Abstracts

Rüdiger Frey, Institute for Statistics and Mathematics, WU Vienna

Corporate Security Prices in Structural Credit Risk Models with Incomplete Information

The talk is concerned with structural credit risk models with incomplete information of the asset value. It is shown that the pricing of typical corporate securities such as equity, corporate bonds or CDSs leads to a nonlinear filtering problem. This problem cannot be tackled with standard techniques as the default time does not have an intensity under full information. We therefore transform the problem to a standard filtering problem for a stopped diffusion process. This problem is analyzed via SPDE results from the filtering literature. In particular we characterize the default intensity under incomplete information in terms of the conditional density of the asset value process. Moreover, we give an explicit description of the dynamics of corporate security prices. Finally, we explain how the model can be applied to the pricing of bond and equity options, we present results from a number of numerical experiments, and we discuss applications to the pricing of contingent convertible bonds.

Masaaki Kijima, Tokyo Metropolitan University, Tokyo

On the Risk Evaluation Method Based on the Market Model

This paper presents a risk evaluation model for interest-rate sensitive products within the no-arbitrage framework. A yield-curve dynamics is modeled, based on the results of the principal component analysis (PCA), to generate future scenarios of interest rates under the observed probability measure. The market model is adopted for the pricing of interest-rate derivatives under the risk-neutral measure by identifying market prices of risk that are consistent with the yield-curve model. Given the future scenarios of yield curve and the market prices of risk, the prices of interest-rate sensitive products are calculated at any future time. Risk measures such as Value-at-Risk (VaR) of portfolios with interest-rate sensitive products can be evaluated through simple Monte Carlo simulation. It is shown, however, that some market models often used in practice are not consistent with the no-arbitrage paradigm.

Birgit Rudloff, Princeton University, Princeton, New Jersey

Systemic Risk Measurement (joint work with Zach Feinstein and Stefan Weber)

Systemic risk refers to the risk that the financial system is susceptible to failures due to the characteristics of the system itself. The tremendous cost of this type of risk requires the design and implementation of tools for the efficient macroprudential regulation of financial institutions. In this talk we will proposes a novel approach to measuring systemic risk.

The suggested systemic risk measures express systemic risk in terms of capital endowments of the financial firms. Acceptability is defined in terms of cash flows to the entire society and specified by a standard acceptance set of a scalar risk measure. Random cash flows can be derived conditional on the capital endowments of the firms within

a large class of network models of financial systems. These may include both local and global interaction. The resulting systemic risk measures are set-valued and allow a mathematical analysis on the basis of set-valued convex analysis. At the same time, they can easily be applied to the regulation of financial institutions in practice.

We explain the conceptual framework and the definition of systemic risk measures, provide algorithms for their computation, and illustrate their application in numerical case studies - e.g. in the network models of Eisenberg Noe (2001), Cifuentes, Shin Ferrucci (2005), and Amini, Filipovic Minca (2013).

Katia Colaneri, University of Chieti-Pescara, Pescara

Hedging of unit-linked life insurance contracts with unobservable mortality hazard rate via local risk-minimization (joint work with Claudia Ceci and Alessandra Cretarola)

In this paper we investigate the local risk-minimization approach for a combined financial-insurance model where there are restrictions on the information available to the insurance company. In particular we assume that, at any time, the insurance company may observe the number of deaths from a specific portfolio of insured individuals but not the mortality hazard rate. We consider a financial market driven by a general semimartingale and we aim to hedge unit-linked life insurance contracts via the local risk-minimization approach under partial information. The Föllmer-Schweizer decomposition of the insurance claim and explicit formulas for the optimal strategy for *pure endowment* and *term insurance* contracts are provided in terms of the projection of the survival process on the information flow. Moreover, in a Markovian framework, we reduce to solve a filtering problem with point process observations.

