ABSTRACT BOOK

BACHELIER FINANCE SOCIETY

10TH WORLD CONGRESS
TRINITY COLLEGE, DUBLIN
16-20 JULY, 2018

Plenary speakers

From optimal execution in front of a background noise to mean field games?

Dr. Charles-Albert Lehalle

Imperial College and CFM

A large number of mathematical frameworks are available to control optimally of the execution of a large order (see for instance "Optimal control of trading algorithms: a general impulse control approach" SIAM J. Financial Mathematics, 2:1, 404-438 by Bouchard, Dang, Lehalle in 2011 or "General intensity shapes in optimal liquidation" Mathematical Finance, 25:3, 457-495. Guéant and Lehalle, in 2015), and some frameworks are emerging to manage the life cycle of small orders in an orderbook (like in "Optimal liquidity-based trading tactics", by Lehalle, Mounjid, and Rosenbaum, arxiv 2018). In all these framework an isolated investor faces a background noise coming from the aggregation of other market participants' behaviours. With recent progresses in Mean Field Games (MFG), it is now possible to propose analyses of the same problems in a closed loop, going further than current isolated views. I will expose proposed approaches for both cases (see "Efficiency of the price formation process in presence of high frequency participants: a mean field game analysis" Mathematics and Financial Economics,10:3, 223-262, by Lachapelle, Lasry, Lehalle, Lions, 2016 for small orders and "Mean field game of controls and an application to trade crowding" Mathematics and Financial Economics, by Cardaliaguet and Lehalle, 2017 for large orders) and explain how MFG can answer to a lot of needs in modelling liquidity on financial markets.

The Amazing Power of Dimensional Analysis in Finance: Market Impact and the Intraday Trading Invariance Hypothesis

Professor Walter Schachermayer

University of Vienna

A basic problem when trading in financial markets is to analyze the prize movement caused by placing an order. Clearly we expect - ceteris paribus - that placing an order will move the price to the disadvantage of the agent. This price movement is called the market impact. Following the recent work of A. Kyle and A. Obizhaeva we apply dimensional analysis - a line of arguments wellknown in classical physics - to analyze to which extent the square root law applies. This universal law claims that the market impact is proportional to the square root of the size of the order.We also analyze the dependence of the trading activity on a stock, i.e. number of trades per unit of time, in dependence of some suitable explanatory variables. Dimensional analysis leads to a 2/3 law: the number of trades is proportional to the power 2/3 of the exchanged risk.The mathematical tools of this analysis reside on elementary linear algebra.

Mean Field Games in Singular Controls, Nash Equilibrium vs. Pareto Optimality

Professor Xin Guo

University of California, Berkeley

Mean Field Game (MFG) theory has been thriving over the past decade. In this talk, we will focus on the ``aggregation issue'' in MFGs, and aim to understand how aggregations in MFG formulation change the nature of the solution for stochastic games. We will illustrate through several examples including the classical fuel follower problems and irreversible investment problems. We will compare N-player stochastic games vs MFGs, and Nash Equilibrium (NE) vs Pareto Optimality (PO).

On the Principle of Randomization in Finance and Insurance

Professor Hansjoerg Albrecher

University of Lausanne

In this talk we discuss the principle of randomization as a powerful tool in analyzing risk models. We study potential benefits for computational purposes, but particularly also for insight and simplifications on the modeling level. A number of illustrations of recent respective results are given. It is also studied how this line of reasoning can impact product design in finance and (re)insurance.

Shorting in Speculative Markets

Professor José Scheinkman

Columbia University

We will develop a continuous-time model of trading with heterogeneous beliefs, where risk-neutral agents face quadratic costs-of-carry on positions and thus their marginal valuation of the asset decreases with the size of their position, as it would be the case for risk-averse agents. In the equilibrium models of heterogeneous beliefs that followed the work by Harrison and Kreps, investors are risk-neutral, short-selling is prohibited and agents face constant marginal costs of carrying positions. The resulting resale option guarantees that the equilibrium price exceeds the price of the asset in a static buy-and-hold model where speculation is ruled out and this difference is identified as a bubble. Our model features three novelties to this literature. First, increasing marginal costs entail that the price depends on asset supply. Second, in addition to the resale option, agents also value an option to delay, and this may cause the market to equilibrate below the buy-and-hold price. Third, we introduce the possibility of short-selling. Our model shows that when shorting is very costly, price formation is dominated by optimists and pessimists' views are hardly reflected. On the other hand, an unexpected decrease in shorting costs may lead to the collapse of a bubble; this links the financial innovations that facilitated shorting of mortgage backed securities to the subsequent collapse of prices relative to fundamentals. We use a Hamilton--Jacobi--Bellman equation of a novel form to describe the equilibrium of our model and derive comparative statics results.

Viscosity Solutions to Master Equations

Professor Jianfeng Zhang

University of Southern California

Master equation is a powerful tool for studying McKean-Vlasov dynamics where the distribution of the state process enters the coefficients directly, with particular applications including mean field games and stochastic control problems with partial information. In this talk we propose an intrinsic notion of viscosity solution for master equations and establish its wellposedness. Our main innovation is to restrict the involved measures to certain set of semimartingale measures which satisfies the desired compactness. As one important example, we study the HJB master equation associated with the control problems for McKean-Vlasov SDEs. Due to practical considerations, we consider closed-loop controls. It turns out that the regularity of the value function becomes much more involved in this framework than the counterpart in the standard control problems. Finally, we build the whole theory in the path dependent setting, which is often seen in applications. The main result in this part is an extension of Dupire's functional Ito formula. This Ito formula requires a special structure of the Wasserstein derivatives, which was originally due to Lions in the state dependent case. We extend this well known result to the path dependent setting. Our arguments are elementary and are new even in the state dependent case.

Why is it important to study various sources of information?

Professor Monique Jeanblanc

Université d'Evry

In this talk, we shall give some examples, based on Enlargement of filtration theory, to see how some extra information can be used to make profit, or even arbitrages and how prices can be changed in an incomplete market. This problem of arbitrages occurring from extra information is well known as insider trading and has been studied by several authors, among them Kchia and Protter and Draouil and Øksendal (with Malliavin calculus techniques). We shall recall some general facts about information drift and pay attention to progressive enlargement and give necessary and sufficient conditions so that No Arbitrages can occur, based on papers with Aksamit, Choulli and Deng. We will also present a case, based on a paper with Coculescu, where prices of a given payoff are computed in different filtrations and give a condition so that, under short selling constraints there are no arbitrages.

Perfect hedging under general price impact and market liquidity

Professor Bruno Bouchard

Université Paris-Dauphine

We discuss a general super-hedging problem within a Markovian continuous time model of financial market with price impact and liquidity cost. It includes the linear impact model discussed in Bouchard et al. (2017). We provide a characterization of the super-hedging price in terms of a fully non-linear parabolic equation. Under additional smoothness conditions on the payoff, it coincides with the perfect hedging price of a modified payoff, showing that these types of models essentially preserve completeness. We also provide a dual formulation in terms of an optimal control problem. Finally, we give an expansion around a model without impact and show how it can be used to build up very easily an approximating hedging strategy in the case of a small impact function.

Talking pennies: Optimal Electricity Demand-Response Contracting

Professor René Aid

Université Paris-Dauphine

We formulate the problem of demand-response contract in electricity markets as a Principal-Agent problem with moral hazard. The Principal is a risk--averse producer subject to energy generation cost and to variation of generation costs due to limited flexibility. The Principal aims at finding the contract inducing the optimal reduction both of the consumption and of its volatility. We interpret

the reduction of the consumption volatility as an increase of the consumer's responsiveness. We provide closed--form expression for the optimal contract that maximises the utility of the principal in the case of linear energy valuation. We show that optimal contracting allows the system to bear more risk as the volatility may increase. By calibrating the model with publicly available data, we drive conclusion on the potential improvement of consumers' responsiveness induced by optimal contracting.

Unquantifiable Uncertainty?

Professor Halil Mete Soner

ETH Zürich

The importance and the potential dangers of model dependency, although known to the academic community for decades,have become abundantly clear during the 2008 financial crisis. Since then several methods have been developed to reduce this dependency. The (completely) model-independent approach delivers bounds and hedges that are valid in all cases. This is in fact the worst-case analysis of the problems. Although, in most cases, the results are too conservative, they provide valuable universal bounds. Robust finance uses models which are not based on one single (historical) probability measure.Instead a set of such measures used in an attempt to obtain answers that are robust to modelling assumptions. Mathematically, these studies raise interesting questions in the of theory stochastic processes. Main difficulty arises from the fact that the classical theory uses the reference measure significantly in its constructions.In the past decade, these questions have been studied with much success.The model-independent approach also made interesting connections to the classical Monge-Kantorovic optimal transport problem. From theoretical decision theory, all these studies are attempts to quantify instances of Knightian type uncertainties. In this talk, I survey the recent results in model-independent and robust finance in the context of Knightian uncertainty.

Hedging and calibration for log-normal rough volatility models

Professor Masaaki Fukasawa

Osaka University

Both historical and implied volatility data suggest volatility is log-normal and rough. We discuss miscellaneous things about log-nornal rough volatility models, including hedging and calibration, putting emphasis on the forward variance curve.

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Posters

Measuring Default Risk for a Portfolio of Equities

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 58

Mr. Matheus Rodrigues (University of São Paulo), Dr. André Maialy (São Paulo School of Economics)

This work evaluates changes proposed by the Basel Committee for capital allocation due to a company default in an equities portfolio of a bank. Recently measures like the Default Risk Charge were designed to account for the risk of default of a company that would not be caught by a 10-day Value at Risk. To design this measures we use a Merton Model to compute the Probability of Default. Which is compared with simulated asset returns to compute a 1-year VaR. The results shown are based in a portfolio of Ibovespa companies and a portfolio of S&P500 companies.

Uniform integrability of a single jump local martingale with state-dependent characteristics

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 57

Mr. Michael Schatz (ETH Zurich), Prof. Didier Sornette (ETH Zurich)

Local martingales that are not uniformly integrable martingales have recently gained attention in the stochastic processes and mathematical finance literature, being linked to special cases in arbitrage theory and the occurrence of bubbles.
We present a deterministic criterion to determine whether a single jump local martingale is a uniformly integrable martingale. Our processes are based on general, possibly explosive diffusions and a state-dependent jump hazard rate, extending results on both pure homogeneous diffusions and deterministic hazard rates. We provide natural examples of local martingales that are not uniformly integrable martingales and live on a stochastically unbounded (yet finite) time window.

Optimal portfolio allocations in a heterogenous banking system

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 496

Dr. Marko Weber (Columbia University), Prof. Agostino Capponi (Columbia University)

We study the portfolio selection implications of leverage requirements, when banks need to deleverage in response to price shocks to satisfy these regulatory requirements. Banks choose their asset holdings in order to minimize their expected execution costs. Consistent with the classic theory of portfolio allocation, diversification is optimal only if each bank neglects the impact caused by other agents' liquidation actions. If banks are heterogeneous in their leverage ratios, in equilibrium they reduce portfolio overlapping and seek diversity, at the expense of sacrificing diversification benefits at the individual level. The bank's equilibrium allocation is not socially efficient. A benevolent social planner aiming for minimal deadweight losses from liquidation should incentive banks to increase their diversity.

Pricing VIX derivatives under Double-Mean-Reverting Logarithmic Model

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 78

Mr. SEEWOO KIM (Yonsei University), Prof. Jeong-Hoon Kim (Yonsei University)

There have been numerous attempts to derive the fair price of VIX derivatives under various stochastic models. And D. Psychoyios shows the fact that the mean-reverting logarithmic diffusion with jumps well approximate the market of the volatility index in his work, 2010. This paper extend this mean-reverting logarithmic model as double-mean-reverting process to obtain improved consequences for VIX derivatives pricing. We derive characteristic functions of our given models and exploit these characteristic functions to obtain the price of VIX derivatives. Through numerical experiment, we perform calibration to market data and examine sensitivity of parameters by providing greeks under our models.

Application of the transmutation operators to parabolic boundary and free boundary problems

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 84

Mr. Igor Kravchenko (ISCTE-IUL), Dr. Vladislav Kravchenko (CINVESTAV del IPN), Dr. Sergii Torba (CINVESTAV del IPN), Dr. José Carlos Dias (ISCTE-IUL)

A numerical method for solving parabolic free boundary problems will be presented. The method is based on recent results from transmutation operators theory allowing one to efficiently construct complete systems of solutions for the parabolic equation, from the corresponding one for the heat equation such as heat polynomials and trigonometric basis. The scheme for the implementation algorithm will also be presented. These techniques can be directly applied to path dependent options.

Determinants of implied volatility smiles - An empirical analysis using intraday DAX equity options

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 129

Prof. Andreas W. Rathgeber (University of Augsburg), Dr. Johannes Stadler (University of Augsburg), Mr. Markus Ulze (University of Augsburg)

In recent years, the importance of high frequency trading and data has enormously increased.
Using over one million trade-by-trade DAX equity options from the EUREX in 2012 with corresponding order books a detailed, market-oriented and modern examination of the determinants of the implied volatility smile is performed and the existing high frequency gap in literature is addressed.
We confirm former low frequency results like moneyness, time, liquidity, volume and underlying moment dependencies. Additionally, new order book based measures, e.g. a control for buyer-/seller-motivated trades, are developed and a mean-reversion process for implied volatilities is revealed.

Accounting for Employee Stock Options: accelerating convergence.

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 144

Dr. Brian Byrne (Dublin Institute of Technology), Ms. Qianru Shang (Dublin Institute of Technology)

Hull and White (2004) have developed a lattice pricing model that makes explicit reference to parameters that are not available in Black Scholes (1973) yet are important for the valuation of Employee Stock Options (ESOs). Cvitanic, Wiener and Zapatero (2008) point out that a key weakness of the lattice approach, when applied to valuing ESOs, is the sluggish convergence not generally experienced in trees configured to estimate plain vanilla options. We propose a small refinement to Hull and White (2004), based on insights developed by Boyle and Lau (1994) which ensures faster convergence in lattice estimation when barriers occur.

Expected Stock Returns and the Correlation Risk Premium

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 156

Mr. Lorenzo Schoenleber (Frankfurt School of Finance and Management), Prof. Adrian Buss (INSEAD), Prof. Grigory Vilkov (Frankfurt School of Finance and Management)

In general equilibrium settings with stochastic variance and correlation, the market-return is driven by shocks to consumption, market variance and average correlation between stocks, and hence the equity risk premium is composed of compensations for variance, correlation and consumption risks. A new empirical methodology of market return prediction, such that estimating variance and correlation betas from the joint dynamics of option-implied-variables and index-returns is proposed, resulting in significant out-of-sample R2's of 10,4% (7,0%) for 3 (12)-months forecast horizons. Inline with a risk-based explanation for the existence of a correlation risk premium, we document that expected correlation predicts future diversification risks.

XVA Principles, Nested Monte Carlo Strategies, and GPU Optimizations

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 172

Prof. Stéphane Crépey (Evry University), Prof. Lokman Abbas-turki (University Pierre and Marie CURIE), Mr. Babacar Diallo (Quantitative Research GMD/GMT Credit Agricole CIB)

We present a nested Monte Carlo (NMC) approach implemented on graphics processing units (GPU) to X-valuation adjustments (XVA), where X ranges over C for credit, F for funding, M for margin, and K for capital. The overall XVA suite involves five compound layers of dependence. Higher layers are launched first and trigger nested simulations on-the-fly whenever required in order to compute an item from a lower layer. With GPUs, error controlled NMC XVA computations are within reach. This is illustrated on XVA computations involving equities, interest rate, and credit derivatives, for both bilateral and central clearing XVA metrics.

Some properties of density functions on maxima of one-dimensional diffusion processes

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 185

Dr. Tomonori Nakatsu (Shibaura Institute of Technology)

In the talk, we shall deal with one-dimensional stochastic differential equations (SDEs), and consider discrete and continuous time maximum of the solution. We will show some important properties of their probability density functions. In particular, we shall obtain expressions, upper bounds and a convergence of the probability density functions by means of integration by parts formulas. The Key to prove the integration by parts formulas is the Malliavin calculus. If time permits, we will consider some other properties of the density functions which have been obtained recently.

Enhanced GRU Framework for Correlation Analysis of Cryptocurrency Market

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 263

Ms. Huisu Jang (Seoul National University), Prof. Jaewook Lee (Seoul National University), Mr. Woojin Lee (Seoul National University), Mr. hyungjin ko (Seoul National University)

Bitcoin has recently received considerable interests in fields of economy and cryptography. In this study, we proposed Enhanced GRU Framework for Correlation Analysis of Cryptocurrency Market. We selected 8 cryptocurrencies to conduct a correlation analysis between input features. We visualized the correlation between the eight altcoins using the proposed model by applying new learning method. We have shown that the proposed model is learned to better represent the relationship of higher-order time series data.

Interest Rate Calibration and Parameter Estimation of Affine Term Structure Models

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 271

Ms. Samyukta Venkataramanan (Dublin Institute of Technology)

Understanding and modelling interest rate term structure models is a challenging topic in financial research. Parameter estimation of affine term structure models is one of the areas that poses a computational challenge in this domain. We establish the exponential integrability of short rate over a bond using Euler and Milstein approximations for the Two-Factor Cox-Ingersoll-Ross model. We confirm the convergence of the bond prices simulated using each of the approximations. Finally, we look at parameter estimation for the model based on the simulated prices using Singleton's empirical characteristic function (ECF) techniques.

Model selection and arbitrage

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 290

Dr. Thomas Liebmann (.)

We discuss which classes of trading strategies admit arbitrage of the first kind for different types of models in a unified multidimensional semimartingale setting, criteria when the differences between these settings vanish, which types of strategies are required to exploit possibly existing arbitrage opportunities, and consequences for model choice and model risk.

