List of abstracts

September 15, 2014

Plenary speakers

Ole Barndorff-Nielsen

Title: Some recent developments in Ambit Stochastics; with particular reference to Turbulence

Abstract: The presentation will mainly address three aspects: integration theory for ambit processes and fields; tempo-spatial ambit fields with spatial dimension 1, where in relation to turbulence the observed variable is the main component of the velocity vector; metatimes, chronometers and generalised subordination.

Jocelyne Bion-Nadal

Title: Model uncertainty and martingale problem

Abstract: We consider problems such as optimization of controlled stochastic systems or robust evaluation of risks under model uncertainty. Uncertainty means that the law of the underlying model is not known. More specifically we consider here the case where the set of possible laws is a non dominated set of probability measures. In the usual setting when the laws are all equivalent, the solution to the problem is represented by an "ess-sup" of conditional expectations. In the non dominated setting we face two kinds of problems. The first one comes from the fact that the Q-conditional expectation is defined up to a Q-null set and that the Q-null sets are non comparable when the probability measure Q describes a non dominated set. The second one is that the sup of a non countable family of measurable maps is not measurable, and the "esssup" has no meaning in the non dominated setting. To encompass these problems we develop a new approach based on the "Martingale Problem". Assume that every possible model is described by a stochastic process with cadlag paths satisfying a stochastic differential equation. Such a model can also be represented

by a probability measure Q on the canonical space of cadlag paths solution to an associated martingale problem. Under some specific property (to be detailed in the talk) on the possibly path dependent coefficients, and ellipticity, we prove that there is a unique solution to this martingale problem. Additional results under these hypothesis lead to a solution to the two above cited problems and to a new approach to robust evaluation of risks or optimization under model uncertainty.

Jose Manuel Corcuera

Title: Contingent Convertibles and Extension Risk

Abstract: A traditional Contingent Convertible (CoCo) converts (mandatorily) into a predefined number of shares or has a principal write down if and when a credit event takes place. By construction CoCos are loss-absorbing debt instruments, imposing a loss on their holders if the issuing bank is in risk of entering into a state of non-viability, reinforcing the bank balance sheet and keeping the bank viable. The interest for CoCos is founded on this feature. A serious drawback of traditional CoCos is the so called *death spiral effect*: by actively hedging the equity risk, CoCo investors can (unintentionally) force the conversion by making the share price deteriorate and eventually trigger the conversion. The introduction of cancellable coupons can be seen as very useful: the death-spiral effect is reduced. Also we shall consider the case that these bonds do not have a fixed maturity but several call dates. We explain how to integrate this Extension Risk into pricing.

Boualem Djehiche

Title: Risk-sensitive mean-field type control

Abstract: I will review some recent results on a seemingly new stochastic maximum principle for risk-sensitive mean-field type control in both the fully and partially observable cases.

Fausto Gozzi

Title: On Infinite dimensional stochastic systems and their control in applied models

Abstract: The main goal of this talk is to show how some recent methodologies for the study of infinite dimensional (deterministic and) stochastic systems

and their control can be useful to treat applied problems in economics. All in continuous time.

We first present some applied models where infinite dimensional ODEs/SDEs are used (economic growth models, forward mortality models, delay/path dependent models for asset pricing, optimal portfolio, optimal advertising) Then we will show an example of recent results and work in progress on such problems (mainly in regularity results for Kolmogorov and HJB equations). Finally we will give applications of such results to some of the quoted applied models and some open issues.

Juri Hinz

Title: On the role of energy mix for optimization of emission market architecture

Abstract: We analyze the performance of tradable pollution permit market given existing energy-generating technologies. Within a general equilibrium framework, we show how the architecture of a proposed emission trading scheme should be optimized with respect to the allocation of production capacities along technologies present in the market.

