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9:40 - 10:10 registration

J. Swart↓

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10:10 - 11:00 Jan Večeř · Frankfurt School of Fin. & Manag., Frankfurt, GermanyBlack-Scholes formula for Asian options

Asian options are securities with a payoff that depends on the average of the underlying stock price over a certain time interval. We identify three natural assets that appear in pricing of the Asian options, namely a stock  $S$ , a zero coupon bond  $B^T$  with maturity  $T$ , and an abstract asset  $A$  (an “average asset”) that pays off a weighted average of the stock price number of units of a dollar at time  $T$ . It turns out that each of these assets has its own martingale measure, allowing us to obtain Black-Scholes type formulas for the fixed strike and the floating strike Asian options. The model independent formulas are analogous to the Black-Scholes formula for the plain vanilla options; they are expressed in terms of probabilities under the corresponding martingale measures that the Asian option will end up in the money. Computation of these probabilities is relevant for hedging. In contrast to the plain vanilla options, the probabilities for the Asian options do not admit a simple closed form solution. However, we show that it is possible to obtain the numerical values in the geometric Brownian motion model efficiently, either by solving a partial differential equation numerically, or by computing the Laplace transform.

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11:10 - 12:00 Bohdan Maslowski · KPMS MFF UK, Prague, CZAbsolute continuity of laws for non-Markovian stochastic evolution equations

It is well known that for linear OU process the absolute continuity of probability laws (and the Strong Feller Property) is equivalent to the exact zero controllability of the corresponding deterministic control system where the noise is replaced by control and the admissible the set of controls is the space  $L^2$ . A similar result is obtained for linear equations driven by more general Gaussian noises - the space of admissible controls is given by some characteristics of the noise (for example, by the Hurst parameter in the case of fBm). Applications to stochastic parabolic equations with distributed and boundary noise are given.

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12:00 - 14:00 lunch time

J. Večeř↓

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14:00 - 14:50 Joern Sass · Univ. of Kaiserslautern, Kaiserslautern, GermanyMaximizing the asymptotic growth rate in a financial market with jumps when facing fixed and proportional transaction costs

In a financial market consisting of one bond and one stock, whose returns follow a Lévy process with compound Poisson jumps, we consider the maximization of the asymptotic growth rate. For trading, an investor faces a combination of fixed costs (management costs proportional to the portfolio value) punishing the frequency of trading and proportional costs punishing the size of the transaction. Due to the structure of the costs it is natural to consider impulse control strategies consisting of trading times and transactions at those times. With jumps, existence is shown in Duncan/Pasik Duncand/Stettner (2010) in a framework with obligatory diversification.

An optimal impulse control strategy can be obtained by solving certain quasi variational inequalities (QVIs). Without jumps, a solution of these QVIs quite explicitly in Irle/Sass (2006). It is given by a constant boundary strategy for the risky fractions invested in the stocks. It can be described by only four parameters: two for the stopping boundaries and two for the risky fractions the investor chooses at these times.

We carry over these results to a model with compound Poisson jumps. It can be shown that a solution of the QVIs can be constructed under mild conditions. Finding such a solution proves that an optimal impulse control strategy exists and can be found within the class of constant boundary strategies. We conclude by analyzing the influence of costs and jumps on the optimal strategies.

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*14:50 - 15:00**J. Večeř↓*

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15:00 - 15:50    Jan Swart, Jana Plačková · ÚTIA AS CR (AV ČR), Prague, CZ*Stochastic order book dynamics*

Classical economical theory tells us that the price of a commodity assumes an equilibrium value which is determined by the requirement that at this level, supply meets demand. We are interested in how this equilibrium is reached for commodities traded at a stock exchange. We develop a simple model, where traders each want to buy or sell one item at a random maximal or minimal price, which is independent for each trader and uniformly distributed on some interval. Each trader either finds an offer that suits him/her, or places a new limit order at his/her maximal/minimal price. Contrary to intuition, we will see that in this model, the theoretical equilibrium price is never reached. We will discuss some consequences of this observation and related open problems.