Series Representation of conditional integral of the variance Process in the Heston Stochastic Volatility Model

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 299

Ms. Jiaqi Shen (Heriot-Watt University), Dr. Anke Wiese (Heriot-Watt University), Dr. Simon J.A. Malham (Heriot-Watt University)

We present a new series representation for the time integral of the variance process of the Heston stochastic volatility model conditional on its values at the endpoints through the decomposition of the Bessel bridges and change of a measure. We represent this quantity by double infinite weighted sums of certain independent random variables. Furthermore, we simulate part of the representation by inverse distribution function, which is approximated by Chebyshev polynomials based on an asymptotic series expansion we derive for the distribution function.

Irreducible Convex Paving for Decomposition of Multi-dimensional Martingale Transport Plans

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 327

Mr. Hadrien De March (Ecole Polytechnique-CMAP), Prof. Nizar Touzi (Ecole Polytechnique-CMAP)

Martingale transport plans on the line are known to have an irreducible decomposition on a (at most) countable union of intervals. We provide an extension of this decomposition for martingale transport plans in higher dimension. Our decomposition is a partition consisting of a possibly uncountable family of relatively open convex components, with the required measurability so that the disintegration is well-defined. We prove the existence of a martingale transport plan filling these components. We also deduce from this decomposition a characterization of the structure of polar sets with respect to all martingale transport plans.

Exploiting Low-Risk Anomaly in the Black-Litterman Framework: Evidence from South Korea

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 342

Mr. SUJIN PYO (Seoul National University), Prof. Jaewook Lee (Seoul National University)

There is a low-risk anomaly in the stock markets around the world for a long time. The Korean financial market is also experiencing low-risk anomalies, and even portfolios of high-risk stocks have lost close to 70% between 2000 and 2016. We exploit the low-risk anomaly in the Black-Litterman framework in the Korean financial market. we predict volatility of firms in Korean Stock Price Index 200(KOSPI 200) to classify stocks into high-risk and low-risk groups. The Black-Litterman portfolio has a Sharpe ratio that is about twice higher than the market portfolio.

The Impact of Sticky Short Rate on Long Bonds

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 343

Prof. Qi Wu (The Chinese University of Hong Kong)

We investigate the impact of sticky short rate on the level and volatility of long term interest rates in the context of a no-arbitrage term structure model. The stickiness is modeled through a boundary condition where as soon as the diffusive short rate hit an arbitrary level, it assumes that constant level for a random amount of time before it diffuses again. When policy rates are persistently low, we show how much stickiness is propagated along the yield-to-maturity dimension as well as its impact on the evolution of long rates in the physical measure.

Local and Occupation Time of a Time Elapsed Process of Brownian Motion

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 356

Ms. Xiaolin Zhu (London School of Economics and Political Science), Prof. Angelos Dassios (London School of Economics and Political Science)

We consider a renewal process U_t, defined as the time elapsed since the last zero of BM. Within the framework of a piecewise-deterministic Markov process involving U_t, where we assume the jump arrivals are driven by a general function of U_t, we derive an explicit expression for the Laplace transform of the Markov process, the marginal densities and simulation schemes at the first jumping time. Furthermore, we prove that the local time of a scaled U_t converges to that of BM, as well as the difference of the two quantities converges to a distribution of a rate of ½.

Option Pricing under Heston Stochastic Volatility with Time-dependent Parameters

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 378

Prof. Chifai Lo (The Chinese University of Hong Kong), Mr. Chi Hei Christopher Liu (The Chinese University of Hong Kong)

Pricing option under Heston stochastic volatility is challenging because it has a closed formula only when the parameters are constant or piecewise constant (Mikhailov and Nogel, 2003). Ap*plying Wei-Norman theorem (Wei and Norman, 1963), we derived an approximate analytical formula for pricing a vanilla call option for any time-dependent model parameters*. The error crrection can be calculated numerically and in turn gives a more accurate result than the volatility expansion based model (Benhamou, Gobet and Miri, 2010) for time-dependent parameters. In addition, the accuracy can be further improved by reiterating the calculation of error correction.

A Diffusion Bridge Sampler for Drift- and Diffusion Dominated Models

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 424

Prof. Erik Lindström (Lund University), Mr. Daniel Damberg (Lund University)

We introduce an adaptive algorithm for sampling multivariate diffusion bridges that performs well for both diffusion and drift dominated models.
The algorithm combines the residual bridge sampler with adaptive MCMC, allowing the algorithm to make online improvements upon the ordinary residual bridge algorithm.
The simulation study show that the proposed bridge sampler is performing at least as good as the residual bridge sampler on a diffusion dominated problem, and substantially better on a drift dominated problem.

Quantifying the Social Benefit of Bail-In Measures using Option-Pricing Techniques

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 443

Dr. Alina-Nicoleta Radu (Bucharest University of Economic Studies)

The paper considers a simple continuous-time model of the banking firm in which the social benefit of bail-in measures such as contingent convertibles is approximated as the resulting reduction in the fair contribution to a resolution fund.The framework assumes that the assets of the financial institution follow a geometric Brownian motion and that the non-equity liabilities, including insured deposits, uncovered bonds, and contingent convertibles arrive at a constant rate with exponentially distributed maturity or lifetime.

Robust singular spectrum analysis: an empirical study

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 448

Mr. Matheus Lima Cornejo (Universidade Federal do Espirito Santo), Dr. Fabio Alexander Fajardo Molinares (Universidade Federal do Espirito Santo)

This paper is aimed at studying robust methodologies for decomposition, filtering and reconstruction of time series, which is relevant for treating events that can cause major effects on the data and on its dependency structure. Based on the proposal of Yarmohammadi, M. and Kalantari, M., the interest in this study is to verify the performance of the robust methodology in scenarios which the data are contaminated by additive outliers. Moreover, a new alternative to the same context is suggested by using an M-estimator with the Huber function while applying SSA in financial time series.

Estimation of SVJD models with Bayesian Methods and Power-Variation Estimators

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 429

Mr. Milan Fičura (University of Economics in Prague, Faculty of Finance and Accounting), Prof. Jiri Witzany (University of Economics in Prague, Faculty of Finance and Accounting)

Methodology is proposed of how to utilize high-frequency power-variation estimators in the Bayesian estimation of Stochastic-Volatility Jump-Diffusion (SVJD) models. Realized variance is used as an additional source of information for the estimation of stochastic variances, while the Z-Estimator is used as an additional source of information for the estimation of asset price jumps. The models are estimated by a combination of a MCMC algorithm and a SIR Particle Filter. The performance of the models is evaluated on simulated times series as well as real world financial time series of the 4 major foreign exchange rates.

Adjusting Positive Definite FX Covariance Matrices

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 451

Mr. Philip Kinlen (AIB)

When optimising a portfolio of currencies , it is helpful to have a positive-definite (PD) covariance matrix of the foreign exchange (FX) rates. However if we wish to adjust an off diagonal element, it is very easy to lose the positive definiteness of the matrix. In this paper we suggest how to adjust off diagonal element of a PD FX covariance matrix while ensuring that the matrix remains positive definite.

Modelling Asynchronous Assets with Jump-Diffusion Processes

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 465

Dr. Roman Makarov (Wilfrid Laurier University), Ms. Yuxin Chen (Wilfrid Laurier University)

We present a new multivariate jump-diffusion model for modelling financial securities that have missing or asynchronous data in time series of historical prices. The proposed model allows us to analyze a portfolio that combines a high-activity asset such as a market index (or an exchange-traded fund tracking a market index) and several low-activity assets. The model is constructed in such a way that low-activity assets correlate with each other only implicitly through the high-activity asset price process. The model parameters are calibrated using the MLE method.

Negative Rate and the Left Wing of Volatility Smile under SABR Process

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 467

Ms. Kun Huang (Hanken School of Economics)

The weakness of SABR model, proposed by Hagan, Kumar, Lesniewski and Woodward (2002), came to light in low and negative rate environment. The breakdown of Hagan's expansion can be explained by probability mass of forward rate equals zero. My study investigates the asymptotic formula of implied volatility introduced in De Marco, Hillairet and Jacquire (2013) by considering mass at zero. In my paper, the Fourier-cosine series expansion is used for computing mass at zero. The numerical results show that accuracy of asymptotic formula introduced by De Marco et al. (2013) is high.

Regret Markets

Monday, 16th July - 11:00 - Poster Presentations - Poster - Abstract ID: 470

Prof. David Edelman (University College Dublin)

The concept of Regret Insurance is introduced and argued to be a useful extension of the idea of ordinary Call Options.

In this sense, Regret (insurance) contracts represent the purest form of the value of unknown Information. In the present paper, and argument is made for the potential usefulness of the notion of Regret Insurance within Risk Management, Investment and Portfolio Analysis, and Financial Decisionmaking in general.

How Elementary is Diversification? A Study of Children's Portfolio Choice

Tuesday, 17th July - 12:00 - Mean-Risk Asset Allocation - Poster - Abstract ID: 54

Dr. Ola Mahmoud (University of St Gallen), Prof. Enrico Degiorgi (University of St Gallen)

Diversification is a fundamental concept in economics, decision theory, and finance. This paper asks how elementary the notion of diversification is by studying whether children apply it as a choice heuristic. We find that children do exhibit preferences for diversification, both for the sake of variety across consumption goods and for the purpose of mitigating risk when faced with a choice across risky gambles. Our results indicate that diversification preferences may have fundamental, developmental roots, which contrasts with the traditional normative view of diversification, in which most economic models take diversification preferences as exogenously given.

Orals

Option Implied Tail Risk

Monday, 16th July - 11:30 - Risk Measures - Beckett 1 - Oral - Abstract ID: 364

Dr. Conall O'Sullivan (Smurfit Business School, University College Dublin), Mr. Yan Wang (Smurfit Business School, University College Dublin)

We propose a model-free formula to evaluate the unspanned tails of a risk-neutral distribution. The method leads to the estimation of risk neutral tail probabilities and tail expectations beyond the minimum and maximum strike prices. We extract time series of left and right option implied tail risk measures from S\&P 500 index options. We find the ratio of risk-neutral (RN) left tail conditional expectation to a physical measure of tail risk significantly predicts the equity risk premium. We find that the RN left and right tail conditional expectations significantly predict the variance risk premium.

Performance measures Adjusted for the Risk Situation (PARS)

Monday, 16th July - 12:00 - Risk Measures - Beckett 1 - Oral - Abstract ID: 326

Dr. Roland C. Seydel (Commerzbank AG), Dr. Christoph Peters (German Finance Agency)

We introduce the class of Performance measures Adjusted for the Risk Situation (PARS), which include individual risk characteristics in the financial performance measure. The (risk) situation of an individual or company is determined by all of its future cash flows including (financial) consumption preferences; PARS have zero volatility under the investment strategy replicating these future cash flows. We give several examples of cash flow structures for individuals and companies, showing how their PARS could be defined. In the context of a debt manager, we demonstrate how the PARS can be applied to the dynamic control of bond portfolios via sensitivities.

Risk Management for Whales

Monday, 16th July - 12:30 - Risk Measures - Beckett 1 - Oral - Abstract ID: 15

Dr. Lakshithe Wagalath (IESEG School of Management), Prof. Rama Cont (Imperial College)

We propose a portfolio risk model which integrates market risk with liquidation costs. The model provides a framework for computing liquidation-adjusted risk measures such as Liquidation-adjusted VaR (LVaR). Calculation of liquidation-adjusted Value-at-Risk (LVaR) for simulated and real-life examples reveals a substantial impact of liquidation costs on portfolio risk for portfolios with large concentrated positions.

Scenario-based Capital Requirements for the Interest Rate Risk of Insurance Companies

Monday, 16th July - 13:00 - Risk Measures - Beckett 1 - Oral - Abstract ID: 433

Prof. Sebastian Schlütter (Applied University of Mainz)

Insurance companies can substantially suffer from changing interest rates. Regulatory approaches, such as the Solvency-II-standard formula, measure interest rate risk based on scenarios. Backtesting against historical movements indicates that the standard formula is too optimistic. Also, it neglects changes in the yield curve's steepness and curvature. This paper starts from a stochastic model for interest rates, which builds on the dynamic version of the Nelson-Siegel model. We use a principal component analysis to translate the simulated yield curves into scenarios. Backtesting results indicate that four scenarios suffice to measure interest rate risk almost as exactly as a stochastic model.

Asymptotic behaviour of randomised fractional volatility models

Monday, 16th July - 11:30 - Stochastic Volatility 1 - Beckett 2 - Oral - Abstract ID: 16

Ms. Chloe Lacombe (Imperial College), Dr. Antoine Jacquier (Imperial College), Dr. Blanka Horvath (Imperial College)

We study the asymptotic behaviour of a class of small-noise diffusions driven by fractional Brownian motion, with random starting points. Different scalings allow for different asymptotic properties of the process. In order to do so, we extend some results on sample path large deviations for such diffusions. As an application, we show how these results characterise the small-time and tail estimates of the implied volatility for rough volatility models, recently proposed in mathematical finance.

Moment explosions in the rough Heston model

Monday, 16th July - 12:00 - Stochastic Volatility 1 - Beckett 2 - Oral - Abstract ID: 164

Prof. Stefan Gerhold (TU Wien), Dr. Arpad Pinter (TU Wien), Mr. Christoph Gerstenecker (TU Wien)

We show that the moment explosion time in the rough Heston model [El Euch, Rosenbaum 2016, arxiv:1609.02108] is finite if and only if it is finite for the classical Heston model. Upper and lower bounds for the explosion time are established, as well as an algorithm to compute the explosion time (under some restrictions). This algorithm is then applied to computing the critical moments, which are shown to be finite for all maturities. The critical moments are related to small and large strike asymptotics of the implied volatility.

Regime Switching Rough Heston Model

Monday, 16th July - 12:30 - Stochastic Volatility 1 - Beckett 2 - Oral - Abstract ID: 95

Mr. Mesias Alfeus (University of Technology Sydney), Prof. Ludger Overbeck (University of Giessen)

We consider the implementation and pricing under a regime switching rough Heston model combining the approach by Elliot et al. (2016) with the one by Euch and Rosenbaum (2016).

Hyperbolic normal stochastic volatility model

Monday, 16th July - 13:00 - Stochastic Volatility 1 - Beckett 2 - Oral - Abstract ID: 379

Prof. Jaehyuk Choi (Peking University HSBC Business School), Ms. Chenru Liu (Peking University HSBC Business School), Prof. Byoung Ki Seo (Ulsan National Institute of Science and Technology)

Motivated for alternative option pricing models and heavy-tailed distributions, this study proposes and analyzes a continuous-time stochastic volatility (SV) model based on arithmetic Brownian motion. The normal Stochastic-Alpha-Beta-Rho model is a special case of our model. Using the generalizations of Bougerol's identity from literature, we provide closed-form simulation scheme, efficient quadrature integration for vanilla option price, and fast moment-matching method. Furthermore, the transition probability of another special case is given by Johnson's SU curve, a popular heavy-tailed distribution with superior analytical tractability. Therefore, our model serves as an analytically tractable SV model and heavy-tailed distribution backed by stochastic differential equation.

Cautious Stochastic Choice, Optimal Stopping and Deliberate Randomisation

Monday, 16th July - 11:30 - Dynamic Preferences - Burke Theater - Oral - Abstract ID: 245

Mr. Matthew Zeng (University of Warwick), Dr. Vicky Henderson (University of Warwick), Prof. David Hobson (University of Warwick)

We study Cautious Stochastic Choice (CSC) agents facing optimal timing decisions in a dynamic setting. In an expected utility context, the optimal strategy is always a threshold strategy. In the CSC setting, the investor has a family of utility functions and is concerned with the worst case certainty equivalent. We show that the optimal strategy may be of non-threshold form and may involve randomisation. Our model is consistent with recent experimental evidence in dynamic setups whereby individuals do not play cut-off or threshold strategies.

Discounting, Diversity, and Investment

Monday, 16th July - 12:00 - Dynamic Preferences - Burke Theater - Oral - Abstract ID: 214

Dr. Wei Wei (University of Waterloo), Prof. Xunyu Zhou (Columbia University), Prof. Sebastian Ebert (Frankfurt School of Finance and Management)

This paper presents the class of weighted discount functions, which contains the discount functions commonly used in economics and finance. Weighted discount functions may describe: the discounting behavior of groups; uncertainty about what discount rate to use; behavioral time preferences; and all of these simultaneously. We study investment behavior under weighted discounting in the classical real option setting and come up with the following general result. Greater group diversity, greater parameter uncertainty, and more behavioral time preferences lead to a delay in investment and more risk-taking.

Dynamic statistical uncertainty and decision making

Monday, 16th July - 12:30 - Dynamic Preferences - Burke Theater - Oral - Abstract ID: 365

Prof. Samuel Cohen (University of Oxford)

In many financial situations we need to make decisions using statistical observations. In this talk, we will look at how this can be done in a consistent way, incorporating quantification of statistical uncertainty in our objectives, while still allowing tractable approximations and the incorporation of new information.

Partial Liquidation under Reference-Dependent Preferences

Monday, 16th July - 13:00 - Dynamic Preferences - Burke Theater - Oral - Abstract ID: 174

Dr. Vicky Henderson (University of Warwick), Mr. Jonathan Muscat (University of Warwick)

We propose a multiple optimal stopping model whereby an investor can sell a divisible asset position at times of her choosing. Investors have S-shaped reference-dependent preferences whereby utility is defined to be concave over gains and convex over losses. For a price process following a time-homogeneous diffusion, we employ the constructive potential-theoretic methods developed by Dayanik and Karatzas (2003). As an example we also revisit the optimal stopping model of Kyle, Ou-Yang and Xiong (2006) to allow for partial liquidation. In contrast to the extant literature, we find that the investor may partially liquidate the asset at distinct price thresholds.