Yaozhong Hu

Title: Parameter estimation for long memory Ornstein-Uhlenbeck process

Abstract: Consider an Ornstein-Uhlenbeck process, $dX_t = -\theta X_t dt + \sigma dB_t^H$, driven by fractional Brownian motion B^H with known Hurst parameter $H \geq \frac{1}{2}$ and known variance σ. But the parameter $\theta > 0$ is unknown. Assume that the process is observed at discrete time instants $t = h, 2h, \cdots, nh$. We construct an estimator $\hat{\theta}_n$ of θ which is strongly consistent, namely, $\hat{\theta}_n$ converges to θ almost surely as $n \to \infty$. We also obtain a central limit type theorem and a Berry-Esseen type theorem for this estimator $\hat{\theta}_n$ when $1/2 \leq H < 3/4$. The tool we use is some recent results on central limit theorems for multiple Wiener integrals through Malliavin calculus. It should be pointed out that no condition on the step size h is required, contrary to the existing conventional assumptions. This is a joint work with Jian SONG.

Jan Kallsen

Title: Arbitrage-free modelling of liquid derivatives

Abstract: In practice, model parameters are frequently recalibrated in order to make observed derivative prices consistent with a model for an underlying asset. It is not a priori clear whether this approach is or can be made consistent with the absence of arbitrage. In this talk we discuss how to embed recalibration in an arbitrage-free setup. In this context, drift and consistency conditions play an important role.

Asger Lunde

Title: A Generalized Schwartz models for Energy Spot Prices - Estimation using a Particle MCMC Method

Abstract: We consider a two factor geometric spot price model with stochastic volatility and jumps. The first factor models the normal variations of the price process and the other factor accounts for the presence of spikes. Instead of using various filtering techniques for splitting the two factors, as often found in the literature, we estimate the model in one step using a MCMC method with a particle filter. In our empirical analysis we fit the model to UK natural gas spot prices and investigate the importance of including jumps and stochastic volatility. We find that the inclusion of stochastic volatility in the process used for modeling the normal price variations highly impacts the jump intensity in the spike process. Furthermore, we consider both a continuous and pure jump-driven specification of the volatility process in order to asses if the volatility specification also influences the spike process.

Bernt Øksendal

Title: Malliavin calculus and optimal control of stochastic Volterra equations, with applications to financial markets with memory.

Abstract: Stochastic Volterra equations appear in many applications and models, ranging from population dynamics, economic investment theory, transport of a substance dispersing in a fluid and Newtonian motion of objects in a random environment. They can also be derived from stochastic differential equations with delay. More generally, they represent interesting models for stochastic systems with memory.

Solutions of stochastic Volterra equations are not Markov processes, and therefore classical methods, like dynamic programming, cannot be used to study such control problems. However, we shall see that by using Malliavin calculus it is possible to formulate a modified, functional type of maximum principle suitable for such systems. This principle also applies to situations where the controller has only partial information available to base her decisions upon. We present both a sufficient and a necessary maximum principle of this type, and

then we use the results to study some specific examples. In particular, we solve an optimal portfolio problem in a financial market model with memory.

The talk is based on recent joint work with Nacira Agram, University of Biskra, Algeria.

Mark Podolskij

Title: Limit theorems for ambit fields

Abstract: In this talk we will present some limit theorems for ambit processes. Ambit processes are stochastic models of moving average structure with additional stochastic component. We concentrate on the asymptotic behavior of power variation of ambit processes. We will see that the limit theory strongly depends on the driving Levy motion. When the driver is a Brownian motion the weak convergence is towards a mixed Gaussian law. When the driving motion is a pure jump Levy process some non-standard limits appear. This is joint work with A. Basse-O'Connor and R. Lachieze-Rey.

Barbara Rüdiger

Title: Positive Harris recurrence of the CIR process and its applications

Abstract: We prove the positive Harris recurrence of the CIR process. As a consequence ergodic results on transformations of the CIR process will be given. These have in particular applications to a credit migration model.

The talk is based on a work in collaboration with P. Jin, V. Mandrekar and C. Trabelsi, on Comm. on Stoch. An. Furher development of these results are also discussed.

Francesco Russo

Title: Kolmogorov equations related to frames of diffusion processes and related path dependent calculus.