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*15:50 - 16:20    coffee break**T. Tichý↓*

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16:20 - 17:10    Petr Dostál · KPMS MFF UK, Prague, CZ*Almost optimal strategies for small transaction costs*

We consider a non-consuming agent investing in a stock and a money market interested in the portfolio market price far in the future. We derive an almost log-optimal strategy for small proportional transaction costs for the case when the rate of return and the volatility of the stock market price are bounded Itô processes with bounded coefficients. Further, we modify the almost Kelly-optimal strategy in order to obtain more risk averse trading strategies that can be associated with HARA utility functions unbounded from below in certain sense.

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17:20 - 18:10    Jan Voříšek · KPMS MFF UK, Prague, CZ*Closed-form likelihood approximation for nonlinear SDE with exogenous parameters*

The stochastic cusp model is given by the SDE with kubic, mean reverting drift. Only the stationary density of the process is known in closed-form. It belongs to the class of generalized normal distributions, which allows for skewness, different tail shapes and multiple equilibria. The closed-form approximation of the transition density will be presented in this talk. The closed-form approximation allows simple ML estimation of the parameters of the drift, compared to other methods, such as the numerical solution of the PDE, binomial trees or simulations.

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*18:30 - 22:00    dinner*

9:20 - 9:50 tea

J. Sass↓

9:50 - 10:40 Petr Veverka · FJFI ČVUT (FNSPE CTU) in Prague, CZ

Sufficient stochastic maximum principle for the discounted control problem

In the first part of the talk, some known results on maximum principle on finite time horizon will be reminded. Further, the results will be generalized to the discounted stochastic control problem where some delicate questions concerning the terminal condition of the adjoint backward equation arise. In the last part, some examples will be given.

10:50 - 11:30 Tomáš Tichý · Technical University of Ostrava, CZ

A smoothing filter based on fuzzy transform for (more than) one dimension

This presentation is devoted to the smoothing of discrete functions using the fuzzy transform introduced by Perfilieva. We generalized a smoothing filter based on the fuzzy transform recently proposed by us to obtain a better control on the smoothed functions. For this purpose, a generalization of the concept of fuzzy partition was suggested and the smoothing filter is defined as a combination of the direct discrete fuzzy transform and a slightly modified inverse continuous fuzzy transform. An approximation behavior, total variation of smoothed functions and statistical properties including the description of the white noise reduction and the asymptotic expression of bias and variance are investigated and discussed. The proposed filter is compared with the Nadaraya-Watson estimator and the results are illustrated assuming financial data. Within the analysis provided in Holcapek and Tichy (2011), we have suggested a smoothing filter based only on one independent variable. However, many real world problems are multidimensional in nature and hence we generalize the fuzzy smoothing filter here into two/n dimensions and show its application within a common problem of financial engineering and asset pricing, the option implied volatility surface presentation.

11:30 - 13:30 lunch time

B. Maslowski↓

13:30 - 14:20 Jiří Witzany · University of Economics, Prague

Estimating Correlated Jumps and Stochastic Volatilities

We formulate a bivariate stochastic volatility jump-diffusion model with correlated jumps and volatilities. An MCMC Metropolis-Hastings sampling algorithm is proposed to estimate the model's parameters and latent state variables (jumps and stochastic volatilities) given observed returns. The methodology is successfully tested on several artificially generated bivariate time series and then on the two most important Czech domestic financial market time series of the FX (CZK/EUR) and stock (PX index) returns. Four bivariate models with and without jumps and/or stochastic volatility are compared using the deviance information criterion (DIC) confirming importance of incorporation of jumps and stochastic volatility into the model.

14:30 - 14:50 Jan Bártek · KPMS MFF UK, Prague, CZ

Random dynamical systems defined by fractional stochastic porous media equations

In this talk we explore some properties of stochastic porous medium equation driven by fractional Brownian motion with Hurst index greater than one half. In previous work it has been shown that the existence of solution to this equation is closely related to the existence of solution to the deterministic porous medium equation. Now we study the uniqueness of solution and show that it generates a random dynamical system.

15:00 - 15:20 Jana Šnupárková · KPMS MFF UK, Prague, CZ

On the stochastic bilinear equation with fractional Brownian motion

In the talk we will consider the stochastic bilinear equation where the driving process is a fractional Brownian motion with Hurst parameter greater than one-half.