Sampling of probability measures in the convex order and approximation of Martingale Optimal Transport problems

Monday, 16th July - 11:30 - Optimal Martingale Transport - Davis - Oral - Abstract ID: 44

Prof. Aurelien Alfonsi (Ecole Nationale des Ponts et Chaussees), Dr. Jacopo Corbetta (Zeliade Systems), Prof. Benjamin Jourdain (Ecole Nationale des Ponts et Chaussees)

In this paper, we propose sampling methods preserving the convex order between two probability measures. In particular, we introduce the Wasserstein projection of a first probability measure on the set of probability measures dominated by the second one for the convex order. We apply our techniques to approximate Martingale Optimal Transport problems with two of three marginals by using linear programming solvers.

Computational Methods for Martingale Optimal Transport Problems

Monday, 16th July - 12:00 - Optimal Martingale Transport - Davis - Oral - Abstract ID: 64

Dr. Gaoyue Guo (University of Oxford), Prof. Jan Obloj (University of Oxford)

We develop numerical methods for solving the *martingale optimal transport* (MOT) problem. We prove that the MOT problem can be approximated through a sequence of *linear programming* (LP) problems which result from a discretisation of the marginal distributions combined with a suitable relaxation of the martingale constraint. Specialising to the one-step model in dimension one, we provide an estimation on the convergence rate.
We adopt two computational algorithms to solve the LP problem that is related to a tailored discretisation of the marginals preserving the increasing convex order, based respectively on the iterative Bregman projection and stochastic averaged gradient method.

The Optimal Martingale Transport Problem With Additional Information about Variance of the Returns

Monday, 16th July - 12:30 - Optimal Martingale Transport - Davis - Oral - Abstract ID: 124

Mr. Julian Sester (University of Freiburg), Prof. Eva Luetkebohmert (University of Freiburg)

We investigate the optimal transport problem with martingale constraints and its application to model-independent price bounds for financial derivatives. The novelty of this paper is the additional consideration of information about the variance of the returns of an underlying discrete-time stochastic process. This additional information is well motivated by observations of prices on financial markets. Our theoretical results comprise a dual version of the modified problem. Our empirical results indicate that tighter price bounds for exotic options can be obtained. In this respect, our results also have important implications for the practical applicability and relevance of model-independent price bounds.

Robust Pricing and Hedging around the Globe

Monday, 16th July - 13:00 - Optimal Martingale Transport - Davis - Oral - Abstract ID: 236

Dr. Sebastian Herrmann (University of Michigan), Mr. Florian Stebegg (Columbia University)

We study the martingale optimal transport duality for càdlàg processes with given initial and terminal laws. Strong duality and existence of dual optimizers (robust semi-static superhedging strategies) are proved for a class of payoffs that includes American, Asian, Bermudan, and European options with intermediate maturity. We exhibit an optimal superhedging strategy for which the static part solves an auxiliary problem and the dynamic part is given explicitly in terms of the static part. In the case of finitely supported marginal laws, solving for the static part reduces to a semi-infinite linear program.

Time to Homeownership and Mortgage Design: Income Sharing and Saving Incentive

Monday, 16th July - 11:30 - Systemic Risk - Emmet - Oral - Abstract ID: 289

Dr. Gianluca Marcato (University of Reading), . Rafal Wojakowski (University of Surrey)

Homeownership for young, middle-low income earners decreased due to accumulated student loans, stringent covenants, pressure of strong rental market, household expenditure growth and negative wage-house price growth gap. We finance-engineer an income sharing mortgage: borrowers pledge a portion of their future income to cover the initial deposit and become homeowners by obtaining 100% LTV mortgage straight away. Useful in periods of higher uncertainty and less expensive in high interest rate environment, this mortgage embeds incentives to save, reducing overall systemic risk of the banking sector. Consequently the default risk is not higher than a plain vanilla mortgage with lower LTV.

Can Swing Pricing Prevent Mutual Fund Runs and Fire Sales?

Monday, 16th July - 12:00 - Systemic Risk - Emmet - Oral - Abstract ID: 312

Dr. Marko Weber (Columbia University), Prof. Agostino Capponi (Columbia University), Prof. Paul Glasserman (Columbia University)

We develop a model of the feedback between mutual fund outflows and asset illiquidity. Alert investors anticipate the impact on the fund's net asset value of other investors' redemptions and exit first at favorable prices. Our study shows that: (i) the first-mover advantage introduces a nonlinear dependence between initial price shock and resulting endogenous asset price change, amplifying the fire sale impact of the initial shock; (ii) beyond a critical shock threshold, a run causes the fund's failure; (iii) swing pricing transfers liquidation costs from the fund to redeeming investors and, importantly, reduces these costs and prevents fund failure.

Default contagion in financial block networks

Monday, 16th July - 12:30 - Systemic Risk - Emmet - Oral - Abstract ID: 302

Prof. Nils Detering (University of California, Santa Barbara), Prof. Konstantinos Panagiotou (University of Munich), Mr. Daniel Ritter (Univesity of Munich), Prof. Thilo Meyer-Brandis (University of Munich)

We extend analytic results on default contagion in large financial networks to capture a pronounced block model structure which includes as a special case core-periphery networks. In the literature on systemic risk in large random networks one problematic assumption is that the distribution of interbank liabilities only depends on the creditor. We study a more general setting and obtain among others resilience conditions for the global network based on sub-network conditions. Contrasting earlier research we also give an example that demonstrates how reshuffling edge weights to form blocks can in fact impact resilience even for otherwise very homogeneous networks.

An Asymptotic Model of Fire Sales in Financial Systems

Monday, 16th July - 13:00 - Systemic Risk - Emmet - Oral - Abstract ID: 416

Prof. Nils Detering (University of California, Santa Barbara), Prof. Thilo Meyer-Brandis (University of Munich), Prof. Konstantinos Panagiotou (University of Munich), Prof. Daniel Ritter (University of Munich)

In this article, we propose a model for fire sales (price-mediated contagion). We derive analytic formulas for the final state (fraction of defaulted institutions and total price impact) of large financial systems after being hit by an initial shock. Further, we complement our model by a channel of default contagion. At this we apply results from (Detering et. al., 2017), (Detering et. al. 2018) derived by asymptotic random graph methods and extend them to the non-continuous setting induced by the fire sales. Finally, we provide criteria that determine whether a certain financial system is resilient or prone to small initial shocks and furthermore give sufficient capital requirements for financial systems to be resilient.

Mild solutions to path-dependent PDEs

Monday, 16th July - 11:30 - BSDE and PDE Methods - Swift - Oral - Abstract ID: 352

Dr. Alexander Kalinin (Imperial College London), Prof. Alexander Schied (University of Waterloo)

The recent functional extension of the widely applied Itô formula by Dupire, Cont, and Fournié led to the new exciting class of path-dependent partial differential equations (PPDEs). In relevant publications, the most common approach to construct classical or viscosity solutions to PPDEs is to utilize backward stochastic differential equations (BSDEs). In this talk, we rely instead on Markovian integral equations and present path-dependent diffusions to give a general existence and uniqueness result for mild solutions to semilinear parabolic PPDEs. Moreover, we motivate this solution concept by applications in option pricing models.

On L^1 solutions of BSDE

Monday, 16th July - 12:00 - BSDE and PDE Methods - Swift - Oral - Abstract ID: 431

Dr. Junjian Yang (TU Wien), Dr. Zhenjie Ren (University of Paris-Dauphine), Prof. Nizar Touzi (Ecole Polytechnique-CMAP)

We consider the existence and uniqueness of L^1 solutions of BSDEs and reflected BSDEs. It was shown that if the generator f is of sublinear growth with respect to z, there exists a solution for $\xi\in L^1$. Here, we show the existence and uniqueness of solutions of a linearly growing BSDE under an integrability condition on ξ and f_s^0 uniformly with respect to a family of probability measures.

Recent developments in the theory of stochastic control and optimal stopping with nonlinear expectations

Monday, 16th July - 12:30 - BSDE and PDE Methods - Swift - Oral - Abstract ID: 478

Prof. Roxana Dumitrescu (King's College London), Prof. Agnes Sulem (INRIA), Prof. Marie-Claire Quenez (Universite Paris-Diderot)

In this talk, we present recent developments in the theory of control and optimal stopping with nonlinear expectations, as well as their applications in finance. We first introduce an optimal stopping game with nonlinear expectations (Generalized Dynkin Game) in a non-Markovian framework and study its links with nonlinear doubly reflected BSDEs. These results are applied to the nonlinear pricing of game options. Some additional results are given in the case of nonlinear pricing of American options in incomplete markets with default. In the second part, we present a new mixed generalized Dynkin game/stochastic control with-expectation in a Markovian framework.

Second-order backward SDE with random terminal time and applications

Monday, 16th July - 13:00 - BSDE and PDE Methods - Swift - Oral - Abstract ID: 344

Dr. YIQING LIN (Shanghai Jiao Tong University), Dr. Zhenjie Ren (University of Paris-Dauphine), Prof. Nizar Touzi (Ecole Polytechnique-CMAP), Dr. Junjian Yang (TU Wien)

In this talk, we shall introduce our recent progress on the second-order BSDEs with random terminal time. In particular, we study a control problem on the solutions of BSDEs with random terminal time and prove the existence and uniqueness of the corresponding second-order BSDEs. We afterwards apply this result to solve a Principal-Agent problem with moral hazard when the principal can decide the retirement of the agent.

Portfolio Rho-presentativity

Monday, 16th July - 11:30 - Portfolio Choice and Beyond - Synge - Oral - Abstract ID: 41

Mr. Tristan Froidure (TOBAM), Dr. Khalid Jalalzai (TOBAM), Mr. Yves Choueifaty (TOBAM)

Maximally ρ-presentative portfolios maximize under no constraint an aggregation of their vector of exposure to all assets, that is measured by a symmetric, increasing and concave real-valued function f.
We provide a basic characterization of these portfolios that is independent of f, show that they are long-only, rare and form a union of polytopes that contains well-known long-only portfolios.
This also leads to a correspondence between some classic long-only portfolio optimization problems constrained to have maximum weights and unconstrained problems, thus characterizing the impact on the objective of these constraints often used by practitioners. Finally, several applications illustrate our results.

Optimal portfolio allocation with volatility and co-jump risk that Markowitz would like

Monday, 16th July - 12:00 - Portfolio Choice and Beyond - Synge - Oral - Abstract ID: 324

Dr. Immacolata Oliva (University of Verona), Prof. Roberto Reno (University of Verona)

We study a continuous time optimal portfolio allocation problem with volatility and co-jump risk, allowing prices, variances and covariances to jump simultaneously. Differently from the traditional approach, we deviate from affine models by specifying a flexible Wishart jump-diffusion for co-precision (inverse of covariance matrix). The optimal portfolio weights which solve the dynamic programming problem are genuinely dynamic and proportional to the instantaneous co-precision, reconciling optimal dynamic allocation with the static Markowitz-type economic intuition. Numerical experiments show the accuracy of the proposed approximation and quantify the effect, based on a calibration on historical U.S. data, of price/volatility co-jumps on portfolio selection

Deflators and optimal portfolios under random horizon.

Monday, 16th July - 12:30 - Portfolio Choice and Beyond - Synge - Oral - Abstract ID: 442

Mr. Sina Yansori (University of Alberta), Dr. Tahir Choulli (University of Alberta)

This paper investigates the impact of a random horizon on the optimal investment/portfolio. This random horizon is a general random time that might represent generally an occurrence time of an event (default time) that might impact the market somehow. In this setting, we address the numeraire portfolio and the utility maximization problem. Due to the duality between the investment strategies and the deflators, our ultimate goal translates on explicitly describing the impact of the random horizon on the optimal deflator. For the log utility, it's completely described. We also address the impact of the random time on the numeraire portfolio.

Risk Sensitive Portfolio Optimization with Regime-Switching

Monday, 16th July - 13:00 - Portfolio Choice and Beyond - Synge - Oral - Abstract ID: 104

Dr. Xiang Yu (The Hong Kong Polytechnic University), Dr. Lijun Bo (University of Science and Technology of China), Mr. Huafu Liao (University of Science and Technology of China)

We study an open problem of risk-sensitive portfolio allocation in a regime-switching credit market with default contagion. The state space of the Markovian regime-switching process is assumed to be a countably infinite set. To characterize the value function of the risk sensitive stochastic control problem, we investigate the corresponding recursive infinite-dimensional nonlinear dynamical programming equations (DPEs) based on default states. We propose to construct a sequence of approximating risk sensitive control problems with finite state space and prove that the resulting smooth value functions will converge to the classical solution of the original system of DPEs.

Option Pricing with Orthogonal Polynomial Expansions

Monday, 16th July - 11:30 - Simulation, Estimation and Approximation - Ui Chadhain - Oral - Abstract ID: 123

Dr. Damien Ackerer (Swissquote Bank), Prof. Damir Filipovic (EPFL and Swiss Finance Institute)

We derive analytic series representations for European option prices in polynomial stochastic volatility models. This includes the Jacobi, Heston, Stein–Stein, and Hull–White models, for which we provide numerical case studies. We find that our polynomial option price series expansion performs as efficiently and accurately as the Fourier transform based method in the affine case.

Adaptive numerical methods for stochastic differential equation models with non-Lipschitz coefficients

Monday, 16th July - 12:00 - Simulation, Estimation and Approximation - Ui Chadhain - Oral - Abstract ID: 105

Dr. Conall Kelly (University College Cork), Prof. Gabriel Lord (Heriot-Watt University), Prof. Alexandra Rodkina (The University of the West Indies), Dr. Eeva Rapoo (The University of South Africa)

We present adaptive timestepping strategies for stochastic differential equation models with non-Lipschitz coefficients: consider for example the superlinear diffusion coefficient of the 3/2 stochastic volatility model. These strategies manage highly nonlinear coefficient response in order to control potential runaway growth in numerical solutions. We demonstrate strong convergence of the explicit and semi-implicit Euler-Maruyama method for equations with one-sided drift and globally Lipschitz diffusion and for equations with monotone coefficients respectively. Such an approach can improve multi-level Monte Carlo simulation. A strategy that preserves almost sure stability / instability and positivity for equations with positive, locally Lipschitz coefficients is also presented.

Options Portfolio Selection

Monday, 16th July - 12:30 - Simulation, Estimation and Approximation - Ui Chadhain - Oral - Abstract ID: 498

Dr. Eberhard Mayerhofer (University of Limerick), Dr. Paolo Guasoni (Dublin City University)

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.

Assessment of time-varying systemic risk in credit default swap indices: simultaneity and contagiousness

Monday, 16th July - 13:00 - Simulation, Estimation and Approximation - Ui Chadhain - Oral - Abstract ID: 362

Prof. Hyun Jin Jang (Ulsan National Institute of Science and Technology), Ms. So Eun Choi (Korea Advanced Institute of Science and Technology), Prof. Geon Ho Choe (Korea Advanced Institute of Science and Technology)

The study aims to assess systemic risk inherent in credit default swap (CDS) indices using empirical and statistical analyses. We define systemic risk from two perspectives: possibilities of simultaneous default and contagious default. We then quantify them separately across benchmark models. To do so, we employ a Marshall-Olkin copula model to measure simultaneous default risk, and an interacting intensity based-model to capture contagious default risk. In addition, we select time series models that have minimal prediction errors to forecast the level of systemic risk. For an empirical test, we collect daily data for the iTraxx Europe CDS index and its tranche prices in the period between 2005 and 2014, and calibrate model parameters varying across time. Finally, we examine remarkable changes in each dynamic of systemic risk before and after important credit-related events that have occurred in the global financial and European sovereign debt crises.

Reduced-form framework for life insurance liabilities under model uncertainty

Monday, 16th July - 14:30 - Insurance - Beckett 1 - Oral - Abstract ID: 136

Prof. Francesca Biagini (University of Munich), Ms. Yinglin Zhang (University of Munich)

In this paper we extend the classic reduced-form setting for credit and insurance markets to the case under model uncertainty, when we consider a family of priors possibly mutually singular to each other. To this end, we introduce on a progressively enlarged filtration a sublinear conditional expectation with respect to a family of possibly nondominated probability measures. Furthermore, we study the superhedging approach in continuous time for payment streams under model uncertainty, and establish several equivalent versions of dynamic robust superhedging duality.

Minimum Return Rate Guarantees under Default Risk - Optimal Design of Quantile Guarantees

Monday, 16th July - 15:00 - Insurance - Beckett 1 - Oral - Abstract ID: 167

Prof. Antje Mahayni (University Duisburg-Essen), Mr. Oliver Lubos (University Duisburg-Essen), Mr. Sascha Offermann (University Duisburg-Essen)

The paper analyzes the design of participating life insurance contracts with minimum return rate guarantees. Without default risk, the insured receives the maximum of a guaranteed rate and a participation in the investment returns. With default risk, the payoff is modified by a default put implying a compound option. We represent the yearly returns of the liabilities by a portfolio of plain vanilla options.
In a BS model, the optimal payoff constrained by a maximal shortfall probability can be stated in closed form. Due to the completeness of the market, it can be implemented for any equity to debt ratio.

Optimal Saving and Insurance under Generalized Mean-Variance Preferences

Monday, 16th July - 15:30 - Insurance - Beckett 1 - Oral - Abstract ID: 188

Prof. Nicole Branger (University of Muenster), Prof. Antje Mahayni (University of Duisburg-Essen), Dr. Nikolaus Schweizer (Univfersity of Tilburg), Mrs. Cathleen Sende (University of Duisburg-Essen)

We analyze the optimal insurance demand in a dynamic setup with two periods. In addition to the possibility to insure against losses, the investor is allowed to transfer wealth via savings. To economically interpret the optimal savings and insurance decisions, we rely on a generalized mean-variance setup. This dynamic setup allows us to disentangle time and risk preferences by means of a variance decomposition. While the variance within the period where a loss can occur determines the optimal insurance level, the aversion against the variance of the expected wealth levels over time gives the optimal savings decision.