Abstract: First we remind the framework of Banach space valued processes via regularizations introduced by C. Di Girolami and the speaker. Second we will revisit the functional Itô path-dependent calculus started by B. Dupire, R. Cont and D.-A. Fournie, and its link with the first mentioned calculus. The third part of the talk will be devoted to the study of the Kolmogorov type equation associated with the so called window Brownian motion, called path-dependent heat equation, for which well- posedness at the level of classical

solutions is established. Then, a notion of strong approximating solution, called strong-viscosity solution, is introduced which is supposed to be a substitution tool to the viscosity solution. The definition of strong-viscosity solution will be extended to semilinear PDEs associated with the path dependent heat equation. This is inspired by the notion of good solution, and it is based again on an approximating procedure.

Marta Sans-Sole

Title: Probability densities of SPDEs in high spatial dimensions

Abstract: We consider the class of non-linear stochastic partial differential equations

$$\begin{aligned} Lu(t,x) &= \sigma(u(t,x))\dot{F}(t,x) + b(u(t,x)),\ (t,x) \in]0,T] \times R^d, \\ u(0,x) &= \frac{\partial}{\partial t}u(0,x) = 0,\ x \in R^d, \end{aligned}$$

where L is a second order differential operator, σ and b are real functions, $\dot{F}$ is the formal derivative of a Gaussian stochastic process and $d \in N$. The setting is that of [D. Conus and R.C. Dalang, 2008]. It applies in particular to the wave operator

$$\frac{\partial^2}{\partial t^2} - \Delta_d.$$

Under suitable hypotheses, these equations possess a random field solution.

Fix $(t,x) \in [0,T] \times R^d$. The purpose is to study the existence of density for the law of $u(t,x)$. We will use two methods that yield different type of results. The first one relies on the classical approach of Malliavin calculus. We establish the equivalence between stochastic integrals with respect to a cylindrical Brownian motion and the Skorohod integral, and extend the integration theory in [D. Conus and R.C. Dalang, 2008] to Hilbert space valued integrands. With these ingredients, and commutation formulae of the Malliavin derivative and stochastic and pathwise integrals, we prove that the random field solution to these equations at any fixed point $(t,x) \in [0,T] \times R^d$ is differentiable in the Malliavin sense. In the particular case of equations with additive noise, we establish the existence of density for the law of the solution at $(t,x) \in]0,T] \times R^d$. The results apply to the stochastic wave equation in spatial dimension $d \geq 4$. The second method follows [A. Debusche and N. Fournier, 2013]. It is based on an integration by parts procedure in functional spaces. Assuming that the coefficient σ is bounded away from zero, we obtain the existence of a density for the law of $u(t,x)$, and that the density belongs to some Besov space.

This is joint work with André Süß.

Agnes Sulem

Title: Control of interbank contagion under partial information

Abstract: We consider a stylized core-periphery financial network in which links lead to the creation of projects in the outside economy but make banks prone to contagion risk. The controller seeks to maximize, subject to budget constraints, the value of the financial system defined as the total amount of external projects. Under partial information on interbank links, revealed in conjunction with the spread of contagion, the optimal control problem is shown to become a Markov decision problem. We find the optimal intervention policy using dynamic programming.

Our numerical results show that the optimal strategy depends on the connectivity in the system in a non-monotonous way. In the low connectivity regime, it is optimal to increase the rate of intervention in the core banks as connectivity increases. On the contrary, for highly connected systems, it is optimal to increase the rate of intervention in the peripheral banks as connectivity increases.

Joint work with Andreea Minca, Cornell University

Josef Teichmann

Title: Consistent Recalibration Models.

Abstract: We present a tractable re-calibration methodology for term structure models combining the advantages of factor models and of HJM-type models.

Michele Vanmaele

Title: Quadratic hedging strategies: how robust are they?

Abstract: We will investigate the consequences of the choice of the model to partial hedging in incomplete markets in finance. A first general approach is based on backward stochastic differential equation with jumps (BSDEJ) which is driven by a Brownian motion and a Poisson random measure. We present two candidate-approximations to this BSDEJ and we prove that the solution of each candidate-approximation converges to the solution of the original BSDEJ in a space which we specify. As an application, we consider models in which the small variations in the price dynamics are modeled with a Poisson random measure with infinite activity and models in which these small variations are modeled with a Brownian motion or are cut off. Using the convergence results on BSDEJs, we show that quadratic hedging strategies are robust towards the approximation of the market prices and we derive an estimation of the model risk.

