List of talks: Innovative Research in Mathematical Finance, September 3-7 2018

Beatrice Acciaio, LSE, London School of Economics, London, England.

Dynamic Cournot-Nash equilibrium via causal optimal transport.

We study Cournot-Nash equilibrium problems in a dynamic setting, where each agent faces a cost that is composed by an idiosyncratic part depending on its own type and action, and a mean-field term depending on the actions distribution over all agents. We use tools from dynamic optimal transportation of non-anticipative nature in order to get a characterization of the equilibrium problems, along with existence and uniqueness results.The talk is based on a joint project with Julio Backhoff-Veraguas.

Cagin Ararat, Bilkent University, Turkey.

Computation of systemic risk measures.

Various approaches to measure systemic risk have been proposed in the recent literature using multivariate functionals. These functionals are typically defined in terms of a so-called aggregation function, which takes into account the interconnectedness of the institutions in the network, and a univariate risk measure applied to the random output of the aggregation function. In this talk, we specialize into the Eisenberg-Noe and Rogers-Veraart network models and formulate the corresponding systemic risk measures as large-scale vector optimization problems. While the former model yields a convex problem which can be solved efficiently using non-smooth optimization techniques, the efficient frontier for the latter model turns out to be the boundary of a non-convex set.

Esmaeil Babaei Khezerloo, Manchester University, England.

Capital growth in financial markets with frictions.

The aim of this work is to extend the classical capital growth theory to models of asset market with frictions—transaction costs and portfolio constraints. A natural generalization of the notion of a benchmark investment strategy (numeraire portfolio) is proposed, and it is shown how such portfolios can be used for the analysis of growth-optimal investment strategies. The analysis is based on the classical von Neumann-Gale model of economic dynamics, a stochastic version of which is used in this study as a framework for the modeling of financial markets with frictions.

Jocelyne Bion Nadal, Ecole Polytechnique, France.

Approximation and calibration of laws of solutions to stochastic differential equations.

In many situations where stochastic modeling is used, one desires to choose the coefficients of a stochastic differential equation which represents the reality as simply as possible. For example one desires to approximate a diffusion model with high complexity coefficients by a model within a class of simple diffusion models. To achieve this goal, we introduce a new Wasserstein type distance on the set of laws of solutions to d-dimensional stochastic differential equations. This new distance $\tilde{W}^2$ is defined similarly to the classical Wasserstein distance $\tilde{W}^2$ but the set of couplings is restricted to the set of laws of solutions of $2d$-dimensional stochastic differential equations. We prove that this new distance $\tilde{W}^2$ metrizes the weak topology. Furthermore this distance $\tilde{W}^2$ is characterized in terms of a stochastic control problem. In the case d = 1 we can construct an explicit solution. The multi-dimensional case, is more tricky and classical results do not apply to solve the HJB equation because of the degeneracy of the diferential operator. Nevertheless, we prove that this HJB equation admits a regular solution.

Daniel Balint, ETH Zurich, Switzerland.

Discounting invariant FTAP for large financial markets.

For large financial markets as introduced in Kramkov and Kabanov 94, there are several existing absence-of-arbitrage conditions in the literature. They all have in common that they depend in a crucial way on the discounting factor. We introduce a new concept, generalizing NAA1 (K&K 94) and NAA (Rokhlin 08), which is invariant with respect to discounting. We derive a dual characterization by a contiguity property (FTAP). We investigate connections to the infinite time horizon framework (as for example in Karatzas and Kardaras 07) and illustrate negative result by counterexamples. Based on joint work with M. Schweizer.

Luciano Campi, London School of Economics, England.

Mean-field games with absorption.

We introduce a simple class of mean field games with absorbing boundary over a finite time horizon. In the corresponding N-player games, the evolution of players' states is described by a system of weakly interacting Itô equations with absorption on first exit from a given set. Once a player exits, her/his contribution is removed from the empirical measure of the system. Players thus interact through a renormalized empirical measure. In the definition of solution to the mean field game, the renormalization appears in form of a conditional law. We also consider the case of a system keeping track of the number of

past absorbed players. Under fairly general assumptions, we show that in both cases a solution of the mean field game induces approximate Nash equilibria for the N-player games with approximation error tending to zero as N tends to infinity. This convergence is established provided the diffusion coefficient is non-degenerate. The degenerate case is more delicate and gives rise to counter-examples. The talk is based in joint works with Markus Fischer, Maddalena Ghio and Giulia Livieri.