A market consistent framework for the fair evaluation of insurance contracts under Solvency II

Monday, 16th July - 16:00 - Insurance - Beckett 1 - Oral - Abstract ID: 361

Dr. Anna Maria Gambaro (Universita del Piemonte Orientale), Prof. Gianluca Fusai (Cass Business School, City, University of London), Dr. Riccardo Casalini (UnipolSai Assicurazioni S.p.A.), Dr. Alessandro Ghilarducci (Deloitte Consulting Srl)

Solvency II directive is pushing insurance companies in engaging into market consistence evaluation of their balance sheet, including the financial options embedded in life with-profit funds. The robustness of these valuations is crucial for insurance companies in order to produce sound estimates and good risk management strategies for liability driven products such as with-profit saving and pension funds. This paper introduces a simulative approach for evaluation of insurance assets and liabilities, which is more suitable for risk management of liability driven products than common approaches generally adopted by insurance companies, in particular with respect to the assessment of valuation risk.

A Multidimensional Hilbert Transform Approach for Barrier Option Pricing and Survival Probability Calculation

Monday, 16th July - 14:30 - Option Pricing - Beckett 2 - Oral - Abstract ID: 63

Mr. Jie Chen (The Chinese University of Hong Kong), Ms. Liaoyuan Fan (The Chinese University of Hong Kong), Prof. Lingfei Li (The Chinese University of Hong Kong)

This paper proposes a novel approach for pricing discretely monitored multi-asset barrier options and computing joint survival probability in multivariate exponential Levy asset price models. We prove exponential convergence of the method for a large class of Levy processes and confirm its computational efficiency for popular two-dimensional Levy models and the three-dimensional Black-Scholes model. Our method outperforms the multidimensional Fourier-cosine algorithm.

A closed-form approximation to European option prices under a multifactor extension of Heston's stochastic volatility model

Monday, 16th July - 15:00 - Option Pricing - Beckett 2 - Oral - Abstract ID: 194

Mr. Sotheara Veng (Pusan National University), Prof. Ji-hun Yoon (Pusan National University)

In this study, we extend the multi-scale stochastic volatility model of [Fouque and Lorig, SIAM J. Finan. Math., 2011] by incorporating a slow varying factor of volatility. Asymptotic analysis is developed to obtain an explicit approximation for European option prices. An accuracy result of the asymptotic approximation is also provided. For numerical illustration, our model is calibrated to index options on the market, and we find that the resulting implied volatility surfaces fit the market data much better than those produced by the multi-scale stochastic volatility model of [Fouque and Lorig, SIAM J. Finan. Math., 2011] for long-term call options.

An Approximation of an Equivalent European Payoff for the American Put Option

Monday, 16th July - 15:30 - Option Pricing - Beckett 2 - Oral - Abstract ID: 279

Dr. Ciprian Necula (University of Zurich)

We develop a numerical procedure, in the Black-Scholes model, to approximate the payoff of a European type option generating prices that are equal to the prices of the American put option in the continuation region. This equivalent European payoff is a sum of power payoffs and the price and the hedging indicators can be computed in closed form. For a given set of model parameters the computation of the equivalent European payoff reduces to solving a linear optimization problem. We conduct a numerical experiment and the method produces American prices with relative RMSE less than 0.01% compared to a benchmark.

Perpetual American options in a diffusion model with stochastic interest rates

Monday, 16th July - 16:00 - Option Pricing - Beckett 2 - Oral - Abstract ID: 181

Dr. Pavel Gapeev (London School of Economics and Political Science), Prof. Goran Peskir (The University of Manchester)

We present solutions to the perpetual American standard put and call option pricing problems in an extension of the Black-Merton-Scholes model in which the dynamics of the interest rate are described by a mean-reverting Ornstein-Uhlenbeck process. The method of proof consists of reducing the original optimal stopping problems to the equivalent elliptic-type free-boundary problems and applying the smooth-fit principle for the value functions at the optimal exercise boundaries for the underlying assets. We derive closed-form expressions and some explicit estimates for the value functions and prove that the optimal exercise boundaries provide unique solutions of the appropriate nonlinear integral equations.

A multi-factor polynomial framework for long-term electricity forwards with delivery period

Monday, 16th July - 14:30 - Affine & Polynomial Processes: Applications - Burke Theater - Oral - Abstract ID: 130

Mrs. Xi Kleisinger-Yu (ETH Zurich), Prof. Martin Larsson (ETH Zurich)

We propose a multi-factor polynomial framework to model and hedge long-term electricity forwards with delivery period. In this framework the computation of forwards, their long maturity asymptotics, and cross-maturity correlations are fully explicit, and the model calibration works easily and well. We investigate a rolling hedge that addresses the non-storability of electricity and poor liquidity in long-term markets, and is risk-minimizing in the sense of Föllmer and Schweizer. We calibrate the model to a selection of German power curves and investigate the quality of the hedge. This research is part of a collaboration with Axpo Trading.

A Term Structure Model for Dividends and Interest Rates

Monday, 16th July - 15:00 - Affine & Polynomial Processes: Applications - Burke Theater - Oral - Abstract ID: 293

Mr. Sander Willems (EPFL and Swiss Finance Institute), Prof. Damir Filipovic (EPFL and Swiss Finance Institute)

Over the last decade, dividends have increasingly become a standalone asset class instead of a mere side product of an equity investment. In this paper we present a framework based on polynomial processes to jointly price the term structures of dividends and interest rates. The framework has desirable features such as: i) seasonal behavior in the dividend dynamics, ii) closed-form prices for the term structures of dividend futures and interest rate swaps, iii) efficient moment-based approximations for dividend futures options, stock options, and interest rate swaptions, and iv) a flexible correlation structure between the two term structures.

Quantization goes Polynomial

Monday, 16th July - 15:30 - Affine & Polynomial Processes: Applications - Burke Theater - Oral - Abstract ID: 26

Dr. Giorgia Callegaro (University of Padova), Dr. Lucio Fiorin (University of Padova), Dr. Andrea Pallavicini (Imperial College London)

Quantization algorithms have been recently successfully adopted in option pricing problems to speed up Monte Carlo simulations thanks to the high convergence rate of the numerical approximation. In particular, recursive marginal quantization has been proven a flexible and versatile tool when applied to stochastic volatility processes. In this paper we apply for the first time these techniques to the family of polynomial processes, by exploiting, whenever possible, their peculiar properties. We derive theoretical results to assess the approximation errors, and we describe in numerical examples practical tools for fast exotic option pricing.

Linearized Filtering of Affine Processes Using Stochastic Riccati Equations

Monday, 16th July - 16:00 - Affine & Polynomial Processes: Applications - Burke Theater - Oral - Abstract ID: 445

Prof. Josef Teichmann (ETH Zurich), Mr. Lukas Gonon (ETH Zurich)

We consider an affine process $ X $ which is only observed up to an additive white noise, and we ask for the law of $ X_t $, for some $ t > 0 $, conditional on observations up to time $ t $. This is a possibly high dimensional filtering problem which is not even locally approximately Gaussian, whence essentially only particle filtering methods remain. In this work we present an efficient filter by solving a system of stochastic generalized Riccati differential equations. The efficiency is illustrated with filtering affine stochastic variance processes from discrete price observations.

Optimal investment in an illiquid financial market

Monday, 16th July - 14:30 - Price Impact and Portfolio Choice - Davis - Oral - Abstract ID: 321

Dr. Moritz Voss (University of California, Santa Barbara), Prof. Peter Bank (TU Berlin)

We introduce a price impact model which accounts for finite market depth, tightness and resilience whose coupled bid- and ask-price dynamics induce convex costs. We provide existence of an optimal solution to the classical problem of maximizing expected utility from terminal liquidation wealth. In the simplest model configuration, it turns out that the resulting singular optimal stochastic control problem reduces to a deterministic problem. Rather than studying the associated Hamilton-Jacobi-Bellmann PDE, we exploit convex analytic techniques allowing us to construct the solution explicitly and to describe the free boundaries of the action- and non-action regions in the underlying state space.

Stability for gains from large investors' strategies in M1/J1 topologies

Monday, 16th July - 15:00 - Price Impact and Portfolio Choice - Davis - Oral - Abstract ID: 452

Mr. Peter Frentrup (Humb), Mr. Todor Bilarev (Humboldt-Universitat zu Berlin), Prof. Dirk Becherer (Humboldt-Universitat zu Berlin)

One crucial aspect for market impact models is the definition of gains from block trade: the large investor should be unable to circumvent liquidity cost by fast trading in small blocks or rates. Skorokhod's J_1 topology cannot cover such approximations of a trading strategy; unlike Skorokhod's M_1 topology. Starting from a general model for observed price being a function of an unperturbed price and controlled impact, we extend the gains functional from continuous finite-variation to adapted càdlàg strategies, continuously in M_1 in probability. A large class of strategies helps with optimal liquidation problems, and is a prerequisite for e.g. hedging.

Utility Maximization in a Multidimensional Market with Small Nonlinear Price Impact.

Monday, 16th July - 15:30 - Price Impact and Portfolio Choice - Davis - Oral - Abstract ID: 480

Dr. Thomas Cayé (Dublin City University), Dr. Ibrahim Ekren (University of Michigan), Prof. Erhan Bayraktar (University of Michigan)

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 joint work with Erhan Bayraktar and Ibrahim Ekren.

Quasi-sure duality for multi-dimensional martingale optimal transport

Monday, 16th July - 16:00 - Price Impact and Portfolio Choice - Davis - Oral - Abstract ID: 323

Mr. Hadrien De March (Ecole Polytechnique-CMAP)

We provide a multi-dimensional quasi sure duality for the martingale optimal transport problem. We also prove a disintegration result which states a natural decomposition of the martingale optimal transport problem on the irreducible components, with pointwise duality verified on each component. We also extend the martingale monotonicity principle to the present multi-dimensional setting. Our results hold in dimensions 1, 2, in dimension 3 provided that the target measure is dominated by Lebesgue, or under the Continuum Hypothesis. We finally provide a counterexample showing that smoothness conditions on the coupling function do not guarantee pointwise duality in dimension higher than 2.

Utility Maximization under Model Uncertainty

Monday, 16th July - 14:30 - Robust Finance - Emmet - Oral - Abstract ID: 238

Ms. Dorothee Westphal (TU Kaiserslautern), Prof. Jörn Sass (TU Kaiserslautern), Prof. Ralf Wunderlich (BTU Cottbus-Senftenberg)

When modelling financial markets one is often confronted with model uncertainty in the sense that parameters of the model or the distributions of some factors in the model are only known up to a certain degree. Expert opinions can help towards reducing this uncertainty in a market with Gaussian drift.
In a more general setting, we investigate how optimal trading strategies for a utility maximization problem behave, when the degree of model uncertainty increases. If uncertainty exceeds a certain threshold simple strategies such as uniform portfolio diversification outperform more sophisticated ones due to being more robust.

Convergence of utility indifference prices to the superreplication price in a multiple-priors framework

Monday, 16th July - 15:00 - Robust Finance - Emmet - Oral - Abstract ID: 99

Dr. Romain Blanchard (LMR, Universite Reims Champagne-Ardenne), Prof. Laurence Carassus (Research Center, Leonard de Vinci Pole universitaire and LMR, Universite Reims Champagne-Ardenne)

This paper formulates a utility indifference pricing model for investors trading in a discrete time financial market under non-dominated model uncertainty. The investors preferences are described by strictly increasing concave (possibly) random functions defined on the positive axis. In this multiple-priors framework we prove that the utility indifference price of some contingent claim converges to its superreplication price when the investor absolute risk-aversion tends to infinity. We also revisit the notion of certainty equivalent and establish its relation with the absolute risk aversion.

Dynamic Probability Scoring Rules, Statistical Martingale Testing and Model Selection

Monday, 16th July - 15:30 - Robust Finance - Emmet - Oral - Abstract ID: 487

Prof. Jan Vecer (Charles University)

We present a novel approach for measuring the quality of a time evolving probability estimates. Examples of such probabilistic estimates are election predictions, weather predictions, or probabilities of some market events that appear in hedging of financial products, such as probabilities that a price of an asset will end up over or below a certain level. The basic idea of our approach is that if we have two different probability estimates of the outcome, one can use this discrepancy for setting a trade of these two values against each other. The exact trading price set by this procedure and the corresponding volume is determined by optimization of some utility function that describes the hypothetical behavior of these two bettors. Such optimization procedure finds an equilibrium, where the supply and demand functions of the two agents meet. This creates a sequence of trades that matches every discrepancy that was not reflected in the past trades. We show that the expected profit loss of the true probability series is positive against any other probability sequence regardless of the choice of the utility function. As the true probability evolution is a martingale (conditional expectation of the ultimate outcome), this procedure can be used as a martingale test. In addition,this approach also gives a procedure to select a statistically optimal model, so it can also be used for model selection.

Pricing and hedging in incomplete markets with model uncertainty

Monday, 16th July - 16:00 - Robust Finance - Emmet - Oral - Abstract ID: 207

Dr. Anne Balter (Tilburg University), Prof. Antoon Pelsser (Maastricht University)

We search for a trading strategy and the associated robust price of unhedgeable assets in incomplete markets under the acknowledgement of model uncertainty. This robust optimal control problem under model uncertainty leads to risk-neutral pricing for the traded risky assets, and adjusting the drift of the nontraded risk drivers in a conservative direction. The adjustment that ensures a robust strategy leads to what is known as actuarial or prudential pricing. We prove existence and uniqueness of the robust price in an incomplete market via the link between the PDE and BSDE for viscosity and classical solutions.

Normal Variance Mixture Distributions as Approximations of Poisson Mixture Sums

Monday, 16th July - 14:30 - Stochastic Processes - Swift - Oral - Abstract ID: 463

Prof. Uwe Schmock (Technische Universität Wien), Prof. Peter Eichelsbacher (Ruhr-Universitat Bochum), Dr. Piet Porkert (Technische Universität Wien)

By the central limit theorem and its generalisations, normal and - more generally - stable distributions turn up as weak limits of suitable scaled sums of i.i.d. random variables. When the number of summands is itself random having a Poisson mixture distribution, then normal variance mixture distributions appear as weak limits. This justifies their use to model asset price returns. We give upper bounds for the quality of the approximation with respect to the Kolmogorov and the Wasserstein distance. We also relate these distances to the risk measures value-at-risk and expected shortfall, respectively.

Predictive Distribution of Anticipative alpha-Stable Markov Processes

Monday, 16th July - 15:00 - Stochastic Processes - Swift - Oral - Abstract ID: 415

Mr. Sébastien Fries (ENSAE-ParisTech & CREST)

The anticipative alpha-stable autoregression of order 1 is a stationary Markov process undergoing explosive episodes akin to bubbles in financial time series data. Although featuring infinite variance, conditional moments up to integer order four may exist. Little is known about their forms and this impedes understanding and forecasting of anticipative processes. The conditional expectation, variance, skewness and kurtosis are provided at any forecast horizon under any admissible parameterisation. During bubble episodes, these moments become equivalent to that of a Bernoulli distribution charging complementary probabilities to two polarly-opposite outcomes: pursued explosion or collapse. The results extend to the continuous time Ornstein-Uhlenbeck.

On the Determination of the Lévy Exponent in Asset Pricing Models

Monday, 16th July - 15:30 - Stochastic Processes - Swift - Oral - Abstract ID: 329

Mr. Georgios Bouzianis (Department of Mathematics, King's College London), Prof. Lane Hughston (Goldsmiths College)

We consider the problem of determining the Lévy exponent in a geometric Lévy model for asset prices, given the price data of derivatives. The model, formulated under the real-world probability measure, consists of a pricing kernel together with one or more risky assets driven by the same Lévy process. We show that if the prices of power-payoff derivatives, for which the payoff is the value of the benchmark portfolio raised to the power q, are given for a range of values of q, then the Lévy exponent is completely determined up to an irrelevant linear additive factor.

A closed-form representation of mean-variance hedging for additive processes via Malliavin calculus

Monday, 16th July - 16:00 - Stochastic Processes - Swift - Oral - Abstract ID: 106

Dr. Takuji Arai (Keio University), Dr. Yuto Imai (Waseda University)

We focus on mean-variance hedging problem for models whose asset price follows an exponential additive process. Some representations of mean-variance hedging strategies for jump type models have already been suggested, but none is suited to develop numerical methods of the values of strategies for any given time up to the maturity. In this paper, we aim to derive a new explicit closed-form representation, which enables us to develop an efficient numerical method using the fast Fourier transforms. Note that our representation is described in terms of Malliavin derivatives. In addition, we illustrate numerical results for exponential Levy models.

A mathematical framework for inefficient market bubbles.

Monday, 16th July - 14:30 - Bubbles and Macro Models - Synge - Oral - Abstract ID: 56

Mr. Michael Schatz (ETH Zurich), Prof. Didier Sornette (ETH Zurich)

Following the understanding that asset price bubbles are generated by market failures, we present a framework for explosive semimartingales that is based on the antagonistic combination of (i) an excessive pre-crash process and (ii) the random time of a drawdown.
We show that “rational expectation bubbles” are by design afflicted with an inherent error in both continuous (“strict local martingale”) and discrete time models.
Our framework significantly extends the range of feasible asset price processes during times of excessive growth. It will simplify and foster interdisciplinary exchange at the intersection of economics and mathematical finance and encourage further research.

An Economic Bubble Model and Its First Hitting Time

Monday, 16th July - 15:00 - Bubbles and Macro Models - Synge - Oral - Abstract ID: 213

Mr. Luting Li (London School of Economics and Political Science), Prof. Angelos Dassios (London School of Economics and Political Science)

We introduce a new diffusion process X_t to describe asset price dynamics within an economic bubble cycle. The main feature in our model is the special drift term where the dependence structure among the price, the instantaneous return and the mean-reversion rate are mitigated. Our theoretical works show that both X_t and its first hitting time are well-defined; calibration scheme and related probabilities are provided for application. Numerical examples illustrate the applications in 2000 dot-com bubble and 2007 Chinese stock market crash. In the end a prediction on BitCoin price has been given.