In a second approach we consider two specific models for the stock price process. The first model is a geometric Lévy process in which the small jumps might have infinite activity. The second model is a geometric Lévy process where the small jumps are truncated or replaced by a Brownian motion which is appropriately scaled. To prove the robustness of the quadratic hedging strategies we use pricing and hedging formulas based on Fourier transform techniques. We compute convergence rates and motivate the applicability of our results with examples. Finally we will also discuss the robustness to the discretization of the model. Starting form a jump-diffusion model, we get discrete time models by performing a simple Euler discretization scheme. The error caused by the discretization method is analyzed. Further, we describe discrete time BSDEJs related to quadratic hedging strategies within the discretized models. We investigate the convergence of the discrete time quadratic hedging strategies to quadratic hedging strategies in the continuous time framework.

References

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[2] Di Nunno, G., Khedher, A., Vanmaele, M.: Robustness of quadratic hedging strategies in finance via backward stochastic differential equations with jumps.

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Almut Veraart

Title: Cross-commodity modelling by multivariate ambit fields

Abstract: This paper proposes a multivariate model for commodity forward curves which is based on multivariate ambit fields. We show how a multivariate ambit field can be used to describe complex dependencies between commodities while staying in a tractable multivariate martingale framework. Moreover, we study in detail how spread options can be priced in our new ambit framework. Here we consider both calendar spreads written on one commodity as well as spread options on different commodity futures. This is joint work with Ole E. Barndorff-Nielsen and Fred E. Benth

Mihail Zervos

Title: Optimal stopping of one-dimensional Itô diffusions with generalised drift

Abstract: We consider the problem of optimally stopping a one-dimensional Itô diffusion with generalised drift over an infinite horizon. We derive a variational inequality that the problem's value function should satisfy and we prove a verification theorem. We then solve the special case that arises when the state process is a skew geometric Brownian motion and the reward function is the one of a financial call option. We show that the optimal stopping strategy can take several qualitatively different forms, depending on parameter values.

Contributed talks

Knut Aase

Title: Insider trading with non-fiducial market makers

Abstract: The single auction equilibrium of Kyle's (1985) is studied, in which market makers are not fiduciaries. They have some market power which they utilize to set the price to their advantage, resulting in positive expected profits. This has several implications for the equilibrium, the most important being that the by perturbing the price by a relatively modest amount, the market maker is able to obtain a profit of the order of magnitude, and even better than, a perfectly informed insider. Our model indicates why speculative prices are more volatile than predicted by fundamentals. Noise traders may be uninformed, or partially informed. We also analyze a situation where the market maker has inside information as well as being non-fiduciary, which may lead to a more efficient market.

Michail Anthropelos

Title: An Equilibrium Model for Commodity Spot and Forward Prices.

Abstract: We consider a market model that consists of financial investors, producers and consumers of a (consumption) commodity. Producers trade the forward contracts to hedge the commodity price uncertainty, while speculators invest in these contracts to diversify their portfolios. It is argued that the commodity equilibrium prices are the ones that clear out the market of spot and forward contracts. Assuming that producers and speculators are utility maximizers and that the consumers demand and the exogenously priced financial market are driven by Lèvy processes, we provide explicit expressions for the equi-

librium prices and analyze their dependence on the model parameters. (Joint work with M. Kupper, Univ. Konstanz; and A. Papapantoleon, TU Berlin)

Christa Cuchiero

Title: A structural model for electricity forward prices

Abstract: We develop a structural modeling framework for electricity *forward* prices, taking into account the main relevant risk factors e.g., demand, capacity, fuel prices, etc. Our approach is inspired by the model introduced by Aid et al. [1], where the electricity *spot* price is formed by an equilibrium argument between demand and supply with a supply curve obtained by ordering the different modes of fuel based production according to their variable costs. In contrast to spot price modeling, we directly model the whole term structure of electricity forward prices as stochastically weighted sum of forward prices of fuels used for electricity production, where the weights depend on several key factors, in particular demand (or residual demand, i.e., total demand minus infeed from renewables) which in turn is heavily influenced by meteorological quantities. A concrete model specification is based on polynomial processes (see [2]), which are used to model both fuel prices and weights. For the latter generalized multivariate Jacobi processes are especially suited. This approach gives rise to an analytically tractable model class which qualifies in particular for risk management purposes due to the clear economic interpretation of the underlying driving forces.