Laurence Carassus, L. de Vinci Pôle Universitaire, Research Center and LMR, University of Reims, France.

Pricing without martingale measure. With J. Baptiste and E. Lépinette.

For several decades, the no-arbitrage (NA) condition and the martingale measures have played a major role in the financial asset's pricing theory. Here, we propose a new approach based on convex duality instead of martingale measures duality: our prices will be expressed using Fenchel conjugate and bi-conjugate. This naturally leads to a weak condition of absence of arbitrage opportunity, called Absence of Immediate Profit (AIP), which asserts that the price of the zero claim should be zero. We study the link between (AIP), (NA) and the no-free lunch condition. We show in a one step model that, under (AIP), the super-hedging cost is just the payoff's concave envelop and that (AIP) is equivalent to the non-negativity of the super-hedging prices of some call option. In the multiple-period case, for a particular, but still general setup, we propose a recursive scheme for the computation of a the super-hedging cost of a convex option. We also give some numerical illustrations.

Thomas Caye, Dublin City University, Ireland.

Utility maximization in a multidimensional market with small nonlinear price impact.

We study a portfolio choice problem in a multi-dimensional market with frictions. An investor with constant relative risk aversion invests in a market composed of a riskless asset and a multi-dimensional risky asset. Trading is hindered by sublinear price impacts that affect the asset traded but possibly also the other risky assets. In the limit for small price impact, we determine the asymptotic expansion of the value function and provide an asymptotically optimal family of trading strategies. This a work in progress with Erhan Bayraktar and Ibrahim Ekren.

Hyejin Cho, Paris 1 University, France.

On overconfidence, bubbles and the stochastic discount factor.

This study is intended to provide a continuous-time equilibrium model in which overconfidence generates disagreements between two groups regarding asset fundamentals. Every agent in trading wants to sell more than the average stock price in the market. However, the overconfident agent drives a speculative bubble with a false belief that the stock price will tend to move to the average price over time. I present the difference between a false belief and a stochastic stationary process, which does not change when shifted in time. The gap between beliefs shows how to accommodate dynamic fluctuations as parameters change, such as the degree of overconfidence or the information of signals. By showing how changes in an expectation operator affect the stochastic variance of economic fundamentals, speculative bubbles are revealed at the burst independently from the market.

Tahir Choulli, Alberta University, Canada.

How martingales' space expands when its filtration is progressively enlarged?

Our starting point is a filtered probability space $(\Omega, \mathcal{F}, \mathbb{F} := (\mathcal{F}_t)_{t\geq 0})$, where $\mathbb{F}$ satisfies the usual conditions of completeness and right-continuity. To this stochastic basis, we add a larger filtration $\mathbb{G}$, which is the progressive enlargement of $\mathbb{F}$ with some random times. Financially speaking $\mathbb{F}$ represents the "public" flow of information which is available to all agents over time, while the random times can model the firms' default times (in credit risk theory), or death times of insured, or more general any occurrence times of events that might impact the market somehow. By keeping in mind our main financial applications that reside in the two settings of credit risk and life insurance, the progressive enlargement of $\mathbb{F}$ with the random times, denoted by $\mathbb{G}$, sounds tailor-made to model the new flow of information. For this obtained new "informational system", we are concerned with the deep and explicit description of the space of all $\mathbb{G}$-martingales. Our leitmotif for this objective lies in the strong relationship between risks and martingales established by arbitrage theory. For this new informational system, we want to understand the different types of martingales in $\mathbb{G}$ induced by the random times alone and/or jointly with $\mathbb{F}$. Precisely, we want to answer the following questions: Can we single out the martingale(s) that can be classified as pure random time martingales? How many are there of such martingale(s)? How these martingale(s) interplay with the martingale(s) coming from $\mathbb{F}$? Above all, can we define a martingale basis for the flow $\mathbb{G}$, and every $\mathbb{G}$-martingale can be decomposed with respect to this basis? The applications of the answers to these questions are numerous and multifold. We can cite the case of describing as explicit as possible the set of all deflators for informational markets of this type. This application is itself an important point in solving many other financial and economical problems.