Equity Risk Premium Predictability from Cross-Sectoral Downturns

Monday, 16th July - 15:30 - Bubbles and Macro Models - Synge - Oral - Abstract ID: 267

Prof. Jose Faias (Catolica Lisbon SBE), Prof. Juan Zambrano (Maynooth University)

We use a time-varying endogenous sectoral disaster-risk consumption-based asset pricing model to explain a substantial portion of the equity-risk premium. This model illustrates the crucial role of left cross-sectoral bivariate tail dependence, which endogenously incorporates shocks that are imperceptible at the aggregate level. We proxy left tail dependence by the average of pairwise left tail dependency among major equity sectors, and we confirm that this significantly predicts the equity risk premium in- and out-of-sample and that this information is crucial for improving other predictors' forecasts.

Optimal Retirement in a General Market Environment

Monday, 16th July - 16:00 - Bubbles and Macro Models - Synge - Oral - Abstract ID: 281

Prof. Hyeng Keun Koo (Ajou University), Prof. Zhou Yang (South China Normal University), Prof. Yong Hyun Shin (Sookmyung Women's University)

We study optimal retirement, consumption/portfolio selection problem of an agent in a non-Markovian environment. We show that under a suitable condition the optimal retirement decision is to retire when the individual's wealth reaches a threshold level. We express the value and the optimal strategy by using the strong solution of the backward stochastic partial differential variational inequality (BSPDVI) associated with the dual problem. We derive properties of the value function and the optimal strategy by analyzing the strong solution and the free boundary of the BSPDVI.

Why PD curves calibrated from scoring models should have a Fermi-Dirac shape?

Monday, 16th July - 14:30 - Risk Measures: Theory and Practice - Ui Chadhain - Oral - Abstract ID: 440

Dr. Vivien Brunel (Pole Leonard de Vinci)

Scoring model performance measurement is usualy achieved by using CAP and ROC curves. We map CAP curves to a ball-box problem and we use statistical physics techniques to compute the number of CAP curves that correspond to a given accuracy ratio. We derive the probability of default curve for a scoring model as a function of the portfolio target default rate and the target accuracy ratio of the scoring model, without any additional arbitrary choice. We show that practitioners should stop using logistic PD curves and should adopt the Fermi-Dirac function to improve the accuracy of their credit risk measurement.

Convex Functions on Dual Orlicz Spaces

Monday, 16th July - 15:00 - Risk Measures: Theory and Practice - Ui Chadhain - Oral - Abstract ID: 370

Dr. Keita Owari (Ritsumeikan University), Prof. Freddy Delbaen (ETH Zurich)

In the dual $L_{\Phiˆ*}$ of a Δ_2-Orlicz space L_Φ, that we call a dual Orlicz space, we show that a proper (resp. finite) convex function is lower semicontinuous (resp. continuous) for the Mackey topology $\tau(L_{\Phiˆ*},L_\Phi)$ if and only if on each order interval $[-\zeta,\zeta]=\{\xi: -\zeta\leq \xi\leq\zeta\}$ ($\zeta\in L_{\Phiˆ*}$), it is lower semicontinuous (resp. continuous) for the topology of convergence in probability. For this purpose, we provide the following Komlós type result: every norm bounded sequence $(\xi_n)_n$ in $L_{\Phiˆ*}$ admits a sequence of forward convex combinations $\bar\xi_n\in\mathrm{conv}(\xi_n,\xi_{n+1},...)$ such that $\sup_n|\bar\xi_n|\in L_{\Phiˆ*}$ and $\bar\xi_n$ converges a.s.

Expected shortfall and portfolio management in contagious markets

Monday, 16th July - 15:30 - Risk Measures: Theory and Practice - Ui Chadhain - Oral - Abstract ID: 375

Ms. Alice Buccioli (Aarhus BSS, Aarhus University), Mr. Thomas Kokholm (Aarhus BSS, Aarhus University), Mr. Marco Nicolosi (University of Perugia)

For portfolio allocation purposes, neglecting to consider the interdependence of risks embedded in asset returns leads to underestimating the potential of realizing severe losses over short horizons. To address this contagious risk, we consider a multi-dimensional Hawkes-driven framework where we tackle the problem of minimum loss portfolio allocation, in terms of Expected Shortfall. This is the optimization problem financial institutions face when implementing the capital requirements that are imposed by regulations. We use GMM to estimate the model on three stock indexes (XNG, MSH, BTK) representing three major sectors of the US economy and we perform an extensive out-of-sample back-test.

Fatou property of risk measures on Orlicz spaces

Monday, 16th July - 16:00 - Risk Measures: Theory and Practice - Ui Chadhain - Oral - Abstract ID: 184

Prof. Niushan Gao (Ryerson University), Prof. Denny Leung (National University of Singapore), Prof. Cosimo-Andrea Munari (University of Zurich), Prof. Foivos Xanthos (Ryerson University)

For a coherent risk measure ρ *on the space of bounded random variables*, Delbaen (2002) proved that ρ can be represented as the worst expectation over a class of probabilities whenever ρ has the Fatou property. Lately, it has been asked whether Delbaen's representation theorem holds on more general model spaces, specifically, Orlicz spaces. In this talk, we present a comprehensive investigation on this problem. We show that theorem fails in general and remains valid if if the risk measure possess additional properties (e.g., law-invariance, strong Fatou property).

Portfolio Optimisation with Semivariance

Tuesday, 17th July - 11:30 - Mean-Risk Asset Allocation - Beckett 1 - Oral - Abstract ID: 47

Dr. Kwok Chuen Wong (Dublin City University), Dr. Paolo Guasoni (Dublin City University)

In this talk, I shall study dynamic portfolio management using semivariance as a portfolio risk measure. In the literature, mean-semivariance optimisation under the Black-Scholes model has been shown to be no optimal solution. Inspired by this non-existence result, I shall establish necessary and sufficient conditions under which the mean-semivariance optimisation possesses an optimal solution. I shall suggest the models under which such sufficient conditions are satisfied. Besides, I shall establish that utility-semivariance optimisation possesses an optimal solution even under the Black-Scholes model. I will conclude this talk by investigating the extension to general downside deviation risk measures.

Optimal Portfolio Allocation with Option-Implied Moments: A Forward-Looking Approach

Tuesday, 17th July - 12:30 - Mean-Risk Asset Allocation - Beckett 1 - Oral - Abstract ID: 117

Ms. Tzu-ying Chen (National Taiwan University), Prof. San-lin Chung (National Taiwan University), Prof. Yaw-Huei Wang (National Taiwan University)

This paper proposes a forward-looking approach to estimate individual stock moments from option prices, including option-implied mean, volatility, beta, and covariance, and uses these inputs to determine optimal portfolios. We find that using forward-looking information to form optimal portfolios leads to a significant improvement in out-of-sample performance. In particular, its superiority is largely due to the use of forward-looking mean. The superior performance of our forward-looking approach is significantly more pronounced during crisis periods, even after accounting for transactions costs.

Dynamic Mean-Risk Asset Allocation and Myopic Strategies: A Universal Portfolio Rule

Tuesday, 17th July - 13:00 - Mean-Risk Asset Allocation - Beckett 1 - Oral - Abstract ID: 193

Mr. Xuedong He (The Chinese University of Hong Kong), . Zhaoli Jiang (The Chinese University of Hong Kong)

In a market that consists of multiple stocks and one risk-free asset whose expected return rates and volatility are deterministic, we study a continuous-time mean-risk portfolio selection problem in which an agent is subject to a constraint that the expectation of her terminal wealth must exceed a target and minimizes the risk of her investment, which can be the variance or tail risk of her terminal wealth. Setting the target to be proportion to the agent's current wealth, we derive the equilibrium policy in closed form, and this policy is myopic and does not depend on the risk measure ...

Sovereign-Bond Backed Securities as a new Safe Asset for the Eurozone: a Dynamic Credit Risk Perspective

Tuesday, 17th July - 11:30 - Credit Risk 1 - Beckett 2 - Oral - Abstract ID: 412

Prof. Rüdiger Frey (Vienna University of Economics and Business)

We carry out a detailed quantitative analysis for synthetic securities backed by diversified portfolios of European sovereign bonds (socalled SBSs). Such securities have recently received a lot of interest as a tool to improving the functioning of the euro area. For this we popose a reduced-form credit risk model with common Markov modulated mean-reversion level that captures the co-movement of credit spreads. We carry out an empirical analysis of this model and derive analytical pricing formulas. Moreover, we study the robustness of SBSs and the impact of defaults and regime switches on the volatility of SBSs.

CDS index options in Markov chain models

Tuesday, 17th July - 12:00 - Credit Risk 1 - Beckett 2 - Oral - Abstract ID: 453

Dr. Alexander Herbertsson (University of Gothenburg)

We study CDS index options in a credit risk model where default times have intensities which are driven by a finite-state Markov chain representing the underlying economy. In this setting, we derive computational tractable formulas for the price of a CDS index option. In particular, the evaluation of the CDS index option is handled by translating the Cox-framework into a bivariate Markov chain. Under same exogenous circumstances, we give numerical examples showing that CDS index options prices in the Markovian model can be several hundred percent bigger compared with models assuming that the CDS index spreads follows a log-normal process.

Modelling Liquidation Risk with Occupation Times

Tuesday, 17th July - 12:30 - Credit Risk 1 - Beckett 2 - Oral - Abstract ID: 466

Dr. Roman Makarov (Wilfrid Laurier University)

We develop a new structural model that allows for a distinction between default and liquidation to be made. Default occurs when firm's asset value process crosses a bankruptcy barrier. Here, we do not assume that default immediately triggers liquidation. Instead, the firm is allowed to continue operating even if it is in default. Liquidation is triggered as soon as the firm's asset value has cumulatively spent a prespecified amount of time below the default barrier or has dropped below the liquidation barrier. The proposed model includes the Black–Cox model as a limiting case.

Mimicking Credit Ratings by a Perpetual-Debt Structural Model

Tuesday, 17th July - 13:00 - Credit Risk 1 - Beckett 2 - Oral - Abstract ID: 474

Prof. Gaia Barone (LUISS, Rome)

In this paper, we outlined the general lines of a structural model that is based on the Leland model (1994), but differs from its assumptions about the tax regime. In the revised model, that we will call Perpetual Debt Structural Model (PDSM), stocks are equivalent to a portfolio that contains a perpetual American option to default.This paper aims to offer a first empirical test of the model. Essentially, the question is: «Is the PDSM is sufficiently flexible to give default probabilities consistent with those historically estimated by Moody's?». The answer is positive. The paper contains a simple firm-level application.

Convex duality and Orlicz spaces in expected utility maximization

Tuesday, 17th July - 11:30 - Arbitrage Theory - Burke Theater - Oral - Abstract ID: 169

Prof. Sara Biagini (LUISS, Rome), Prof. Aleš Černý (Cass Business School, City, University of London)

We report further progress towards a complete theory of state-independent expected utility maximization with semimartingale price processes for arbitrary utility function. Without any technical assumptions we establish a surprising Fenchel duality result on conjugate Orlicz spaces, offering fresh perspective on the classical papers of Kramkov and Schachermayer (1999, 2003). This leads to new notion of *effective market completion*and shows dual optimizer cannot be associated with a supermartingale deflator in general. The analysis points to an intriguing interplay between no-arbitrage conditions and standard convex optimization and motivates study of the Fundamental Theorem of Asset Pricing (FTAP) for Orlicz tame strategies.

How local in time is the no-arbitrage property under capital gains taxes ?

Tuesday, 17th July - 12:00 - Arbitrage Theory - Burke Theater - Oral - Abstract ID: 332

Prof. Christoph Kühn (Goethe University Frankfurt)

In frictionless financial markets, no-arbitrage is a local property in time. This means, a discrete time model is arbitrage-free if and only if there does not exist a one-period-arbitrage. With capital gains taxes, this equivalence fails. For a model with a linear tax and one non-shortable risky stock, we introduce the concept of robust local no-arbitrage (RLNA) as the weakest local condition which guarantees dynamic arbitrage-freeness. Under a sharp dichotomy condition, we prove (RLNA). Since no-one-period-arbitrage is necessary for no-arbitrage, the latter is nested between two local conditions, which allows us to estimate its non-locality.

Arbitrage-Free Pricing in Nonlinear Market Models

Tuesday, 17th July - 12:30 - Arbitrage Theory - Burke Theater - Oral - Abstract ID: 103

Prof. Tomasz Bielecki (Illinois Institute of Technology), Prof. Igor Cialenco (Illinois Institute of Technology), Prof. Marek Rutkowski (University of Sydney)

We proposed a nonlinear arbitrage-free pricing theory, which arises in a natural way when accounting for salient features of real-world trades such as: trading constraints, differential funding costs, collateralization, counterparty credit risk and capital requirements. We introduce the notion of regular market models, and within this class of models, we propose several notions of no-arbitrage, and several definitions of fair prices. Finally, we will discuss the BSDEs approach to the proposed valuation and hedging methodology, and we will consider several illustrative examples.

Absence of arbitrage revisited

Tuesday, 17th July - 13:00 - Arbitrage Theory - Burke Theater - Oral - Abstract ID: 288

Prof. Martin Schweizer (ETH Zurich), Mr. Daniel Balint (ETH Zurich)

The classic Black-Scholes model on an infinite horizon does not admit an equivalent martingale measure unless we already start with a martingale model. So it does not satisfy NFLVR. But in which sense is it still possibly "arbitrage-free"? We provide a general analysis of this type of question on an open time interval for asset prices which are nonnegative semimartingales and whose sum never hits zero. Martingale-type characterisations and many explicit examples illustrate our approach.

The Evaluation of Gas Sales Agreements with Indexation using GPUs

Tuesday, 17th July - 11:30 - Computational Finance - Davis - Oral - Abstract ID: 110

Mr. Wenfeng Dong (University of York), Dr. Boda Kang (University of York)

A typical gas sales agreement is an agreement between a supplier and a purchaser for the delivery of variable daily quantities of gas between specified minimum and maximum daily limits. The main constraint of such an agreement that makes them difficult to value is that the strike price is set based on the indexation principle under which the strike price is called the index. We design an algorithm to price such swing contracts and find optimal daily decisions by using GPUs. With the help of a concrete numerical example, we also provide detailed analysis.

Stochastic Grid Bundling Method for Backward Stochastic Differential Equations

Tuesday, 17th July - 12:00 - Computational Finance - Davis - Oral - Abstract ID: 360

Mr. Ki Wai Chau (Centrum Wiskunde & Informatica), Prof. Cornelis W. Oosterlee (Centrum Wiskunde & Informatica)

We apply stochastic grid bundling method (SGBM) to numerically solve backward stochastic differential equations.
SGBM takes advantage of both regress-later and the adaptive local basis to improve on traditional Monte-Carlo regression.
The dependent variable is regressed in SGBM on basis functions at the end of the interval instead of the beginning as in traditional method, and the conditional expectation is computed exactly. This results in better accuracy.
With the adaptive local basis approach, the regression basis is defined on a partition of the domain, and the partition depends on the simulated examples. This results in better result and scalability.

Geometric Learning and Filtering in Finance

Tuesday, 17th July - 12:30 - Computational Finance - Davis - Oral - Abstract ID: 408

Mr. Anastasis Kratsios (Concordia University), Dr. Cody Hyndman (Concordia University)

We develop a method for incorporating relevant geometric information into a broad range of classical filtering and machine learning algorithms. We apply these techniques to approximate the solution of the non-Euclidean filtering problem to arbitrary precision. We then extend the particle filtering algorithm to compute our asymptotic solution to arbitrary precision. The filtering techniques are applied to incorporate the non-Euclidean geometry present in stochastic volatility models, optimal Markowitz portfolios and the shape of the forward-rate. We obtain improvements of principal component analysis and the improved algorithms can be used to parsimoniously estimate the evolution of the shape of forward-rate curves.

Second order sensitivities in linear or constant time

Tuesday, 17th July - 13:00 - Computational Finance - Davis - Oral - Abstract ID: 410

Dr. Roberto Daluiso (University of Milano-Bicocca)

We analyse and compare methods to compute the full set of second order sensitivities of a Monte Carlo price in a time which is at most O(NT) where N is the number of inputs and T is the time required to compute the price. The new ones include an algorithm which achieves a complexity O(T), unlike the O(NT) attained by all recipes from previous literature.

A multiple-curve Lévy forward rate model in a two-price economy

Tuesday, 17th July - 11:30 - HJM models and Variations - Emmet - Oral - Abstract ID: 346

Dr. Christoph Gerhart (University of Freiburg), Prof. Ernst Eberlein (University of Freiburg)

An advanced Heath-Jarrow-Morton (HJM) forward rate model driven by time-inhomogeneous Lévy processes is presented which is able to handle the recent development to multiple curves and negative interest rates. It is also able to exploit bid and ask price data. Valuation formulas for standard interest rate derivatives such as caps, floors, swaptions and digital options are established. These formulas can numerically be evaluated very fast by using Fourier based valuation methods. Calibration results are presented based on data from September 2013 and September 2016. The latter is of particular interest since rates were deep in negative territory at that time.

A stochastic spread HJM model with stochastic volatility

Tuesday, 17th July - 12:00 - HJM models and Variations - Emmet - Oral - Abstract ID: 108

Dr. Karl Hofmann (Deloitte GmbH), Mr. Moritz Geelhaar (TU Berlin), Prof. Antonis Papapantoleon (National Technical University of Athens), Dr. Patrick Büchel (Commerzbank AG)

We present an interest rate model incorporating stochasticity on spreads on the OIS rate, employing a Trolle–Schwartz model for the OIS rate and a Trolle–Schwartz commodity model for the spreads, both facilitating stochastic volatility. We describe the model's basic properties and derive necessary drift conditions following the works of Grbac and Rungaldier to ensure arbitrage-free-ness under the OIS numéraire. Moreover, we provide a simulation scheme for the hypothetical spread bonds and derive a semi-closed-form solution based on Fourier pricing methods for bond options on spread-bearing zero bonds.

