stock market from a statistical physics point of view. We shall consider a modeling approach proposed in Johansen et al. (2000) to study the nature of a possible crash occurred in the Sri Lankan stock market in 1994 with a mentioning of the political events of the country that had been prevailing during that time which could be the key force that had derived the market towards the said crash. We shall determine the parameters that governed this crash and fit a periodic function for the actual data based on the critical phenomena in statistical mechanics. We also proposed a modeling approach via which we illustrate the critical crashes in the market are not unusual phenomena when the market is modeled as a system in statistical physics, where we employ a version of Deridda's random Energy Model Derrida (1980), Derrida (1997) applied to the price fluctuations in the financial market.

Session 3

György Ottucsák - "Principal Component and Constantly Rebalanced Portfolio":
A class of portfolio selection methods, the so called log-optimal Constantly Rebalanced Portfolio (CRP) is considered in discrete time model of sequential investments, which means that at the beginning of each trading period the capital of the investor is distributed among the assets according to a fixed portfolio vector. Beside the empirical analysis of the well-known best CRP (BCRP) (obtained by assuming perfect knowledge of future stock prices) on 44-years long New-York Stock Exchange (benchmark) data sets two other CRPs are introduced and empirically analyzed: the causal CRP (CCRP) which recalculates its portfolio at the beginning of each trading period and a variant of the log-optimal BCRP, which has smaller computational complexity, and has some relations to Markowitz CRP, where the expected return is maximized for a given level of risk. to achieve these strategies complexity feasible algorithms based on quadratic programming and gradient descent are given. Some corresponding materials to the log-optimal phenomena and to the benchmark data sets are available on http://www.szit.bme.hu/~oti/portfolio.

Robert Stelzer - "Multivariate Continuous Time Lévy-Driven GARCH Processes":
A multivariate extension of the COGARCH(1,1) process introduced in Klüppelberg, Lindner and Maller [J. Appl. Probab. 41 (2004), 601-622] is presented and shown to be well-defined. The definition generalizes the idea of Brockwell, Chadraa and Lindner [Ann. Appl. Probab. 16(2006), 790-826] for the definition of the univariate COGARCH(p,q) process and is in a natural way related to multivariate discrete time GARCH processes as well as positive-definite Ornstein-Uhlenbeck type processes.
Furthermore, we establish important Markovian properties and sufficient conditions for the existence of a stationary distribution for the volatility process, which lives in the positive semi-definite matrices, by bounding it by a univariate COGARCH(1,1) process in a special norm. Moreover, criteria ensuring the finiteness of moments of both the multivariate COGARCH process as well as its volatility process are given. Under certain assumptions on the moments of the driving Lévy process, explicit expressions for the first and second order moments and (asymptotic) second order stationarity are obtained.
As a necessary prerequisite we study the existence of solutions and some other properties of stochastic differential equations being only defined on a subset of $\mathbb{R}^d$ and satisfying only local Lipschitz conditions. Finally, we present some illustrative examples and simulations.

Masaaki Fukasawa - "Central Limit Theorem for the Realized Volatility Based on a Tick Time Sampling":
A central limit theorem for the realized volatility estimator of the integrated volatility based on a specific random sampling scheme is proved. the estimator is shown to be also robust to market microstructure noise induced by price discreteness and bid-ask spreads.

Christina Niethammer - "On Q-Optimal Signed Martingale Measures in Exponential Lévy Models":
We give a sufficient condition to identify the q-optimal signed martingale measures in exponential Lévy models. As a consequence we find that the q-optimal signed martingale measures can be equivalent only, if the tails for upward jumps are extraordinarily light. Moreover, we derive convergence of the q-optimal signed martingale measures to the entropy minimal martingale measure as q approaches one. Finally, some implications for portfolio optimization are discussed.

Huseyin Merdan - "Asset Price Dynamics with Heterogenous Groups":
This talk presents the study of the price dynamics of an asset under various conditions by using a system of ordinary differential equations. One of these conditions involves the introduction of new information that is interpreted differently by two groups. Another studies the price change due to a change in the number of shares. We will examine the steady state under these conditions to determine the changes in the price due to these phenomena. Numerical studies are also shown to understand the transition between the regimes. The differential equations naturally incorporate the effects due to the finiteness of assets (rather than assuming unbounded arbitrage) in addition to investment strategies that are based on either price momentum (trend) or valuation considerations.

Session 4

Wolfgang Putschögl - "Optimal Investment Under Dynamic Risk Constraints and Partial Information":
We consider an investor who wants to maximize expected utility of terminal wealth. A typical model for stock prices is provided by a stochastic differential equation with non-constant coefficients. If the drift process is e.g. Independent of the driving Brownian motion this leads to a model with partial information under the realistic assumption that only the prices can be observed. For special models corresponding strategies can be computed but due to the non-constant drift the position in the stock varies between extreme long and short positions making these strategies very risky when trading on a daily basis. Motivated by Cuoco et al. (2002) we impose a (different) class of risk constraints on the strategy, computed on a short horizon, and then find the optimal policy in this class. This leads to much more stable strategies. We provide an example, where the drift process is modeled as a continuous time Markov chain with finitely many states. the risk constraints not only limit the risk caused by time discretization, they also reduce the influence of certain parameters which may be difficult to estimate. We provide a detailed sensitivity analysis for the parameters involved in the strategy and how they affect the strategies in the constrained and unconstrained case. The results are applied to historical stock prices.