Christa Cuchiero, University of Vienna, Austria.

Infinite dimensional polynomial processes.

Albina Danilova, London School of Economics, England.

Risk aversion of insider and asymmetric information.

We analyse how the risk aversion of insider affects the equilibrium in insider trading model. In particular, we will consider a static information Kyle-Back model under new assumptions: a) exponential utility preferences of the insider, b) non- Gaussianity of the signal, and c) price set by the market maker being a function of weighted signal which is not necessarily Gaussian either. We will discuss conditions on the weighting and pricing functions which ensure the existence of equilibrium and derive, under afore mentioned conditions, the equilibrium pricing and weighting functions, as well as insiders optimal trading strategy.

Bernard De Meyer, Panthéon Sorbonne University, France.

Price dynamics and repeated games: the CMMV pricing model.

A market with asymmetric information can be viewed as a repeated exchange game between the informed sector and the uninformed one. In a market with risk-neutral agents, De Meyer [2010] proves that the price process should be a particular kind of Brownian martingale called CMMV (Continuous Martingales of Maximal Variation). This type of dynamics is due to the strategic use of their private information by the informed agents. This type of dynamics also appears in Markets with risk-aversion: Under the martingale equivalent measure, the price process at equilibrium should be a CMMV. This leads to a new type of pricing and hedging formulas.

Eugene A. Feinberg, Stony Brook University, USA.

Lebesgue's convergence theorem and Fatou's lemma for varying probabilities.

The talk describes Fatous lemma, the monotone convergence theorem, and Lebesgues dominated convergence theorem for varying probabilities. In particular, we discuss the cases of weak convergence, setwise convergence, and convergence in total variation. In general, Fatou's lemma and convergence theorems do not hold in their classic forms for weakly converging probabilities, but they hold under stronger assumptions on convergence of functions. We formulate such assumptions. We discuss applications of these results as well as applications of the uniform Fatou lemma, which holds for probabilities converging in total variation.

Masaaki Fukasawa, Osaka University, Japan.

Hedging under small transaction costs.

We study the limit of cost-normalized hedging error for a class of trading strategies when fixed or linear transaction cost coefficient tends to 0 and give explicit strategies which attain the lower bound of the limit error variance.

Miryana Grigorova, University of Leeds, England.

Non-linear pricing of American options in an incomplete market with default.

Alexander Gushchin, Steklov Mathematical Institute, Moscow, Russia.

Joint distributions of terminal values of increasing processes and their compensators, single jump martingales and the Skorokhod embedding problem.

Paolo Guasoni, Dublin City University, Ireland.

Options Portfolio Selection.

We develop a new method to optimize portfolios of options in a market where European calls and puts are available with many exercise prices for each of several potentially correlated underlying assets. We identify the combination of asset-specific option payoffs that maximizes the Sharpe ratio of the overall portfolio: such payoffs are the unique solution to a system of integral equations, which reduce to a linear matrix equation under suitable representations of the underlying probabilities. Even when implied volatilities are all higher than historical volatilities, it can be optimal to sell options on some assets while buying options on others, as hedging demand outweighs demand for asset-specific returns.

Andreas Hamel, Free University of Bozen-Bolzano, Italy.

From multivariate quantiles to set-valued risk measures: A set optimization approach to financial models with frictions.

Some questions in mathematics are not answered for quite some time, but just sidestepped. One of those questions is the following: What is the quantile of a multi-dimensional random variable? The "sidestepping" in this case produced so-called depth functions and depth regions, and the most prominent among them is the halfspace depth invented by Tukey in 1975, a very popular tool in statistics. When it comes to the definition of multivariate quantiles, depth functions replace cummulative distribution functions, and depth regions provide potential candidates for quantile vectors. However, Tukey depth functions, for example, do not share all features with (univariate) cdf's and do not even generalize them.