The Heath-Jarrow-Morton Model with Regime Shifts and Jumps Priced

Tuesday, 17th July - 12:30 - HJM models and Variations - Emmet - Oral - Abstract ID: 90

Prof. Robert Elliott (University of Calgary/University of South Australia), Prof. Tak Kuen Siu (Macquarie University)

The pricing of regime-switching risk in a Markovian, regime-switching, Heath-Jarrow-Morton environment in Elliott and Siu (2016) is re-visited. An extended Heath-Jarrow-Morton model for stochastic forward rates incorporating both regime shifts and jumps is considered, where jumps in the forward rate dynamics are directly triggered by regime switches. No-arbitrage drift conditions taking into account the pricing of both the regime-switching and jump risks are derived by considering two situations. The rst situation starts with a risk-neutral measure while the second situation starts with a real-world measure.
Keywords:

A Consistent Stochastic Model of the Term Structure of Interest Rates for Multiple Tenors

Tuesday, 17th July - 13:00 - HJM models and Variations - Emmet - Oral - Abstract ID: 265

Prof. Martino Grasselli (University of Padua and DVCR Paris), Mr. Mesias Alfeus (University of Technology Sydney), Prof. Erik Schlogl (University of Technology Sydney)

We construct a stochastic model framework for the term structure of interest rates in which a frequency basis arises endogenously. This roll-over risk consists of two components, a credit risk component due to the possibility of being downgraded and thus facing a higher credit spread when attempting to roll over short–term borrowing, and a component reflecting the (systemic) possibility of being unable to roll over short–term borrowing at the reference rate (e.g., LIBOR) due to an absence of liquidity in the market.

Adaptive Robust Trading Under Model Uncertainty

Tuesday, 17th July - 11:30 - High Frequency Trading - Swift - Oral - Abstract ID: 254

Prof. Tomasz Bielecki (Illinois Institute of Technology), Prof. Tao Chen (University of California, Santa Barbara), Prof. Igor Cialenco (Illinois Institute of Technology), Prof. Areski Cousin (University of Strasbourg), Prof. Monique Jeanblanc (Evry University)

We propose a new methodology, called adaptive robust control, for solving a discrete-time Markovian control problem subject to Knightian uncertainty. We apply the general framework to an optimal investment problem where the uncertainty comes from the fact that the true law of the underlying model is only known to belong to a certain family of probabilities. We provide a learning algorithm that reduces the model uncertainty through progressive learning about the unknown system. One pillar in the proposed methodology is the recursive construction of the confidence sets for the unknown parameter, which allows to establish the corresponding Bellman equations.

Algorithmic Trading with Partial Information: A Mean Field Game Analysis

Tuesday, 17th July - 12:00 - High Frequency Trading - Swift - Oral - Abstract ID: 450

Dr. Sebastian Jaimungal (University of Toronto), Mr. Philippe Casgrain (University of Toronto)

Financial markets are often driven by latent factors. Here, we address an algorithmic trading problem with collections of heterogeneous agents who aim to perform statistical arbitrage in such latent environments, and the trading actions of all agents have permanent and temporary impact. We solve the stochastic game by investigating its mean-field game limit and, using a novel convex analysis approach, we show that the solution is characterized by a vector-valued FBSDE. We demonstrate that the FBSDE admits a unique solution, and obtain it in closed-form. Moreover, we prove that the MFG equilibrium provides an ϵ-Nash equilibrium for the finite game.

Daily Leveraged ETF Rebalancing under Market Frictions

Tuesday, 17th July - 12:30 - High Frequency Trading - Swift - Oral - Abstract ID: 286

Prof. Min Dai (National University of Singapore), Prof. Steven Kou (National University of Singapore), Prof. Halil Mete Soner (ETH Zurich), Dr. Chen Yang (ETH Zurich)

Leveraged Exchange-Traded Fund is an instrument that aims at target daily returns equal to a constant multiple of underlying daily returns. Common LETF rebalancing strategies involve large transactions daily right before market closure, which is costly due to market frictions like transaction costs and front-running. We propose a stochastic control model involving market frictions and market closure, and find the optimal intraday rebalancing strategy explicitly. The optimal strategy strikes a balance between today's optimal leverage and preparation for tomorrow, exhibiting a U-shaped trading pattern. Also, we observe slippage in our model, consistent with the empirical findings on LETF return deviations.

Maximising Fill Ratios in FX Markets with Latency, Volatility and Model Ambiguity

Tuesday, 17th July - 13:00 - High Frequency Trading - Swift - Oral - Abstract ID: 248

Mr. Leandro Sánchez Betancourt (University of Oxford), Dr. Alvaro Cartea (University of Oxford)

We analyse how latency affects the strategies of foreign exchange (FX) traders that send liquidity taking orders to the FX electronic exchange. Latency affects the prices and fill ratios obtained by traders. In this paper we assume that traders send marketable orders with a price limit, targeting a desired fill ratio (FR). We develop a model that maximizes FR whilst minimising how deep the marketable orders can walk the FX exchange's limit order book, we also consider model ambiguity. We solve in close form and employ a proprietary data set to show the performance of our proposed dynamic trading strategy.

Optimal Stopping and the Sufficiency of Randomized Threshold Strategies

Tuesday, 17th July - 11:30 - Optimal Stopping - Synge - Oral - Abstract ID: 322

Prof. David Hobson (University of Warwick), Mr. Matthew Zeng (warwic), Dr. Vicky Henderson (University of Warwick)

In a classical optimal stopping problem the aim is to maximize the expected value of a functional of a diffusion evaluated at a stopping time. This note considers optimal stopping problems beyond this paradigm in which the value associated to a stopping rule depends on the law of the stopped process. If this value is quasi-convex then it is sufficient to restrict attention to the class of threshold strategies. However, if the objective function is not quasi-convex, this may not be the case. We show that, nonetheless, it is sufficient to restrict attention to mixtures of threshold strategies.

Optimal Stopping at Random Intervention Times

Tuesday, 17th July - 12:00 - Optimal Stopping - Synge - Oral - Abstract ID: 163

Mr. Mick Schaefer (University of Hamburg), Prof. Alexander Szimayer (University of Hamburg)

We propose a Markovian model to value American-style complete contracts of temporarily inattentive agents. Exercise decisions maximizing the contract's payoff are not admissible continuously but at random intervention times. Premature forced exercise events can occur randomly accounting for e.g. liquidity needs or mortality. We state the contract value in terms of an optimal stopping problem which is converted to optimal control and provides a characterization in terms of a partial integro differential equation. We suggest the three numerical approaches, forward improvement iteration, finite differences and least squares Monte-Carlo, where the latter can treat the most complex and multi-dimensional settings.

Optimal stopping in a large financial network model

Tuesday, 17th July - 12:30 - Optimal Stopping - Synge - Oral - Abstract ID: 253

Prof. Nils Detering (University of California, Santa Barbara), Prof. Jean-Pierre Fouque (University of California, Santa Barbara), Dr. Tomoyuki Ichiba (University of California, Santa Barbara)

We shall consider and characterize an optimal stopping problem of a nonlinear diffusion for a node directly coupled with a neighboring node and the empirical measure of the nodes in a large financial network. We start with a finite system of linear stochastic equations for the nodes in the network and study its limits, as we let the number of nodes go to infinity. Then we propose a simple optimal stopping problem for the limiting system and analyze it via the method of backward stochastic differential equation.

Optimal stopping strategies of behavioral gamblers in finite time horizons

Tuesday, 17th July - 13:00 - Optimal Stopping - Synge - Oral - Abstract ID: 27

Dr. Sang Hu (The Chinese University of Hong Kong, Shenzhen), Prof. Jan Obloj (University of Oxford), Prof. Xunyu Zhou (Columbia University)

The optimal casino gambling of infinite horizon has been well studied by He et al (2017). In this paper we present systematic solution to finite-time betting problem. Skorokhod embedding in finite horizon arises due to the change of decision variables from stopping time to probability distribution function. In solving the embedding problem, we introduce randomized Root stopping time and derive necessary and sufficient conditions such that stopping time exists given the distribution. We also show that if there exists any other stopping time that embeds the given probability distribution in finite horizon, there exists randomized Root stopping time.

Equilibrium with Heterogenous Information

Tuesday, 17th July - 11:30 - Equilibria: Heterogenous Preferences & Information, Learning & Reference Dependence - Ui Chadhain - Oral - Abstract ID: 133

Prof. Scott Robertson (Boston University, Questrom School of Business), Prof. Marcel Rindisbacher (Boston University, Questrom School of Business), Prof. Jerome Detemple (Boston University, Questrom School of Business)

We consider the equilibrium problem in the presence of information asymmetry. There are three investor types: informed, who initially see a noisy version of the terminal asset value; uninformed who see no signal; and noise, who think they are seeing a signal, but are seeing pure noise. All three types seek to maximize expected utility form terminal wealth. Equilibrium consists of a market filtration, asset dynamics, and optimal strategies satisfying the clearing condition. Under minimal conditions, equilibria are established using multiple filtration enlargements. Explicit identification of the market signal, the asset dynamics, and optimal trading strategies are given.

Heterogeneous Preferences, Constraints, and the Cyclicality of Leverage

Tuesday, 17th July - 12:00 - Equilibria: Heterogenous Preferences & Information, Learning & Reference Dependence - Ui Chadhain - Oral - Abstract ID: 157

Mr. Tyler Abbot (Sciences Po)

This paper solves an open problem in financial mathematics by characterizing the equilibrium in a continuous time financial market populated by heterogeneous agents who differ in their rate of relative risk aversion and face convex portfolio constraints. The model is studied in an application to margin constraints. It is shown how margin constraints increase the market price of risk and decrease the interest rate, producing a higher equity risk premium. In addition, heterogeneity and margin constraints are shown to produce both pro- and counter-cyclical leverage cycles. This ambiguity of the leverage cycle is then documented empirically.

The Learning Premium

Tuesday, 17th July - 12:30 - Equilibria: Heterogenous Preferences & Information, Learning & Reference Dependence - Ui Chadhain - Oral - Abstract ID: 338

Prof. Maxim Bichuch (Johns Hopkins University), Dr. Paolo Guasoni (Dublin City University)

We find equilibrium stock prices and interest rates in a representative-agent model with uncertain dividends' growth, gradually revealed by dividends themselves, where asset prices are rational – reflect current information and anticipate the impact of future knowledge on future prices. In addition to the usual risk-premium, stock returns include a learning premium, which reflects the expected change in prices from new information. In the long run, the learning premium vanishes, as prices and interest rates converge to their counterparts in the standard setting with known growth. The model helps explains the increase in price-dividend ratios of the past century.

Reference Dependence and Market Participation

Tuesday, 17th July - 13:00 - Equilibria: Heterogenous Preferences & Information, Learning & Reference Dependence - Ui Chadhain - Oral - Abstract ID: 479

Dr. Andrea Meireles Rodrigues (Dublin City University)

This paper finds optimal portfolios for the reference-dependent preferences of Koszegi and Rabin, with piecewise linear gain-loss utility, in a one-period model with a safe and a risky asset. If the return of the risky asset is highly dispersed relative to its potential gains, two personal equilibria arise, one of them including risky investments, the other one only safe holdings. In the same circumstances, the risky personal equilibrium entails market participation that decreases with loss aversion and gain-loss sensitivity, whereas the preferred personal equilibrium is sensitive to market and preference parameters.

Inter-temporal Mutual Fund Management

Tuesday, 17th July - 14:30 - Optimal Control and Optimal Investment 1 - Beckett 1 - Oral - Abstract ID: 96

Prof. Phillip Yam (The Chinese University of Hong Kong), Prof. Alain Bensoussan (UT Dallas and CityU HK), Dr. Yiqun Li (CityU HK)

In this talk, I shall introduce a way to completely resolve the general intertemporal mutual fund (open-end) management problem which has been long missing in the field. Even though the primal HJB equation drastically turns into a fully non-linear PDE which can barely be treated by common prevalent approach, we propose a transformation together with a notable extension of existing PDE theory. Interesting financial consequence, especially in contrast to those portfolio management strategies only concerning on the terminal reward, will be discussed.

Optimal Portfolio Choice for Early Retirement with Cointegration between the Stock and Labor Markets

Tuesday, 17th July - 15:00 - Optimal Control and Optimal Investment 1 - Beckett 1 - Oral - Abstract ID: 31

Prof. Min Dai (National University of Singapore), Mrs. Shan Huang (National University of Singapore), Dr. Seyoung Park (Loughborough University)

We present an optimal portfolio choice for retiring early when a borrowing and short sale constrained investor is facing cointegration between the stock and labor markets. There exists a target wealth-to-income ratio under which the investor does not invest in stocks, whereas above which she increases the proportion of financial wealth invested in stocks as she accumulates wealth. Contrary to common intuition, flexibility in determining the retirement timing allows the investor to invest less in stocks than without retirement flexibility. The investor's willingness to retire earlier becomes stronger as risk aversion increases or as wages decline in the long term.

Outperformance and Tracking: Dynamic Asset Allocation for Active and Passive Portfolio Management

Tuesday, 17th July - 15:30 - Optimal Control and Optimal Investment 1 - Beckett 1 - Oral - Abstract ID: 387

Mr. Ali Al-Aradi (University of Toronto), Dr. Sebastian Jaimungal (University of Toronto)

Portfolio management problems are often divided into two types: active and passive, where the objective is to outperform and track a preselected benchmark, respectively. Here, we formulate and solve a dynamic asset allocation problem that combines these two objectives in a unified framework. We look to maximize the expected growth rate differential between the wealth of the investor's portfolio and that of a performance benchmark while penalizing risk-weighted deviations from a given tracking portfolio. Using stochastic control techniques, we provide closed-form expressions for the optimal allocation and show how the optimal strategy can be related to the growth optimal portfolio.

Investing for the Long Run

Tuesday, 17th July - 16:00 - Optimal Control and Optimal Investment 1 - Beckett 1 - Oral - Abstract ID: 160

Prof. Eckhard Platen (University of Technology Sydney), Prof. Dietmar Leisen (University of Mainz)

This paper studies long term investing by an investor that maximizes either expected utility from terminal wealth or from consumption. We introduce the concepts of a growth optimal portfolio (GP) and of the minimum price to attain target payouts. The paper finds that the dynamics of the GP needs to be captured and not the entire market dynamics, which simplifies significantly practical implementations of optimal portfolio strategies. Our concepts allow us to reconcile utility optimization with the practitioner approach of growth investing. We illustrate empirically that our new framework leads to improved lifetime consumption portfolio choice and asset allocation strategies.

Optimal Strategies With Option Compensation Under Mean Reverting Returns or Volatilities

Tuesday, 17th July - 14:30 - Utility Maximization: Opinions, Constraints and Computation - Beckett 2 - Oral - Abstract ID: 392

Mr. Marco Nicolosi (University of Perugia), Prof. Stefano Herzel (University of Rome, Tor Vergata)

We study the problem of a fund manager whose contractual incentive is
given by the sum of a constant and a variable term. The manager has a power utility function and the continuous time stochastic processes driving the dynamics of the market prices exhibit mean reversion either in the volatilities or in the expected returns. We provide an approximation for the optimal wealth and for the optimal strategy based on affine processes and the fast fourier transform.

High-frequency expert opinions and power utility maximization in a market with Gaussian drift

Tuesday, 17th July - 15:00 - Utility Maximization: Opinions, Constraints and Computation - Beckett 2 - Oral - Abstract ID: 446

Prof. Ralf Wunderlich (BTU Cottbus-Senftenberg), Prof. Abdelali Gabih (Universite Chouaib Doukkali), Mr. Hakam Kondakji (Brandenburg University of Technology Cottbus-Senftenberg)

In a continuous-time financial market with partial information on the drift we solve utility maximization problems which include expert opinions on the unobservable drift modelled by an Ornstein Uhlenbeck process. For improving drift estimates and expected utility investors also rely on expert opinions providing a noisy estimate of the current state of the drift. That procedure can be seen as a continuous-time version of the classical Black-Litterman approach.
For solving a portfolio problem for power utility we apply dynamic programming techniques. Diffusion approximations for high-frequency discrete-time experts allow to simplify the problem and to derive more explicit solutions.

A sensitivity analysis of the long-term expected utility of optimal portfolios

Tuesday, 17th July - 15:30 - Utility Maximization: Opinions, Constraints and Computation - Beckett 2 - Oral - Abstract ID: 200

Prof. Hyungbin Park (Seoul National University), Prof. Stephan Sturm (Worcester Polytechnic Institute)

This talk discusses the sensitivity of the long-term expected utility of optimal portfolios. Under an incomplete market given by a factor model, we consider the utility maximization problem with long-time horizon. The main purpose is to find the extent how much the optimal expected utility is affected in the long run for small changes of the underlying factor model. The long-term behavior of the optimal expected utility can be characterized by a solution pair of an ergodic HJB equation, and we will conclude that this solution pair determines the long-term sensitivity.

Risk management with multiple VaR constraints

Tuesday, 17th July - 16:00 - Utility Maximization: Opinions, Constraints and Computation - Beckett 2 - Oral - Abstract ID: 154

Prof. An Chen (University of Ulm), Dr. Thai Nguyen (University of Ulm), Prof. Mitja Stadje (University of Ulm)

We study the utility maximization problem under multiple Value-at-Risk constraints, which is particularly important for financial institutions which have to follow short-time VaR-type regulations under somerealistic regulatory frameworks like Solvency II, but need to serve long-term liabilities. We show that multiple VaR constraints for long-term investors is useful for loss prevention at intermediate time instances andthe multiple-VaR solution at maturity on average dominates the one-VaR solution in a wide range of intermediate market scenarios, but performs worse in good and very bad market scenarios. The range of these very bad market scenarios is however rather limited.