The talk is based on joint work with Thorsten Schmidt and Julian Wergieluk.

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Tiziano De Angelis

Title: A non convex singular stochastic control problem in electricity balancing and its related optimal stopping boundaries

Abstract: We show that the equivalence between certain problems of singular stochastic control (SSC) and related questions of optimal stopping known for

convex performance criteria continues to hold in a non convex problem provided a related discretionary stopping time is introduced. Our problem is one of storage and consumption for electricity, a partially storable commodity with both positive and negative prices in some markets, and has similarities to the finite fuel monotone follower problem. In particular we consider a non convex infinite time horizon SSC problem whose state consists of an uncontrolled diffusion representing a real-valued commodity price, and a controlled increasing bounded process representing an inventory. We analyse the geometry of the action and inaction regions by characterising the related optimal stopping boundaries.

Cristina Di Girolami

Title: Stochastic calculus for non-semimartingales in Banach spaces, an infinite dimensional PDE and some stability results

Abstract: This talk develops some aspects of stochastic calculus via regularization for processes with values in a general Banach space B. A new concept of quadratic variation which depends on a particular subspace is introduced. An Itô formula and stability results for processes admitting this kind of quadratic variation are presented. Particular interest is devoted to the case when B is the space of real continuous functions defined on $[-T, 0]$, $T > 0$ and the process is the window process $X(\cdot)$ associated with a continuous real process X which, at time t, it takes into account the past of the process. If X is a finite quadratic variation process (for instance Dirichlet, weak Dirichlet), it is possible to represent a large class of path-dependent random variable h as a real number plus a real forward integral in a semiexplicite form. This representation result of h makes use of a functional solving an infinite dimensional partial differential equation. This decomposition generalizes, in some cases, the Clark-Ocone formula which is true when X is the standard Brownian motion W. Some stability results will be given explicitly.
This is a joint work with Francesco Russo (ENSTA ParisTech Paris).

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Paul Ehling

Title: Disagreement about Inflation and the Yield Curve

Abstract: We study how differences in beliefs about expected inflation impact real and nominal yield curves in a frictionless economy. Inflation disagreement induces a spillover effect to the real side of the economy with a strong impact on the real yield curve. When investors have a coefficient of relative risk aversion greater than one, real yields across all maturities rise as disagreement increases. Real yield volatilities also rise with disagreement. Using the feature that nominal bond prices can be computed from weighted-averages of quadratic Gaussian yield curves, we explore three properties of the model numerically. First, both real and nominal yield curves are strongly impacted by inflation disagreement relative to a full information economy. Second, increased inflation disagreement drives nominal yields and nominal yield volatilities higher at all maturities. Third, expected inflation beliefs impact real yields. Empirical support for our predictions on yield levels and yield volatilities is provided.

Marcus Eriksson

Title: A stochastic control problem in the Nordic Green Certificate market.

Abstract: We propose and investigate a valuation model for the income of selling tradeable green certificates (TGCs) in the Swedish-Norwegian market,

formulated as a singular stochastic control problem. Our model takes into account the production rate of renewable energy from a "typical" plant, the dynamics market price of TGCs and the cumulative amount of certificates sold. We assume that the production rate has a dynamics given by an exponential Ornstein-Uhlenbeck process and the TGC logrpice a Levy process. For this class of dynamics for the state variables we find optimal decision rules and a closed form solution to the control problem. Furthermore, we perform an empirical analysis of the TGC logreturns based on data between November 2009 until May 2013. The empirical analysis strongly indicates that the TGC logprice is a normal inverse Gaussian distributed Lévy process. For this case the valuation model is explicitly calculated.

Heidar Eyjolfsson

Title: Simulation of volatility modulated Volterra processes using hyperbolic SPDEs

Abstract: We propose a finite difference scheme to simulate solutions to a certain type of hyperbolic stochastic partial di fferential equation (HSPDE). These solutions can in turn estimate so called volatility modulated Volterra (VMV) processes and Lévy semistationary (LSS) processes, which is a class of processes that have been employed to model turbulence, tumor growth and electricity forward and spot prices. We will see that our finite difference scheme converges to the solution of the HSPDE as we take finer and finer partitions for our finite difference scheme in both time and space. Finally we demonstrate our method with an example from the energy finance literature.