On the other hand, the naive definition of quantiles via the joint distribution function turned out to be not very helpful for statistical purposes, although it is still in use to define multivariate V@Rs (Embrechts and others) as well as stochastic dominance orders (Müller/Stoyan and others).

The crucial point and an obstacle for substantial progress for a long time is the missing (total) order for the values of a multi-dimensional random variable. On the other hand, (non-total) orders appear quite natural in financial models with proportional transaction costs (a.k.a. the Kabanov market) in form of solvency cones.

We propose new concepts for multivariate ranking functions with features very close to univariate cdf's and for set-valued quantile functions which, at the same time, generalize univariate quantiles as well as Tukey's halfspace depth regions. Our constructions are designed to deal with general vector orders for the values of random variables, and they produce unambigious lower and upper multivariate quantiles, multivariate V@Rs as well as a multivariate first order stochastic dominance relation. Financial applications to markets with frictions are discussed as well as many other examples and pictures which show the interesting geometric features of the new quantile sets.

The talk is based on: AH Hamel, D Kostner, *Cone distribution functions and quantiles for multivariate random variables*, J. Multivariate Analysis 167, 2018.

Blanca Horvath, Kings College, London, England.

Learning Rough Volatility.

Calibration time being the bottleneck for models with rough volatility, we present ways for substantial speed-ups, along every step of the calibration process: In a first step we describe a powerful numerical scheme (based on functional central limit theorems) for pricing a large family of rough volatility models. In a second step we discuss various machine learning methods that significantly reduce calibration time for these models. By simultaneously calibrating several (classical and rough) models to market data, we re-confirm as a byproduct of our calibration results, that volatility is rough, calibration performance being best for very small Hurst parameters in a multitude of market scenarios.

Yuri Kabanov, Besançon University and Lomonosov Moscow State University, France.

On a multi-asset version of the Kusuoka limit theorem of option superreplication under transaction costs.

Kostas Kardaras, LSE, London School of Economics, London, England.

Efficient estimation of present-value distributions for long- dated contracts.

Estimation of the distribution of present values for long-dated financial and insurance contracts is typically extremely slow. PDE methods will fail due to singularities and lack of information about boundary conditions; on the other hand, when Monte-Carlo methods are utilised, simulation for each path realisation may take an prohibitive amount of time, leading to poor results. In this work, an alternative simulation method is proposed, using ergodicity and time-reversal, leading to significantly better results (in effect, reducing the simulation to a single path). For Markov chain factor models, density estimation with same rate of convergence as for the cdf is possible.

Idris Kharroubi, Sorbonne University, France.

Quenched mass transport of particles towards a target.

We consider the stochastic target problem of finding the collection of initial laws of a mean-field stochastic differential equation such that we can control its evolution to ensure that it reaches a prescribed set of terminal probability distributions, at a fixed time horizon. Here, laws are considered conditionally to the path of the Brownian motion that drives the system. We establish a version of the geometric dynamic programming principle for the associated reachability sets and prove that the corresponding value function is a viscosity solution of a geometric partial differential equation. This provides a characterization of the initial masses that can be almost surely transported towards a given target, along the paths of a stochastic differential equation. This talk is based on a joint work with Bruno Bouchard and Boualem Djehiche.

Yuri Kutoyants, Le Mans University, France

On approximation of BSDE

We present a review of some recently obtained results on estimation of the solution of backward stochastic differential equation (BSDE) in the Markovian case. We suppose that the forward equation depends on some finite dimensional unknown parameter. The approximation of the solution of BSDE is done in two steps. First we estimate the unknown parameter with the help of the recently developed approach based on the Multi-step MLE-process and then this estimator-process and the solution of the corresponding partial differential equation allow us to construct the desired approximation. We are interested by three models of observation admitting a consistent estimation of the unknown parameter: small noise, large samples and unknown volatility. In the first two cases we have continuous time observations and the unknown parameter is in the drift coefficient and in the third case the volatility of the forward equation depends on the unknown parameter and we have discrete time observations. We show that the presented estimators of the solutions of the BSDEs in the mentioned three cases are asymptotically efficient.