Maximum likelihood estimation of first-passage structural credit risk models correcting for the survivorship bias

Tuesday, 17th July - 14:30 - Econometrics - Burke Theater - Oral - Abstract ID: 373

Dr. Diego Amaya (Wilfrid Laurier University), Dr. Mathieu Boudreault (Universite du Quebec a Montreal), Prof. Don McLeish (University of Waterloo)

We study the statistical properties of the maximum likelihood estimator (MLE) accounting for survivorship bias for models based on the first-passage of the geometric Brownian motion. We find that neglecting the survivorship bias overestimates the drift while conditioning on survival underestimates it. Therefore, we propose a bias correction method for non-iid samples that is first-order unbiased and second-order efficient. With an empirical study based upon a sample of more than 13,000 companies over the period 1980 through 2016 inclusive, our results show the economic significance of over- or under-correcting for survivorship.

Self Similarity in Long Horizon Returns

Tuesday, 17th July - 15:00 - Econometrics - Burke Theater - Oral - Abstract ID: 65

Prof. Dilip Madan (Robert H. Smith School of Business)

Daily return distributions are limit laws associated with pure jump processes. The processes are a combination of identically distributed increments and a selfsimilar distribution. The presence of a selfsimilar component with a scaling coefficient above a half is shown to halt the converge to a normal distribution. Estimations conducted on 214 equity underliers over the period January 2007 to February 2017 support this lack of convergence to normality at very long horizons. In the long run markets are perpetual motion machines creating the information of their necessary movements and then responding to these with an exponential decay.

Do Hedge Funds Hedge? New Evidence from Tail Risk Premia Embedded in Options

Tuesday, 17th July - 15:30 - Econometrics - Burke Theater - Oral - Abstract ID: 152

Dr. Anmar Al Wakil (University of Paris-Dauphine), Prof. Serge Darolles (University of Paris-Dauphine)

This paper deciphers tail risk in hedge funds from option-based trading strategies. It demonstrates tradable tail risk premia strategies as measured by pricing discrepancies between real-world and risk-neutral distributions are instrumental in hedge fund performance, in both time-series and cross-section. After controlling for Fung-Hsieh factors, a positive one-standard deviation shock to volatility risk premia is associated with a decline in aggregate hedge fund returns of 25.2% annually. Results evidence hedge funds that load on volatility (kurtosis) risk premia subsequently outperform low-beta funds by 11.7% (8.6%) annually. It suggests to what extent hedge fund alpha arises from selling crash insurance strategies.

Gaussian approximation of maxima of Wiener functionals and its application to high-frequency data

Tuesday, 17th July - 16:00 - Econometrics - Burke Theater - Oral - Abstract ID: 471

Prof. Yuta Koike (University of Tokyo)

In this talk we present a new upper bound for the Kolmogorov distance between the maximum of a high-dimensional vector of smooth Wiener functionals and the maximum of a Gaussian random vector. As a special case, we show that the maximum of multiple Wiener-Ito integrals with common orders is well-approximated by its Gaussian analog in terms of the Kolmogorov distance if their covariance matrices are close to each other and the maximum of the fourth cumulants of the multiple Wiener-Ito integrals is close to zero. We also present its application to high-frequency financial econometrics.

Robust Martingale Selection Problem and its Connections to the No-Arbitrage Theory

Tuesday, 17th July - 14:30 - Robust and Model-Free Finance - Davis - Oral - Abstract ID: 203

Dr. Matteo Burzoni (ETH Zurich), Dr. Mario Sikic (University of Zurich)

Given a collection of random sets $V=(V_t)$ the martingale selection problem consists in finding a stochastic process S taking values in V and such that S is a martingale under a measure Q. We derive conditions for the solvability of this problem in a pointwise framework and show how this is related to the no-arbitrage theory. We obtain versions of the Fundamental Theorem of Asset Pricing in examples spanning frictionless, proportional transaction cost and illiquidity markets with possible trading constraints.

Incorporating statistical model error into the calculation of acceptability prices of contingent claims

Tuesday, 17th July - 15:00 - Robust and Model-Free Finance - Davis - Oral - Abstract ID: 89

Mr. Martin Glanzer (University of Vienna), Prof. Georg Pflug (University of Vienna)

Optimal bid and ask prices for contingent claims can be found by stochastic optimization. However, the underlying stochastic model for the asset price dynamics is typically based on data and statistical estimation. We define a confidence set by a nonparametric neighborhood of an estimated baseline model. This neighborhood serves as ambiguity set for a stochastic optimization problem under model uncertainty. We obtain distributionally robust solutions of the acceptability pricing problem and derive the dual problem formulation. Moreover, we relate the bid and ask prices under model ambiguity to the quality of the observed data. Some examples illustrate our results.

Model-free bounds, optimal transport and applications in finance

Tuesday, 17th July - 15:30 - Robust and Model-Free Finance - Davis - Oral - Abstract ID: 418

Prof. Antonis Papapantoleon (National Technical University of Athens), Mr. Daniel Bartl (University of Konstanz), Prof. Michael Kupper (University of Konstanz), Dr. Thibaut Lux (Helvetia Insurance Group), Mr. Stephan Eckstein (University of Konstanz)

This talk considers model-free bounds for multi-asset option prices in a setting where the marginals are known and the dependence structure is partially known. We will first present methods to sharpen the classical Fréchet-Hoeffding bounds on copulas using additional information on the dependence structure, and discuss their application in option pricing. Then, we will consider model-free hedging of multi-asset option prices in the presence of additional information on the dependence structure. An extension of the classical optimal transport super-hedging duality will allow us to provide new insights in model-free hedging, and show (non) sharpness of the improved Fréchet-Hoeffding bounds.

Asset pricing in an imperfect world

Tuesday, 17th July - 16:00 - Robust and Model-Free Finance - Davis - Oral - Abstract ID: 135

Prof. Gianluca Cassese (Universita Milano Bicocca)

In a model with no given probability measure, we consider asset pricing in the presence of frictions and imperfections and characterize the property of coherent pricing, a notion related to (but weaker than) the no arbitrage property. Prices are coherent if and only if the set of pricing measures is non empty, i.e. if pricing by expectation is possible. We then decompose coherent prices highlighting the role of bubbles. Eventually we show that under very weak conditions the coherent pricing of options allows for a very clear representation which allows, as in Breeden and Litzenberger, to extract the implied probability.

EMPIRICAL ANALYSIS AND FORECASTING OF MULTIPLE YIELD CURVES

Tuesday, 17th July - 14:30 - Interest Rate, Yield Curves, and Derivatives - Emmet - Oral - Abstract ID: 128

Prof. Eva Luetkebohmert (University of Freiburg), Dr. Christoph Gerhart (University of Freiburg)

Post-crisis interest rate markets are characterized by multiple (tenor-dependent) yield curves. This paper provides an in-depth empirical analysis of pre– and post–crisis term structures of interest rates. We suggest a consistent and stable approach for bootstrapping of multiple yield curves which we apply to market data over the time period 2005-2017. Based on the resulting daily tenor-dependent yield curves we determine principal components characterizing the shape of yield curves and interest rate spreads. Finally, we develop a simple dynamic factor model to forecast tenor-dependent term structures of interest rates.

Computation and Estimation of Shadow Interest Rate Models

Tuesday, 17th July - 15:00 - Interest Rate, Yield Curves, and Derivatives - Emmet - Oral - Abstract ID: 205

Mr. Muchen Zhao (Northwestern University), Prof. Vadim Linetsky (Northwestern University)

Second order cumulant approximation method proposed by Priebsch (2013) is widely used in shadow rate term structure models. We provide an error analysis for this method, demonstrate large potential errors with realistic parameter configurations, and derive third and fourth order cumulant approximations as the remedy. We show that T-maturity shadow rate volatility (TMSRV) largely determines approximation errors, and thus propose a robust variable order scheme that varies approximation orders based on TMSRV. With estimation on US Treasury data including up to 30-year bonds, we show the second order scheme can generate large errors, while our variable order scheme ensures accuracy.

Long-term risk with stochastic interest rates

Tuesday, 17th July - 15:30 - Interest Rate, Yield Curves, and Derivatives - Emmet - Oral - Abstract ID: 166

Mr. Federico Severino (Universita della Svizzera Italiana)

In continuous-time arbitrage-free markets we study the impact on pricing of the intertemporal aggregation of exposures to short-term rates variability across increasingly large investment horizons. When interest rates are constant, the instantaneous rate drives both risk-neutral prices and the evolution of pricing kernels. However, no ex-ante measurable financial variable is known to play an analogous dual role when rates are stochastic. Without assuming any specific dynamics for interest rates, we show how pure-discount bond yields address this issue when the forward measure is employed. Our analysis is consistent with long-term risk convergences when the horizon under consideration becomes arbitrarily large.

Hybrid Lévy models: Design and computational aspects

Tuesday, 17th July - 16:00 - Interest Rate, Yield Curves, and Derivatives - Emmet - Oral - Abstract ID: 126

Prof. Ernst Eberlein (University of Freiburg), Mr. Marcus Rudmann (University of Freiburg)

Two different versions of a hybrid interest rate-equity model are developed. Independent time-inhomogeneous Lévy processes are used as drivers of the dynamics. Dependence between the markets is generated by introducing the driver of one market as an additional term into the dynamics of the other. In both cases the dependence can be quantified by a single parameter. Numerically efficient valuation formulas for derivatives are developed. As an example for a hybrid financial product a performance basket is discussed. Using market quotes for liquidly traded interest rate and equity derivatives we show that the hybrid approach can be successfully calibrated.

Option Market Making with Imperfect Competition

Tuesday, 17th July - 14:30 - Equilibria: Macro - and Microeconomic Aspects - Swift - Oral - Abstract ID: 305

Dr. Martin Herdegen (Warwick), Prof. Johannes Muhle-Karbe (Carnegie Mellon University), Mr. Florian Stebegg (Columbia University)

Option pricing models typically consider either monopolistic market makers, or settings with infinite competition. Real markets, however, are often dominated by a few large dealers with substantial market power. We study how such imperfect competition is reflected in equilibrium option prices.
To this end, we study a three-stage Stackelberg game of the following form. Dealers move first and quote competing price schedules. Clients then decide how many shares of the option to trade with each dealer. Finally, the dealers hedge their option positions in a market for the underlying of the option, where they interact through their common price impact.

Equilibrium Implications of Interest Rate Smoothing

Tuesday, 17th July - 15:00 - Equilibria: Macro - and Microeconomic Aspects - Swift - Oral - Abstract ID: 42

Dr. Diogo Duarte (Florida International University), Dr. Rodolfo Prieto (Boston University)

We introduce a macro-finance model in which monetary authorities adjust the money supply by targeting not only output and inflation but also the slope of the yield curve. We study the impact of McCallum-type rules on capital growth, the volatility of interest rates, the spread between long- and short-term rates, the persistence of monetary shocks and equity volatility. Our model supports the Federal Reserve's choice to incorporate financial data in their policy decisions and expand the monetary base to decrease the nominal interest rate spread, at the cost of lower expected long term growth.

Control-Stopping Games for Market Microstructure and Beyond

Tuesday, 17th July - 15:30 - Equilibria: Macro - and Microeconomic Aspects - Swift - Oral - Abstract ID: 115

Dr. Sergey Nadtochiy (University of Michigan), Dr. Roman Gayduk (University of Michigan)

We present a family of a control-stopping games which arise naturally in equilibrium-based models of market microstructure, as well as in other models with strategic buyers and sellers. In such a game, an agent can always stop the game by executing a trade at the bid or ask price quoted by the other agent. The equilibria are described by a system of coupled control-stopping problems, or, equivalently, by a system of RBSDEs with oblique reflection. We describe the associated mathematical challenges and prove existence of a solution to this system.

Recursive Utility with Investment Gains and Losses: Existence, Uniqueness, and Convergence

Tuesday, 17th July - 16:00 - Equilibria: Macro - and Microeconomic Aspects - Swift - Oral - Abstract ID: 195

Dr. Jing Guo (Columbia University), Mr. Xuedong He (The Chinese University of Hong Kong)

We consider a generalization of the recursive utility model by adding a new component that represents utility of investment gains and losses, and study the utility process in this generalized model with constant elasticity of intertemporal substitution and relative risk aversion degree and with infinite time horizon. We prove that the utility process uniquely exists and is globally attracting when the agent derives nonnegative gain-loss utility and that it can be non-existent or non-unique otherwise. We then consider a portfolio selection problem with gain-loss utility and solve it by proving that the corresponding dynamic programming equation has a unique solution.

Fully Dynamic Pricing: Risk Indifference and No Good Deal

Tuesday, 17th July - 14:30 - Risk Dynamics - Synge - Oral - Abstract ID: 143

Dr. Jocelyne Bion-Nadal (CNRS, CMAP Ecole Polytechnique), Prof. Giulia Di Nunno (University of Oslo)

We propose a dynamic pricing evaluation derived from a fully-dynamic risk-measure on L_p-spaces, $p \in [1,\infty]$. The concept of fully-dynamic risk-measures offers the possibility of changing the risk perspectives over time. It fits well the study of both short and long term investments.
Dynamic risk-indifference pricing is an alternative to utility-indifference pricing. We analyse whether the risk-indifference price provides a proper convex price-system satisfying time-consistency. This entails the use of capacities and the extension of the whole price-system to the Banach spaces derived by the capacity seminorms. Furthermore we study the relationship of the dynamic risk-indifference price with no-good-deal bounds.

Procyclicality of Empirical Measurements of Risk in Financial Markets

Tuesday, 17th July - 15:00 - Risk Dynamics - Synge - Oral - Abstract ID: 272

Mr. Marcel Bräutigam (Sorbonne University; ESSEC Business School; LabEx MME-DII), Dr. Michel Dacorogna (DEAR Consulting), Prof. Marie Kratz (ESSEC Business School, CREAR)

In our study we quantify the procyclicality of the historical Value at Risk (VaR). To do so we introduce a dynamic risk measure called Sample Quantile Process (SQP) – a rolling-window generalization of the VaR. By conditioning the SQP on the current state of realized volatility, we are able to empirically quantify the procyclicality. Moreover, using a simple GARCH(1,1) model, we conclude that this pro-cyclical effect is related to the clustering of volatility. At the same time, we prove that part of this procyclicality is intrinsically caused by the way the risk is estimated, using a historical VaR.

Intrinsic Risk Measures

Tuesday, 17th July - 15:30 - Risk Dynamics - Synge - Oral - Abstract ID: 199

Mr. Alexander Smirnow (University of Zurich), Prof. Walter Farkas (University of Zurich)

Monetary risk measures classify a financial position by the minimal amount of external capital that must be added to make it acceptable.
We propose a new concept: intrinsic risk measures. An intrinsic risk measure is defined by the smallest percentage of the currently held financial position which has to be sold and reinvested in an eligible asset such that the resulting position becomes acceptable.
We show that this approach provides a more direct path from unacceptable positions towards the acceptance set. We derive representations on conic and convex acceptance sets and we detail the connections to their monetary counterparts.

Quantifying the Model Risk Inherent in the Calibration and Recalibration of Option Pricing Models

Tuesday, 17th July - 16:00 - Risk Dynamics - Synge - Oral - Abstract ID: 219

Dr. Yu Feng (University of Technology Sydney), Mr. Ralph Rudd (University of Cape Town), Mr. Christopher Baker (University of Cape Town), Mr. Qaphela Mashalaba (University of Cape Town), Mr. Melusi Mavuso (University of Cape Town), Prof. Erik Schlogl (University of Technology Sydney)

The adage “all models are wrong, but some are useful” certainly applies to finance: Models that have been empirically invalidated remain in widespread use. Often, model usage contradicts the model assumptions: As market prices change, parameters in option pricing models, assumed to be time–invariant, are recalibrated. Incorrect models, and model misuse, represent an increasingly recognised source of risk - “model risk.” We focus on two aspects of model risk: the inability of a model to fit market prices at a given point in time (calibration error) and the model risk due to recalibration of parameters (contradicting model assumptions).

Asian Options pricing under exponential Ornstein–Uhlenbeck dynamics

Tuesday, 17th July - 14:30 - American, Asian and Exotic Options - Ui Chadhain - Oral - Abstract ID: 386

Mr. Riccardo Brignone (Universita Milano Bicocca), Prof. Gianluca Fusai (Universita del Piemonte Orientale), Dr. Ioannis Kyriakou (Cass Business School, City, University of London)

Asian options are quite popular in commodity derivative markets where mean–reversion is widely observed. In this paper we consider a jump-diffusion exponential Ornstein-Uhlenbeck dynamics. From a mathematical perspective, the problem turns out to be related with the sum of correlated log-normal random variables, whose distribution in unknown. We propose 2 methods to overcome this issue and proceed with pricing:

- Moment Matching (MM)
- Lower Bound (LB)

In particular, in order to implement MM we calculate analytically the moments of the arithmetic average of prices and fit various distributions. MonteCarlo with various Control Variables is used as benchmark to evaluate numerical results.

Runge-Kutta-Gegenbauer relaxation for parallelised option pricing

Tuesday, 17th July - 15:00 - American, Asian and Exotic Options - Ui Chadhain - Oral - Abstract ID: 367

Dr. Stephen O'Sullivan (Dublin Institute of Technology), Dr. Conall O'Sullivan (Smurfit Business School, University College Dublin)

We present an alternative approach to the classic Projected Successive Over-Relaxation (PSOR) fixed-point iterative method for pricing American options via finite-differencing. Relaxation factors for the Runge–Kutta–Gegenbauer (RKG) relaxation method are prescribed via a recurrence relation derived from Gegenbauer orthogonal polynomials, thereby ensuring internal stability and rapid convergence for mixed-type systems of PDEs. The proposed method has the advantage that it does not require immediate replacement making it particularly well-suited to parallelisation of computationally intensive problems dependent on multiple assets or factors since colouring schemes are not required. We present test results for American options under Heston's stochastic volatility model.

