

Risk & Stochastics and Financial Mathematics Joint Seminar in 2015

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

Thursday 3 December - Kristoffer Glover (University of Technology, Sydney) The optimal time to close an open-ended mutual fund

In this talk I will attempt to shed some light onto two intimately linked questions about empirically observed mutual fund behaviour: (1) Why do open-ended mutual funds decide to close their doors to new investors? and (2) Why do these funds underperform after closing? A theoretical model for the optimal closure of an open-ended mutual fund is developed in which the fund is subject to performance sensitive fund flows and a decreasing return-to-scale on its investment portfolio. Such funds are found to optimally close 'too late' from the perspective of the fund investors, since the optimal fund size that maximises the fund manager's expected fee income is larger than the size at which the fund's 'alpha' is expected to become negative. In other words, the fund closes at a point where the decreasing returns-to-scale have already started to negatively affect fund performance; thus explaining the empirically observed underperformance after closure. Additional empirical predictions generated from the model will also be discussed.

19 November - Rémy Praz (Copenhagen Business School) Equilibrium asset pricing with both liquid and illiquid markets

I study a general equilibrium model in which investors face endowment risk and trade two correlated assets; one asset is traded on a liquid market whereas the other is traded on an illiquid over-the-counter (OTC) market. Endowment shocks not only make prices drop, they also make the OTC asset more difficult to sell, creating an endogenous liquidity risk. This liquidity risk increases the risk premium of both the OTC asset and liquid asset. Furthermore, the OTC market frictions increase the trading volume and the cross-sectional dispersion of ownership in the liquid market. Finally, if the economy starts with only the OTC market, then I explain how opening a correlated liquid market can increase or decrease the OTC price depending on the illiquidity level. The model's predictions can help explain several empirical findings.

5 November - Yaroslav Melnyk (Swiss Financial Institute @ École polytechnique fédérale de Lausanne)

Portfolio Optimization with Recursive Utility under Small Transaction Costs

In this article we investigate the portfolio problem of an investor with Epstein-Zin recursive utility under proportional transaction costs. We characterize the solution via variational inequalities and prove existence of classical solutions for small cost parameters. We also provide a suitable verification theorem. This allows us to derive rigorous asymptotic expansions for optimal no-trading regions and consumption strategies and to investigate the effects of the investor's relative risk aversion and the elasticity of intertemporal substitution (EIS) ψ on the optimal strategies. Our main findings are: (a) At the leading order, the no-trading region is the same as with expected additive utility; in particular, it is determined solely by the relative risk aversion. The no-trading region depends on the investor's EIS only at the next-to-leading order, and only indirectly (via optimal consumption). (b) The investor's optimal consumption depends on his EIS also at the leading order. The optimal consumption rate is higher, as a percentage of current wealth, than in the frictionless case if and only if $\psi > 1$.

Based on joint work with Johannes Muhle-Karbe and Frank Thomas Seifried.

22 October - Johannes Ruf (University College London and an Associate Member at the Oxford-Man Institute of Quantitative Finance)

Föllmer's Measure and Novikov/Kazamaki-Type Conditions

In the first part of the talk, I will discuss the construction of Föllmer's measure on the canonical path space. In the second part, I will discuss sharpened Novikov/Kazamaki-type conditions that provide sufficient and necessary conditions for the martingale property of a nonnegative local martingale.

This talk is based on joined papers with Nicolas Perkowski and Martin Larsson.

8 October - Sebastian Herrmann (ETH Zürich)

Hedging with Small Uncertainty Aversion

We study the pricing and hedging of derivative securities with uncertainty about the volatility of the underlying asset. Rather than taking all models from a prespecified class equally seriously, we penalise less plausible ones based on their "distance" to a reference local volatility model. In the limit for small uncertainty aversion, this leads to explicit formulas for prices and hedging strategies in terms of the security's cash gamma.

6 October - Nevroz Sen (McGill)

Estimation theory for non-linear major-minor mean field games

In the Mean Field Games (MFG) framework where there is an agent (so-called Major) which has asymptotically non vanishing influence on any other Minor agent, the best response control process of each Minor agent depends upon its own state, the Major agent's state and the conditional distribution of the generic minor agent, namely the system's stochastic mean field; this is in contrast to the basic MFG setup where the mean field is deterministic. The theory of MFG with a Major agent (MM-MFG) is well understood when the observations of the Minor agents are complete.

In this talk we analyze the non-linear MM-MFG problem where each Minor agent partially observes the Major agent's state. We employ non-linear filtering theory derived for McKean-Vlasov type state equations and the Separation Principle in order to analyze the game in the infinite population limit. The main results are the existence and uniqueness of the solutions to the stochastic MFG system equations and the epsilon-Nash equilibrium property where the best response control process of each Minor agent depends upon the conditional density generated by that agent's non-linear filter together with the system's mean field and its own state.

Joint work with Peter E. Caines

28 May - Martin Herdegen (ETH Zürich)

Sensitivity of optimal consumption streams

We study the sensitivity of optimal consumption streams with respect to perturbations of the random endowment. We show that to the leading order, any consumption correction for the perturbed endowment is still optimal as long as the budget constraint is binding. More importantly, we also establish the optimal correction at the next-to leading order. This can be computed in two steps. First, one has to find the optimal correction for a deterministic perturbation. This only involves the risk-tolerance process of the unperturbed problem and yields a risk-tolerance martingale and a corresponding risk-tolerance measure. If the risk-tolerance process and the interest rate are deterministic, the latter is constant. In a second step, one can then calculate the optimal correction for any random perturbation. This is given by an explicit formula whose key ingredients are the conditional expectations of the terminal cumulative perturbation and the integrated risk-tolerance process under the risk-tolerance measure.