Emmanuel Lépinette, Paris-Dauphine University, France

Beyond the Kabanov financial market model with proportional transaction costs.

In this talk, we present the main developments on models with friction which originate from the pioneering model proposed by Kabanov where random cones are introduced to model the solvent financial positions.

Thibaut Mastrolia, Ecole Polytechnique, France.

Optimal make take fees for market making regulation.

We consider an exchange who wishes to set suitable make-take fees to attract liquidity on its platform. Using a principal-agent approach, we are able to describe in quasi-explicit form the optimal contract to propose to a market maker. This contract depends essentially on the market maker inventory trajectory and on the volatility of the asset. We also provide the optimal quotes that should be displayed by the market maker. The simplicity of our formulas allows us to analyze in details the effects of optimal contracting with an exchange, compared to a situation without contract. We show in particular that it leads to higher quality liquidity and lower trading costs for investors. Joint work with Omar El Euch, Mathieu Rosenbaum and Nizar Touzi.

Ilya Molchanov, University of Bern, Switzerland.

Set-valued risk measures in the non-convex setting.

Non-convex random sets of admissible positions naturally arise in the setting of fixed transaction costs or when only a finite range of possible transactions is considered. The talk defines set-valued risk measures in such cases and explores the situations when they return convex result, namely, when Lyapunov's theorem applies. The case of fixed transaction costs is analysed in greater details. Joint work with Andreas Haier (FINMA, Switzerland).

Marvin Mueller, ETH Zurich, Switzerland.

Limit order books: tractable SPDE models.

Complexity of nowadays electronic financial markets with high trading frequencies demands for new classes of high dimensional models. Macroscopic descriptions for the dynamics of buy and sell side of the limit order book lead to a system of stochastic partial differential equations, which can be shown to be very tractable. We discuss specifications of these models which admit explicit representations and can be easily calibrated to market data.

Following empirical observations, we use the order flow imbalance as a predictor for the next price move. On that way, the limit order book model induces a model for the dynamics of the mid-price process.

Juan-Pablo Ortega, University of St. Gallen, Switzerland.

The universality problem in dynamic machine learning with applications to realized covolatilities forecasting..

'We will start by showing how a relatively recent family of dynamic machine learning paradigms known collectively as reservoir computing are capable of unprecedented performances in the forecasting of deterministic (chaotic attractors) and stochastic processes (financial realized covariance matrices). We will then focus on the universal approximation properties with respect to uniform and L^p criteria of the most widely used families of reservoir computers in applications. These results are a much awaited generalization to the dynamic context of the well-known static results obtained by Cybenko and Hornik et al in the context of neural networks.

Serge Pergamenchtchikov, Rouen University, France.

Stochastic differential equations with singular perturbations.

In this talk we present a review of some results on the asymptotic theory of singular perturbation developed for the stochastic differential equations in the joint works of Kabanov and Pergamenshchikov. We present the stochastic version of the Tikhonov theorem, the asymptotic expansions for such systems and the boundary layer problem. Moreover, we talk about the large deviation problem for this case and we present the new action function. It turns out that for singular perturbations, the action function does not contain derivatives in the different from of the well known classical Laplace action function. Then, we discuss the optimal control problem for the singular perturbed stochastic differential equation in the case when the objective function depends on the terminal value of the singular component.

Landy Rabehasaina, University of Franche-Comté, France

Asymptotics for IBNR/infinite queue processes.

We consider in this talk an Incurred but Not Reported (IBNR) k dimensional process modelling the arrivals of claims at in insurance company which have occurred but have not yet been declared, which is also a general model for $G/G/\infty$ queues. In a first part, we will give asymptotics for joint moments as well as the limiting distribution of the $k$dimensional processes properly rescaled, in the case where interclaims are light tailed. In a second part, in the case when the successive claims amounts are modelled by a finite Markov chain and arrive according to a Poisson process with intensity λ we will show, when the delays are fat tailed with index α, that three phenomena occur when we re-scale the intensity by a factor n^γ and the delays by a factor n: Slow arriving, Fast arriving and Equilibrium cases when γ is respectively less, larger or equal to α. We will then exhibit three different limiting distributions for the process. This is joint work with J.K.Woo (Univ. of New South Wales).