Giorgio Ferrari

Title: On the Optimal Boundary of a Three-Dimensional Singular Stochastic Control Problem Arising in Irreversible Investment

Abstract: This paper examines a Markovian model for the optimal irreversible investment problem of a firm aiming at minimizing total expected costs of production. We model market uncertainty and the cost of investment per unit of production capacity as two independent one-dimensional regular diffusions, and we consider a general running cost function. The optimization problem is set as a three-dimensional degenerate singular stochastic control problem. We provide the optimal control as the solution of a Skorohod reflection problem at a suitable free-boundary surface. Such boundary arises from the analysis of a family of two-dimensional parameter-dependent optimal stopping problems and it is characterized in terms of the unique continuous solution to a parameter-dependent integral equation of Fredholm type.

Nils Framstad

Title: The effect of small intervention costs on the optimal extraction of dividends or of renewable resources.

Abstract: A small fixed transaction cost k is shown to have an asymptotical $k^{1/3}$ effect on the continuation region gap for a risk-neutral agent, and $k^{2/3}$ on the optimal value. This contrasts the known results for portfolio selection problems, where these orders are obtained for proportional transaction costs, while fixed costs incur effects of exponents 1/4 resp. 1/2.

Emil Hedevang

Title: Time change and universality in turbulence and finance

Abstract: Several previous works by O.E. Barndorff-Nielsen, J. Schmiegel, N. Shephard, and P. Blæsild have demonstrated that the distributions of increments of velocities in turbulence or increments of log-prices in finance are universal, that is, in both cases there exists a one-parameter family of distributions such that the distribution of increments over a given lag is a member of that family, indexed by the variance of the increments. In other words, the autocovariance of the process provides a time change making the distributions of increments for different experiments collapse. In the context of turbulence, the one-parameter family is independent of the experiment, hence universal. In the context of finance, similar holds. Furthermore, the family of distributions is well described by the normal inverse Gaussian distribution. In this talk, we analyse new data sets - with emphasis on trade data - and ask if the universality results can be extended.

Jonas Hirz

Title: Modeling Annuity Portfolios Longevity Risk with Extended CreditRisk$^+$

Abstract: Using an extended version of the credit risk model CreditRisk$^+$, we develop a flexible stochastic framework to model life tables and annuity portfolios. Deaths are driven by common stochastic risk factors which may be interpreted as death causes like neoplasms, cardiovascular diseases or idiosyncratic components. This approach provides an efficient, numerically stable algorithm for an exact calculation of the one-period loss distribution where various sources of risk are considered. In particular, our model allows stress testing and, therefore, offers an insight into how certain health scenarios would influence annuity payments of an insurer. Such scenarios may includeimprovement in health treatments and better medication. We provide estimation procedures

for model parameters including MCMC methods. In the most general case, the model allows dependent risk factors as well as multidimensional losses to incorporate claims development results and actuarial reserves. Joint work with Uwe Schmock and Pavel Shevchenko.

Asma Khedher

Title: Quadratic hedging in stochastic volatility models

Abstract: We consider stochastic volatility models where the price process and the volatility might have jumps. We aim at obtaining an explicit representation for mean variance hedging strategies. As specific examples we consider a Heston model with jumps and a Barndorff-Nielson Shephard model. Then we choose among the different possible martingale measures a structure preserving class. We use the Malliavin calculus for Lévy processes as in Benth et al. [1] to compute the mean variance hedging strategy related to the different choices of stochastic volatility models.

References

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Paul Krühner

Title: Representation of infinite dimensional forward price models in commodity markets.