Jakub Zwierz - "On Insiders Who Can Stop At Honest Times":
We consider a market with two types of agents possessing different levels of information. In addition to the regular agent, there is an insider whose additional knowledge consists of being able to stop at an honest time Λ. We show, using the multiplicative decomposition of Azéma supermartingale, that if the martingale part of the price process has the predictable representation property and Λ satisfies some mild assumptions, then there is no equivalent local martingale measure for insider. This extends the results obtained by P. Imkeller to the continuous semimartingale setting and general honest times.

José Manuel Corcuera - "Hedging and Optimization in a Geometric Additive Model":
In our market model the stock price process S = {St, t >= 0} is a geometric additive model. Except for simple cases the above described models are incomplete, we complete the market by a series of assets related to the power-jump processes of the underlying additive process. We will see also how the artificial assets, mentioned above, can be related with call options with different strikes, showing how the market can be completed by using complex portfolios that include call options. Also, by the completeness of the enlarged market, we obtain the optimal portfolio by the martingale method.

Nele Vandaele - "Hedging Unit-Linked Life Insurance Contracts Driven by a Lévy Process":
The aim of this paper is twofold. Firstly, we determine the locally risk minimizing hedging strategy for a pure endowment contract when the risky asset follows a Lévy semimartingale process. In case the risky asset is one-dimensional and continuous, Schweizer found an easy way to determine the locally risk minimizing hedging strategy using the Galtchouk-Kunita-Watanabe decomposition under the minimal martingale measure. Due to the discontinuity of a Lévy process, we had to determine the locally risk-minimizing hedging strategy in a different way.
Secondly, we show how to hedge a surrender option, when the risky asset follows a Lévy martingale process. In this case we get an extra risk term, in addition to the financial risk. In order to hedge this additional risk, we use some concepts from credit risk, like the H-hypothesis and the F-independency.

Takuji Arai - "Optimal Hedging Strategies on Asymmetric Functions":
We treat optimal hedging problems for contingent claims in an incomplete financial market, which problems are based on asymmetric functions. More precisely, the optimal hedging which we consider in this talk, minimizes the expectation of an asymmetric function of the difference between the underlying contingent claim and the value of portfolio at the maturity. In particular, under some assumptions, we shall prove the unique existence of a solution and shall discuss its mathematical property.

Session 5

Anke Wiese - "Numerical Solution of Stochastic Differential Equations Evolving on Manifolds":
We present numerical schemes for nonlinear stochastic differential equations whose solution evolves on a smooth finite dimensional manifold. Given a Lie group action that generates transport along the manifold, we pull back the stochastic flow on the manifold to the Lie group via the action and subsequently to the corresponding Lie algebra. We construct an approximation to the stochastic flow in the Lie algebra via closed operations and then push back to the manifold, thus ensuring our approximation lies in the manifold. We call such schemes stochastic Munthe-Kaas methods after their deterministic counterparts. We also present stochastic Lie group integration schemes based on Castell-Gaines methods. They become stochastic Lie group integrator schemes if we use Munthe-Kaas methods as the underlying ordinary differential integrator. Further, we show that some Castell--Gaines methods are uniformly more accurate than the corresponding stochastic Taylor schemes. Lastly we demonstrate our methods in some examples including a forward stochastic Riccati system that arises in backward form in linear-quadratic control problems such as the mean-variance hedging problem in incomplete financial markets.

Richard Vierthauer - "On Utility Indifference Pricing in Affine Stochastic Volatility Models":
We follow an idea of Mania and Schweizer and consider exponential utility indifference pricing and hedging in linear approximation. In this approximation the problem reduces to solving the pure utility maximization problem under exponential utility and to determining the Galtchouk-Kunita-Watanabe decomposition of the claim under the minimal entropy martingale measure. These objects are obtained semi-explicitly in affine stochastic volatility models with or without jumps. We illustrate our results by a numerical example in the Lévy-driven stochastic volatility model proposed by Barndorff-Nielsen and Shephard. the presentation is based on joint work with Jan Kallsen and Thorsten Rheinländer.

Teppo Rakkolainen - "Optimal Dividend Control in Presence of Downside Risk":
We analyze the determination of a value maximizing dividend policy for a broad class of cash flow processes modeled as spectrally negative jump diffusions. We extend previous results based on continuous diffusion models and characterize the value of the optimal dividend policy explicitly. Utilizing this result, we also characterize explicitly the values as well as the optimal dividend thresholds for a class of associated optimal stopping and sequential impulse control problems. Our results indicate that both the value as well as the marginal value of the optimal policy are increasing functions of policy flexibility in the discontinuous setting as well.

Michel Vellekoop - "Optimal Consumption and Investment of Randomly Terminating Income":
We investigate an optimal consumption and investment problem where we receive a certain fixed income stream that is terminated at a random time. Dual methods are used to reduce the problem to a deterministic optimal control problem that can be solved explicitly. We show that the value function for this problem and the corresponding optimal consumption and investment strategies differ considerably from the case where an income stream is certain to continue indefinitely.

Delphine David - "On the Optimal Control of Stochastic Delayed Systems with Jumps":
We consider the optimal control of stochastic delayed systems with jumps, in which both the state and controls can depend on the past history of the system. In particular we derive necessary and sufficient maximum principles for such problems, and give some applications to financial economics.