Miklos Rasonyi, Renyi Institute, Budapest, Hongria.

Robust utility maximization under transaction costs.

We consider a continuous-time market with proportional transaction costs. Under appropriate assumptions we prove the existence of optimal strategies for investors who maximize their worst-case utility over a class of possible models. We consider utility functions defined either on the positive axis or on the whole real line. Based on joint work with Ngoc Huy Chau.

Wolfgang Runggaldier, Padova University, Italy.

Expected utility maximization under incomplete information and with Cox-Process observations.

We consider the portfolio optimization problem for the criterion of maximization of expected terminal utility (log-and power-utility). The underlying market model is a regime-switching diffusion model where the regime is determined by an un-observable factor process forming a finite state Markov process. The main novelty is due to the fact that prices are observed and the portfolio is re-balanced only at random times corresponding to a Cox process.

Bruno Saussereau, Franche Comté University, France

Fractional Poisson process and applications to actuarial sciences.

Martin Schweizer, ETH Zurich, Switzerland.

Samuelson revisited – a new FTAP without a fixed numeraire.

Albert Shiryaev, Steklov Mathematical Institute, Moscow, Russia.

On the sequential testing of two statistical hypotheses.

We present the different results of the sequential testing of two hypotheses in the case where stochastics is generated by brownian motion. Basic results will be given for two Ornstein-Uhlenbeck processes where we describe asymtotically optimal test when errors of the first and second order tend to zero. Joint work with D.Lisovkij.

Shiqi Song, Evry University, France.

Pricing measures in the plural and their coherences issue.

One knows that, in an incomplete market, the pricing measures are plural, and they are coherent in the sense that they make the same asset process local martingale. However, it is not this pluralism which will be addressed in this talk. Rather, we consider another situation that, in a common market, different participants price with their own pricing measures based on their own and different information flows. How can then the market remain arbitrage-free and how can the prices given under different pricing measures be coherent ? This question has been initially motivated by the recent development of the XVA theory, and has obtained a fairly satisfactory answer there. With this succes in XVA theory, it seems to be the time to raise this question in general.

Xiaolu Tan, Paris Dauphine University, France.

Utility maximization with proportional transaction costs under model uncertainty.

We consider a discrete time financial market with proportional transaction costs under model uncertainty, and study a semi-static utility maximization for the case of exponential utility preference. Using a randomization technique, we can transform the original problem into a frictionless market framework, however, with the extra probability uncertainty on an enlarged space. This allows us to prove the existence of the optimal strategy, the auxiliary dynamic programming principle as well as the convex duality theorem in our context with transaction costs. As an application of the duality representation, some features of utility indifference prices are investigated in the robust setting. Joint work with Shuoqing Deng and Xiang Yu.

Peter Tankov, ENSAE ParisTech, France.

An optimal stopping mean-field game of resource sharing.

We consider a group of producers sharing a common resource reservoir (such as coal-fired power plants using fresh water from the same river for cooling). Each producer faces a random demand for its product and may withdraw the required quantity of resource if the reservoir level is sufficient. If the reservoir does not allow meeting the total demand of all producers, resource is shared among producers proportionnally to their demand levels, and the producers pay penalty for not meeting their demand. Each producer has the opportunity to switch, at a cost, to a technology not requiring the resource (e.g., build a desalination plant), after which it will always be able to meet the demand. Each producer therefore solves an optimal stopping problem, and the problems of different producers are coupled through the resource reservoir level. Assuming that the number of producers is large, we formulate the problem of finding a Nash equilibrium as a mean-field game of optimal stopping. Such games have only recently been considered in the literature: building on [C. Bertucci, Optimal stopping in mean-field games, an obstacle problem approach, J. Math. Pures Appl., in press] we prove existence and uniqueness of equilibrium in our

setting. In addition, we develop a convergent numerical algorithm for computing the equilibrium and present a numerical illustration for the problem of coal power plants using river water.

Joseph Teichmann, ETH University, Switzerland.

Bayesian finance.