Barbara Trivellato, Politecnico di Torino, Torino

Forward Backward Semimartingale Systems for Utility Maximization (joint work with Marina Santacroce)

We consider the problem of maximizing the expected utility of terminal wealth with a terminal random liability when the underlying asset price process is a continuous semimartingale. The optimal strategy is characterized in terms of a semimartingale forward backward system of equations. The results cover the cases of exponential, logarithmic and power utilities, which we analyze as illustrative examples.

Daria Ghilli, University of Padova, Padova

Large deviations for some fast stochastic volatility models by viscosity methods (joint work with Martino Bardi and Annalisa Cesaroni)

The topic of the talk is to present some recent results about short time behaviour of stochastic systems affected by a stochastic volatility evolving at a faster time scale. We study the asymptotics of a logarithmic functional of the process by methods of the theory of homogenisation and singular perturbations for fully nonlinear PDEs. We point out three regimes depending on how fast the volatility oscillates relative to the horizon length. We prove a large deviation principle for each regime and apply it

to the asymptotics of option prices near maturity.

Immacolata Oliva, University of Verona, Verona

Stochastic Delay Differential Equations with Jumps and Application to Pricing and Hedging (joint work with Luca Di Persio)

The Black-Scholes model is nowadays the mostly used by practitioners to describe the dynamics of returns on financial assets, although the scientific community has extensively recognized the existence of remarkable limits in treating up-to-date financial tools, because of too restrictive hypothesis, which imply, as example, flat volatility surfaces, in evident contrast with empirical tests, which show a distinguishing smile pattern in strike/maturity plots.

The most obvious and immediate consequence is that the simple geometric Brownian Motion is not enough, rather it has to be replaced by a suitable stochastic process. More precisely, in order to obtain more efficient and more pertinent models and also in order to describe non-constant volatility surfaces, a different approach could be given by considering forward-backward systems driven by Lévy-type noises, which allow for assets characterized by jumps with random size.

The goal of this work is twofold: on one hand, it is shown that, for a given class of semi-linear parabolic equations, there exists a solution obtained starting from a suitable forward-backward system. On the other hand, such solution is adequate to characterize the fair price and the hedging strategy in case in which the underlying price is subject to jumps.

Chau Ngoc Huy, University of Padova, Padova

Market models with optimal arbitrage (joint work with Peter Tankov)

We construct and study market models admitting optimal arbitrage. We say that a model admits optimal arbitrage if it is possible, in a zero-interest rate setting, starting with an initial wealth of 1 and using only positive portfolios, to superreplicate a constant $c > 1$. The optimal arbitrage strategy is the strategy for which this constant has the highest possible value. Our definition of optimal arbitrage is similar to the one in Fernholz and Karatzas (2010), where optimal relative arbitrage with respect to the market portfolio is studied. In this work we present a systematic method to construct market models where the optimal arbitrage strategy exists and is known explicitly. We then develop several new examples of market models with arbitrage, which are based on economic agents' views concerning the impossibility of certain events rather than ad hoc constructions. We also explore the robustness of arbitrage strategies with respect to small perturbations of the price process, and provide new examples of arbitrage models which are robust in this sense.

Pietro Rigo, University of Pavia, Pavia

Two versions of the fundamental theorem of asset pricing (joint work with Patrizia Berti and Luca Pratelli)

Let L be a convex cone of real random variables on the probability space $(\Omega, \mathcal{A}, P_0)$. The existence of a probability P on $\mathcal{A}$ such that

$$P \sim P_0, \quad E_P|X| < \infty \text{ and } E_P(X) \leq 0 \text{ for all } X \in L$$

is investigated. Two results are provided. In the first, P is a finitely additive probability, while P is σ-additive in the second. If L is a linear space then $-X \in L$ whenever $X \in L$, so that $E_P(X) \leq 0$ turns into $E_P(X) = 0$. Hence, the results apply to various significant frameworks, including equivalent martingale measures and equivalent probability measures with given marginals.