Joint work with Johannes Muhle-Karbe.

19 March - Dylan Possamai (CMAP École polytechnique)

A primer on Principal/Agent models and their recent extensions

We will present the main ideas and intuitions behind the modelization of the so-called principal/agent models, which are at the heart of the contracting theory. The theory emerged in the 70s from the acknowledgment that almost everything in economics was to a certain degree a matter of incentives (incentives to work hard, to produce, to study, to invest, to consume reasonably...) and the fact that such situations could not be reproduced using the general equilibrium theory. While a great number of studies were devoted to quite comprehensive models in discrete time, their continuous-time counterparts have only recently received a lot of attention from the economics literature, starting with the breakthrough works of Holmstrom and Milgrom or later on of Sannikov. We will review the modelization of these problems, both in the cases of moral-hazard and adverse selection and see the type of mathematical tools that can be used to treat them. Moreover, if time permits, we will try to look at some recent generalizations of the theory, as well as still open problems.

5 March - Fausto Gozzi (Luiss University)

Impact of time illiquidity in a mixed market without full observation

In this talk we present and study a class of optimal portfolio problems in a two-assets market where one asset is illiquid in the sense that it can be traded only at given random times (of exponential law) and it cannot be fully observed. This feature arises in many cases in real markets and it clearly modifies the optimal policies with respect to the benchmark given by the standard Merton model. We first recall the Merton model, then introduce a model of Pham and Tankov, where only one illiquid asset is present: we show how to solve this model by the dynamic programming approach. Then we consider the more difficult case of two correlated assets with partial observation and show how the dynamic programming approach also applies to this case in a satisfactory way. We also give some numerical experiments to evaluate the impact of the illiquidity and of the lack of full observation.

26 February - Anastasia Ellanskaya (LAREMA, Departement de Mathematiques, Universite d'Angers)

Utility Maximisation and Utility Indifference Price for Exponential Semi-martingale Models and HARA Utilities

We consider the utility maximisation problem for semi-martingale models and HARA (hyperbolic absolute risk aversion) utilities. Using specific properties of HARA utilities, we reduce the initial maximisation problem to the conditional one, which we solve by applying a dual approach. Then we express the solution of the conditional maximisation problem via conditional information quantities related to

HARA utilities, like the Kullback–Leibler information and Hellinger-type integrals. In turn, we express the information quantities in terms of information processes, which is helpful in indifference price calculus. Finally, we give equations for indifference prices. We apply the results to Black–Scholes model with correlated Brownian motions, jump-diffusion model and Lévy model and give an explicit expression for information quantities. Then the previous formulas for the indifference price can be applied.

19 February - Pietro Siorpaes (Vienna)

Optimal investment and price dependence in a semi-static market

We study the problem of maximizing expected utility from terminal wealth in a semi-static market composed of derivative securities, which we assume can be traded only at time zero, and of stocks, which can be traded continuously in time. Using a general utility function defined on the positive real line, we first study existence and uniqueness of the solution, and then we consider the dependence of the outputs of the utility maximization problem on the price of the derivatives, investigating not only stability but also differentiability, monotonicity, convexity and limiting properties.

5 February - Michael Schmutz (Bern and Swiss Financial Market Supervisory Authority (FINMA))

Challenges in risk based solvency frameworks

Risk-based solvency frameworks such as Solvency II to be introduced in the EU or the Swiss Solvency Test (SST) in force since 2011 in Switzerland seek to assess the financial health of insurance companies by quantifying the capital adequacy through calculating the solvency capital requirement (SCR). Companies can use their own economic capital models (internal models) for this calculation, provided the internal model is approved by the insurance supervisor. The Swiss supervisor has essentially completed the first round of internal model approvals. This has provided the supervisor and the industry with many insights into the challenges of designing, assessing, and supervising such models and has shown that there is a considerable number of challenges, in particular modelling challenges, that have not yet been solved in a completely satisfactory way. Some of the most important challenges and problems will be discussed along with some approaches to solutions.

22 January - Georgy Chabakauri (LSE)

Multi-Asset Noisy Rational Expectations Equilibrium with Contingent Claims

We consider a noisy rational expectations equilibrium in a multi-asset economy populated by informed and uninformed investors, and noise traders. Informed investors privately observe an aggregate risk factor affecting the probabilities of

different states of the economy. Uninformed investors attempt to extract that information from asset prices, but full revelation is prevented by noise traders. We relax the usual assumption of normally distributed asset payoffs and allow for assets with more general payoff distributions, including contingent claims, such as options and other derivatives. We show that assets reveal information about the risk factor only if they help span the exposure of probabilities of states to the risk factor. When the market is complete, we provide equilibrium asset prices and optimal portfolios of investors in closed form. In incomplete markets, we derive prices and portfolios in terms of easily computable inverse functions.

Joint work with Kathy Yuan (LSE) and Konstantinos E. Zachariadis (LSE)