We consider an abstract two filtration setting to model (large) financial markets: the trader is using information from the smaller filtration whereas the price process is adapted to the larger filtration. We present an FTAP extending seminal work of Kabanov-Stricker in the discrete time setting for small markets. We show that this modeling approach applies to many important real world situations including model uncertainty, non-semimartingale models, Bayesian calibration, etc. (joint work with Christa Cuchiero and Irene Klein).

Nizar Touzi, Ecole Polytechnique, France.

Continuous time contract theory.

Mikhail Urusov, University of Duisburg-Essen, Germany.

Markov chain approximation for irregular SDEs and continuous strong Markov processes.

We provide a new algorithm for approximating the law of a one-dimensional diffusion solving an SDE with possibly irregular coefficients. The algorithm is based on the construction of Markov chains whose laws can be embedded into the diffusion with a sequence of stopping times. It does not require any regularity or growth assumption; in particular, it applies to SDEs with coefficients that are nowhere continuous and that grow superlinearly. Moreover, the algorithm admits an extension for one-dimensional continuous strong Markov processes. Its performance is illustrated via several examples. This is a joint work with Stefan Ankirchner and Thomas Kruse.

Tiziano Vargiolu, University of Padou, Italy.

On the singular control of exchange rates.

Consider the problem of a central bank that wants to manage the exchange rate between its domestic currency and a foreign one. The central bank can purchase and sell the foreign currency, and each intervention on the exchange market leads to a proportional cost whose instantaneous marginal value depends on the current level of the exchange rate. The central bank aims at minimizing the total expected costs of interventions on the exchange market, plus a total expected holding cost. We formulate this problem as an infinite time-horizon

stochastic control problem with controls that have paths which are locally of bounded variation. The exchange rate evolves as a general linearly controlled one-dimensional diffusion, and the two nondecreasing processes giving the minimal decomposition of a bounded-variation control model the cumulative amount of foreign currency that has been purchased and sold by the central bank. We provide a complete solution to this problem by finding the explicit expression of the value function and a complete characterization of the optimal control. At each instant of time, the optimally controlled exchange rate is kept within a band whose size is endogenously determined as part of the solution to the problem. We also study the expected exit time from the band, and the sensitivity of the width of the band with respect to the model's parameters in the case when the exchange rate evolves (in absence of any intervention) as an Ornstein-Uhlenbeck process, and the marginal costs of controls are constant. The techniques employed are those of the theory of singular stochastic control and of one-dimensional diffusions.

Lioudmila Vostrikova, Angers University, France.

Exponential functionals of PII and mathematical finance.

Exponential functionals arise in many areas, in particular in the theory of self- similar Markov processes in the relation with the Lamperti transform, in the theory of random processes in random environments, in the area of mathematical statistics, for example, in the study of the Pitman estimators, in the mathematical finance in relation with the perpetuities containing the liabilities, with the perpetuities subjected to the influence of the economical factors, with the prices of the Asian options and also with the ruin problem of the insurance companies.

José-Miguel Zapata Garcia, Murcia University, Spain.

A Boolean-valued models approach to random convex analysis and duality theory of conditional risk measures.

By means of tools from mathematical logics and inspired by conditional set theory, we show that a randomized version of a classical locally convex space can be interpreted as a classical locally convex space within a suitable set-theoretic universe. This gives rise to a transfer method that allows us to obtain from any known theorem of classical convex analysis a new randomized version of it, which automatically holds. Similarly, we show that a conditional risk measure can be interpreted as a classical (one- period) risk measure within a suitable set-theoretic universe. This amounts to a transfer method to interpret any known theorem about dual representation of classical risk measures as a new theorem on dual representation of conditional risk measures. As an instance of application, we establish a new general robust representation theorem for conditional risk measures. The number of examples can be easily increased.

Mihail Zervos, London School of Economics, England.

Self-enforcing insurance arrangements.

We analyse efficient risk sharing between two risk-averse agents under limited commitment in a continuous-time endowment economy. Agents' endowments are persistent. We first consider the case with no aggregate uncertainty. We then allow for aggregate uncertainly in the log utility case.