Abstract: The Heath Jarrow Morton approach treats the family of futures – written on a commodity – as primary assets and models them directly. This approach has been used for the modelling of future prices in various markets by several authors and it has found its use by practitioners. We derive several representations of possible future dynamics and implications on futures and the spot from an infinite dimensional point of view. To be more specifically, let us denote the spot price by S_t and the future prices by

$$f_t(x) := \mathrm{E}(S_{t+x}|\mathcal{F}_t), \quad x, t \geq 0.$$

Due to the well-known Heath Jarrow Morton Musiela drift condition the dynamics of f_t cannot be specified arbitrarily under the pricing measure. We model it by

$$df_t = \partial_x f_t dt + \Psi_t dL_t$$

in a suitable function space where L is some Lévy process. Then we derive a series representation for the futures in terms of the spot price process and Ornstein-Uhlenbeck type processes, we represent the spot as a Lévy-semistationary process and find formulae for the correlation between the spot and futures.

Veronika Lunina

Title: Modelling the interrelations in the energy forward markets

Abstract: This paper extends the literature on multicommodity modelling by implementing multivariate models with dynamic interactions between the forward contracts on gas, power, coal, and carbon EUAs, both in first and second moment. We also investigate the issue of the underlying distributional assumption by applying a flexible skew-Student distribution (Bauwens and Laurent, 2005) that allows for individual degrees of freedom as well as individual skewness for the modelled return series. Finally, we look into the issue of second moment dependence (spillovers) between commodity returns. Our main results are as follows. Firstly, we find that spillover effects in second moments indeed exist between energy related commodities. Secondly, we find that these spillover effects are asymmetric in nature, indicating that negative and positive return shocks affect second moments differently. Thirdly, we find that it is crucial to allow for both excess kurtosis and skewness in the underlying conditional distribution, however, interestingly, only the skewness parameters are jointly statistically different from each other, while the degrees of freedom parameters are jointly statistically identical.

Jens Lueddeckens

Title: A stochastic differential equation driven by fractional and jump processes

Abstract: In this talk we study the existence and uniqueness of a solution for a stochastic differential equation of the form

$$\begin{aligned} X(t) &= X(0) + \int_0^t a(s)X(s)\, ds + \int_0^t \sigma(s)X(s)\, dB^H(s) \\ &\quad + \int_0^t \int_{R^0} v(y,s)X(s)\, \delta\tilde{N}(y,s), \end{aligned}$$

where $B^H(t)$ is a fractional Brownian motion and $\tilde{N}(y,s)$ denotes the compensated Poisson random measure. Here $X(0)$ is a random variable in $L^\infty(\Omega)$, σ is a deterministic function with $M^H(\sigma 1_{[b,c]}) \in L^2(R)$ for all $0 \leq b \leq c \leq T$ and $a, v(y) \in L^\infty([0,T] \times \Omega)$ are two stochastic processes.

Therefore we introduce the Hida spaces w.r.t. the product space $(\Omega, \mathcal{F}, \mu) := (\Omega_W \otimes \Omega_N, \mathcal{F}_W \otimes \mathcal{F}_N, \mu_W \otimes \mu_N)$ based on the studies of Øksendal and others ([2], [4], [1]). The Hida space theory together with the ideas of León and others ([3]) for solving a stochastic differential equation driven by Brownian motion and Lévy noise leads us to the existence and uniqueness theorem.

References

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Christoph Mainberger

Title: Supersolutions of BSDEs: Minimality, Constraints, Duality

Abstract: We study supersolutions of backward stochastic differential equations. We provide existence, uniqueness and Markov-type results under minimal assumptions on the generator.

In a next step, we consider constraints on the class of admissible controls, a setting that corresponds to non-standard superhedging problems in incomplete financial markets. This framework in particular comprises classical constraints such as short-selling- or "Gamma"-constraints.

More precisely, controls are restricted to continuous semimartingales of the form $dZ = \Delta dt + \Gamma dW$, while the generator in addition depends on the decomposition (Δ, Γ), thereby incorporating specific penalizations of rapid changes of control values observed for instance in high-frequency trading.

Assuming the generator to be positive, convex and lower semicontinuous we prove the existence of a supersolution that is minimal at finitely many times and derive stability properties of the non-linear operator that maps terminal conditions to the time zero value of this minimal supersolution such as monotone convergence, the Fatou property and L^1-lower semicontinuity.

By means of the stability, we provide duality results within the present framework. We characterize the conjugate in terms of the decomposition parts of the controls and show that it is always attained. Using the dual problem we establish conditions for the existence of solutions of the associated BSDE under constraints. For the particular case of a quadratic generator we explicitly compute the conjugate by means of classical calculus of variations methods.

This talk is based on joint works with Samuel Drapeau, Gregor Heyne, Michael Kupper and Ludovic Tangpi.

Carla Mereu

Title: Utility maximization of DC pension schemes with stochastic contributions

Abstract: We consider an optimal investment problem for a defined contribution pension scheme in the accumulation phase by allowing for a stochastic contribution process. For instance, the contribution can be dependent on a random salary and/or may exhibit a mean-reverting property. We assume that the salary is not traded in the market, but driven by a Brownian motion which is correlated with the one driving the risky asset available on the market. We deal with the problem by maximizing the power utility of the terminal wealth of the pension beneficiary. The problem is solved via an HJB approach. In certain special situations we show that explicit solutions can be achieved. In the case of contributions modelled by a (possibly time-inhomogeneous) geometric Brownian motion, we rely on the properties of the value function to reduce the HJB equation by one dimension. We illustrate the use of numerical algorithms working in the reduced case. Finally, we discuss the asymptotics of the obtained strategies.

John Moriarty

Title: Optimal writing of American call options on electricity priced through a bid stack: free boundary analysis, optimal entry, and natural constraints on option premium, strike price and fuel price.

Abstract: We study American call options on electricity used in real-time balancing of electrical power systems. This involves timing the purchase of electricity to be stored and delivered in the contract and pricing of the call option itself. We give a complete free boundary analysis for simple and plausible models of the electricity spot price, characterising stopping regions (with and without smooth fit) and value functions for both single and swing options.

Carles Rovira

Title: Stochastic differential equations with non-negativity constraints driven by fractional Brownian motion

Abstract: In this talk we consider stochastic differential equations with non-negativity constraints, driven by a fractional Brownian motion with Hurst parameter H.We deal first with stochastic delay equations . When $H > \frac{1}{2}$, we first study an ordinary integral equation where the integral is defined in the Young sense and then we apply this result pathwise to solve the stochastic problem. On the other hand, when H $\in (\frac{1}{3}, \frac{1}{2})$, we consider an existence and uniqueness result of solution for multidimensional delay differential equations with normal reflection and driven by a Hölder continuous function of order $\beta \in (\frac{1}{3}, \frac{1}{2})$.

Benedykt Szozda

Title: Integration with respect to time-changed volatility modulated Volterra processes

Abstract: We develop a stochastic integration theory with respect to volatility modulated Volterra processes driven by time-changed Lévy processes. We extend recent results that used Volterra processes driven by either a Brownian motion or a square-integrable, zero-mean pure-jump Lévy processes with stochastic modulation of the amplitude of the volatility. Our approach allows for more general driving noises like, for example, α-stable processes. From the modelling perspective, we allow for independent modulation of the amplitude and the intensity of the stochastic volatility obtaining a more flexible modelling framework. This is joint work with Ole Barndorff-Nielsen and Fred Espen Benth.

Ludovic Tangpi

Title: Fundamental theorem of asset pricing without reference measure

Abstract: When a financial market is governed by a single probability measure, the absence of arbitrage opportunities is characterized by the existence of equivalent martingale or local martingale measures. In this talk, we focus on the fundamental theorem of asset pricing in the case where the market is governed by a non-dominated set of probability measures. We introduce the concept of free lunch with disappearing risk. Our main result shows that, in a continuous time model, if the agent is allowed to trade only with strategies that are simple integrands, then the absence of such free lunches is equivalent to the existence of a set of local martingale measures equivalent to the set of possible models. Talk based on a join work with Michael Kupper and Patrick Cheridito.

Giovanni Alessandro Zanco

Title: Path depdendent SDEs and PDEs

Abstract: I will present recent results (from joint works with Franco Flandoli and Francesco Russo) about the infinite-dimensional formulation of path-dependent stochastic differential equations, their connection with partial differential equations, existence and uniqueness of solutions and different approaches to Ito-type formulae suitable for this framework. Path-dependent equations are highly non-markovian objects and are very useful in models for which a dependence on the past has to be taken into account.