Robust bounds for the American Put

Tuesday, 17th July - 15:30 - American, Asian and Exotic Options - Ui Chadhain - Oral - Abstract ID: 83

Mr. Dominykas Norgilas (University of Warwick), Prof. David Hobson (University of Warwick)

We consider the problem of finding a model-free upper bound on the price of an American put given the prices of a family of European puts on the same underlying asset. Specifically we assume that the American put must be exercised at either time-1 or time-2 and that we know the prices of all vanilla European puts with these maturities. In this setting we find a model which is consistent with European put prices and an associated exercise time, for which the price of the American put is maximal. Moreover we derive a cheapest superhedge.

Analysis of Calibration Risk for Exotic Options through a Resampling Technique

Tuesday, 17th July - 16:00 - American, Asian and Exotic Options - Ui Chadhain - Oral - Abstract ID: 385

Dr. Marina Marena (Universita di Torino), Prof. Gianluca Fusai (Universita del Piemonte Orientale), Dr. Marco Materazzi (Source, London, UK)

Option pricing models are calibrated to market data of plain vanilla options by minimization of an error functional. In this context, calibration risk arises due to the estimation error of calibrated model parameters and carries over to the price of exotic options. The aim of this work is to provide an empirical evidence of calibration risk across popular option pricing models and to explore the implications for the pricing of some exotic options through a resampling technique. Furthermore, we perform a sensitivity analysis along the lines proposed in Baucells and Borgonovo (2013).

Optimal Expected Utility Risk Measures and Implied Risk Aversion

Wednesday, 18th July - 11:30 - Measuring Risk: Unilateral and Central Exposures - Beckett 1 - Oral - Abstract ID: 384

Prof. Frank Seifried (University of Trier), Dr. Sebastian Geissel (HSBC Germany), Prof. Jörn Sass (TU Kaiserslautern), Prof. Holger Fink (Nuertingen-Geislingen University of Applied Sciences)

We introduce a novel class of convex risk measures based on optimal expected utility (OEU). Taking the investor's point of view, OEU maximizes the sum of capital available today and the certainty equivalent of capital in the future. OEU risk measures are (non-trivial and) coherent risk for CRRA utilities. Based on this, we propose implied risk aversion as an alternative rating methodology for retail structured products: A product is attractive (unattractive) for an investor if its implied risk aversion is higher (lower) than her individual risk aversion.

Discrete-Time Mean-CVaR Portfolio Selection and Time-Consistency Induced Term Structure of the CVaR

Wednesday, 18th July - 12:00 - Measuring Risk: Unilateral and Central Exposures - Beckett 1 - Oral - Abstract ID: 226

Mr. Moris Strub (The Chinese University of Hong Kong), Prof. Duan Li (CityU HK), Prof. Xiangyu Cui (Shanghai University of Finance and Economics), Prof. Jianjun Gao (Shanghai University of Finance and Economics)

We investigate a discrete-time mean-CVaR portfolio selection problem by embedding this time-inconsistent problem into a family of expected utility maximization problems with piecewise-linear utility functions. In contrast to the complete, continuous-time solution, the mean-CVaR efficient frontier in the discrete-time setting is a straight line in the mean-CVaR plane. We further solve an inverse investment problem, where we investigate how mean-CVaR preferences need to adapt such that the pre-commited optimal strategy remains optimal at any point in time. Finally, an empirical application of our results suggests that risk measured by the CVaR might help to understand the long-standing equity premium puzzle.

A Dynamic Model of CCP Risk

Wednesday, 18th July - 12:30 - Measuring Risk: Unilateral and Central Exposures - Beckett 1 - Oral - Abstract ID: 216

Prof. Tomasz Bielecki (Illinois Institute of Technology), Prof. Igor Cialenco (Illinois Institute of Technology), Ms. Shibi Feng (Illinois Institute of Technology)

We introduce a dynamic model of default waterfall of derivatives CCPs and propose a risk sensitive method for sizing the initial margin (IM), and the default fund (DF) and its allocation among clearing members. Using a Markovian model of joint credit migrations, our evaluation of DF takes into account the joint credit quality of clearing members as they evolve over time. Another important aspect of the proposed methodology is the use of the time consistent dynamic risk measures for computation of IM and DF. We analyze the advantages of the proposed methodology and its comparison with the currently prevailing methods.

Wrong-way Risk in Credit Valuation Adjustment of Credit Default Swap with Copulas: Application of Shifted Square Root Jump Diffusion for Default Intensities

Wednesday, 18th July - 13:00 - Measuring Risk: Unilateral and Central Exposures - Beckett 1 - Oral - Abstract ID: 333

Dr. Toshinao Yoshiba (Bank of Japan), Dr. Testuya Adachi (PwC Consulting LLC), Mr. Takumi Sueshige (Tokyo Institute of Technology)

We compare several models for the CVA (credit valuation adjustment) of a CDS (credit default swap) under a copula approach with stochastic default intensities. Adopting the shifted square root jump diffusion for the default intensity, we derive the distribution function of the cumulative intensity which is required for the copula approach. To derive the distribution function, we reduce the multilayered Riemann surface of the characteristic function to a single layer and apply the fractional fast Fourier transform to the characteristic function. The numerical comparison implies that the tail dependent copulas well capture the wrong-way risk for the CVA.

Optimal Portfolio under Fractional Stochastic Environment

Wednesday, 18th July - 11:30 - Stochastic Volatility 2 - Beckett 2 - Oral - Abstract ID: 43

Prof. Jean-Pierre Fouque (University of California, Santa Barbara), Ms. Ruimeng Hu (University of California, Santa Barbara)

Rough stochastic volatility models have attracted lots of attention recently. In this paper, for power-type utilities, we propose to use martingale distortion transformations for the optimal value of asset allocation problems in a (non-Markovian) fractional stochastic environment. We rigorously establish first order approximations of the optimal value and the optimal strategy, when the return and volatility are driven by a stationary slowly varying fractional Ornstein-Uhlenbeck process. We prove that this approximation can be also generated by a zeroth-order trading strategy providing an explicit strategy which is asymptotically optimal in all admissible controls. We extend the discussion to general utility functions.

Information Flow Dependence in Financial Markets

Wednesday, 18th July - 12:00 - Stochastic Volatility 2 - Beckett 2 - Oral - Abstract ID: 229

Mr. Markus Michaelsen (University of Hamburg)

In response to empirical evidence we propose a continuous-time model for multivariate asset returns providing a two-layered dependence structure. The price process is subject to multivariate information arrivals driving the market activity modeled by non-decreasing pure-jump Lévy processes. The jump dependence is determined by a Lévy copula allowing for flexible dependence beyond the conditional aspects of the return distribution. Assuming that conditional asset returns are jointly normal, their dependence is modeled by a Brownian motion allowing for correlation. We apply novel multivariate models to equity data and obtain estimates having an economic intuition with respect to the two-layered dependence structure.

Smiles & Smirks: a tale of factors

Wednesday, 18th July - 12:30 - Stochastic Volatility 2 - Beckett 2 - Oral - Abstract ID: 30

Dr. Laura Ballotta (Cass Business School, City, University of London), Dr. Gregory Rayee (ULB)

We offer a general framework based on time changed Lévy process for modelling the joint evolution of stock log-returns and their volatility, which includes risk factors of both diffusive and jump nature, and leverage effects originated by both factors. The proposed setting encompasses a large number of the most commonly used stochastic volatility models, allows for the construction of new potential alternative models, and enables a comparative study of their features in terms of volatility, volatility of volatility and correlation processes. We analyse the performance in terms of calibration, fit of the volatility surface, hedging and forward volatility.

Affine Forward Variance Models

Wednesday, 18th July - 13:00 - Stochastic Volatility 2 - Beckett 2 - Oral - Abstract ID: 243

Prof. Martin Keller-Ressel (TU Dresden), Prof. Jim Gatheral (Baruch College, CUNY)

We introduce the class of affine forward variance (AFV) models which includes the Heston model and the rough Heston model. We show that AFV models can be characterized by the affine form of their cumulant generating function (CGF), which is obtained as solution of a convolution Riccati equation. We further introduce the class of affine forward order flow intensity (AFI) models, which are structurally similar to AFV models, but driven by jump processes. We show that the AFI model's CGF satisfies a generalized convolution Riccati equation and that a high-frequency limit of AFI models converges to the AFV model.

Optimal Taxation and Wealth Redistribution

Wednesday, 18th July - 11:30 - Managing Conflicting Incentives - Burke Theater - Oral - Abstract ID: 317

Prof. Lane Hughston (Goldsmiths College), Dr. Bernhard K. Meister (Renmin University of China, Beijing), Prof. Robert Zimmer (Goldsmiths College)

As a model for optimal taxation, we consider a society with homogeneous preferences but unequal incomes. The redistribution of income from high earners to low earners then increases the overall utility derived from the overall income. The optimal tax is defined as that which equalizes income after redistribution, subject to the condition that the overall utility is unchanged. We show that the problem of optimal taxation is mathematically equivalent to that of the extraction of the maximal amount of energy from a thermostatic system by quasi-static processes: in short, the problem of constructing an ideal heat engine.

Beyond Valuation Adjustments: an Indifference Approach to Funding and Capital

Wednesday, 18th July - 12:00 - Managing Conflicting Incentives - Burke Theater - Oral - Abstract ID: 390

Prof. Damiano Brigo (Imperial College London), Mr. Marco Francischello (Imperial College London), Dr. Andrea Pallavicini (Imperial College London and Banca IMI)

In the recent years the rise of funding costs and the strengthening of capital requirements induced banks and traders to consider to charge a so called funding valuation adjustment (FVA) and capital valuation adjustment (KVA) to their clients in OTC transactions. Using an indifference pricing approach we show that this roughly corresponds to charge the clients ex ante an amount that makes the deal profitable for the different stakeholders of the bank. Finally we reconcile this view with the usual non arbitrage framework used in the literature on valuation adjustments.

Valuation and incentives of exotic performance-vesting stock grants with path-dependent (price- and earnings-based) vesting schedules

Wednesday, 18th July - 12:30 - Managing Conflicting Incentives - Burke Theater - Oral - Abstract ID: 447

Ms. Elisabeth Megally (University of Zurich and Swiss Finance Institute)

We quantify analytically the incentive properties of performance-vesting (p-v) stock grants and explore how these grants mitigate agency problems associated with the separation of ownership and control: P-v stock grants with a price-based (earnings-based, resp.) vesting schedule compound managers' ownership incentives in a multiplicative (additive, resp.) fashion. However, p-v stock grants may convey inefficient incentives if the threshold performance hurdle is too high or in the case of high risk-taking incentives. We show that p-v stock grants with path-dependent vesting schedules achieve a better alignment between shareholders and managers than p-v grants whose vesting schedule nests standard European call options.

Mathematics of Post Trade Allocation

Wednesday, 18th July - 13:00 - Managing Conflicting Incentives - Burke Theater - Oral - Abstract ID: 393

Prof. Ali Hirsa (Columbia University)

Since the financial crisis, more investors choose a separately managed account (SMA) instead of a co-mingled fund for their investments. The objective of the investor in choosing an SMA is to maintain the legal control of their investment vehicle while tracking the performance of the underlying Fund. However, there is no simple solution for post-trade allocation between the Fund and the SMAs that results in a uniform distribution of returns. This paper is the first systematic treatment of post-trade-allocation risk. We present a solution that convergence to uniform allocation of return with increasing number of trades.

The value of information for optimal portfolio management

Wednesday, 18th July - 11:30 - The Value of Information - Davis - Oral - Abstract ID: 351

Prof. Stefano Herzel (University of Rome, Tor Vergata), Prof. Katia Colaneri (University of Leeds), Mr. Marco Nicolosi (University of Perugia)

What is the value of information for a portfolio manager who invests in the stock market to optimize the utility of her future wealth? We study this problem in a market with a mean reverting market price of risk that cannot be observed by the manager, and it is driven by different risk factors from those directly affecting the stocks. In a nutshell, what we consider is the classical Merton problem for an incomplete market with partial information.

Sentiment Lost: the E ect of Projecting the Empirical Pricing Kernel onto a Smaller Filtration Set

Wednesday, 18th July - 12:00 - The Value of Information - Davis - Oral - Abstract ID: 68

Dr. Carlo Sala (ESADE Business School), Prof. Giovanni Barone Adesi (Universita della Svizzera Italiana)

This paper analyzes the impacts of using a suboptimal information set for the estimation of the empirical pricing kernel.
Not sharing the same nullset, an option-based risk-neutral and a stock-based real world measure lead to a distorted the investor's risk premium. The relative empirical pricing kernel is then no longer a true martingale, but a strict local martingale with consequences on the validity of the risk-neutral pricing. From a probabilistic viewpoints, the missing beliefs are totally unaccessible stopping times on the coarser filtration set, so that an absolutely continuous strict local martingale, once projected, becomes continuous with jumps.

The Value of Information for Pricing and Hedging

Wednesday, 18th July - 12:30 - The Value of Information - Davis - Oral - Abstract ID: 438

Prof. Jan Obloj (University of Oxford), Dr. Anna Aksamit (University of Sydney)

We explore the difference of pricing and hedging problems for agents with different information in a robust approach. The notion of information is naturally linked with sigma-algebras which is made operational by looking at subsets of feasible paths. Our key insight is that information can be equivalent to restriction of price paths under consideration. We then introduce valuation of information based on appropriate distances between sigma-algebras.

An example of martingale representation in progressive enlargement by an accessible random time

Wednesday, 18th July - 13:00 - The Value of Information - Davis - Oral - Abstract ID: 477

Prof. Barbara Torti (University of Rome, Tor Vergata), Prof. Antonella Calzolari (University of Rome, Tor Vergata)

When a filtration represented by a martingale M is enlarged by the observation of a martingale N it can happens that the cross variation process [M,N] enters in the martingale representation of the enlarged filtration. This fact on one hand influences the multiplicity of the enlarged filtration and on the other hand it is linked to the behavior of the sharp brackets of the martingales. Here we illustrate these arguments presenting an elementary example of martingale representation in the context of progressive enlargement by an accessible random time.

Incorporating Signals into Optimal Trading

Wednesday, 18th July - 11:30 - Optimal Execution, and LOB Models - Emmet - Oral - Abstract ID: 192

Dr. Eyal Neuman (Imperial College), Dr. Charles-Albert LEHALLE (Imperial College and CFM)

Optimal trading field of research which was initiated in the late 90's. Its main application is slicing large trading orders, in the interest of minimizing trading costs and potential perturbations of price dynamics due to liquidity shocks. The inclusion of signals (i.e. short term predictors of price dynamics) in optimal trading is a recent development and it is also the subject of this work. We incorporate a Markovian signal in the optimal trading framework which involves a transient market impact and provide results on the existence and uniqueness of an optimal trading strategy.

Hedging Non-Tradable Risks with Transaction Costs and Price Impact

Wednesday, 18th July - 12:00 - Optimal Execution, and LOB Models - Emmet - Oral - Abstract ID: 120

Dr. Ryan Donnelly (University of Washington), Dr. Sebastian Jaimungal (University of Toronto), Dr. Alvaro Cartea (University of Oxford)

An agent hedges exposure to a non-tradable risk factor U using a correlated traded asset S and accounts for the impact of trades on both factors. We obtain in closed-form the optimal strategy when the agent holds a linear position in U. With non-linear exposure to U, we provide an approximation to the optimal strategy in closed-form, and prove that the value function is correctly approximated when cross-impact and risk-aversion are small. With non-linear exposure, the approximate optimal strategy can be written in terms of the optimal strategy for linear exposure with the size of the position changing dynamically according to the exposure's "Delta" under a particular probability measure.

Optimal High Frequency Interactions with Orderbook

Wednesday, 18th July - 12:30 - Optimal Execution, and LOB Models - Emmet - Oral - Abstract ID: 319

Mr. Othmane Mounjid (Ecole Polytechnique-CMAP), Dr. Charles-albert Lehalle (Imperial College and CFM), Prof. Mathieu Rosenbaum (Ecole Polytechnique-CMAP)

We consider an agent who needs to buy (or sell) a relatively small amount of asset over some fixed short time interval. We work at the highest frequency meaning that we wish to find the optimal tactic to execute our quantity using limit orders, market orders and cancellations. To solve the agent's control problem we build an orderbook model and optimize an expected utility function based on our price impact. We derive the equations satisfied by the optimal strategy and solve them numerically. Moreover, we show that our optimal tactic enables us to outperform significantly naive execution strategies.

A Functional Limit Theorem for Limit Order Books with State Dependent Price Dynamics

Wednesday, 18th July - 13:00 - Optimal Execution, and LOB Models - Emmet - Oral - Abstract ID: 283

Dr. Jinniao Qiu (University of Calgary), Dr. Christian Bayer (Weierstrass Institute), Prof. Ulrich Horst (Humboldt University Berlin)

We consider a stochastic model for the dynamics of the two-sided limit order book (LOB). Our model is flexible enough to allow for a dependence of the price dynamics on volumes. For the joint dynamics of best bid and ask prices and the standing buy and sell volume densities, we derive a functional limit theorem, which states that our LOB model converges in distribution to a fully coupled SDE-SPDE system when the order arrival rates tend to infinity and the impact of an individual order arrival on the book as well as the tick size tends to zero.

A Bayesian Approach to Backtest Overfitting

Wednesday, 18th July - 11:30 - Computational Finance - Swift - Oral - Abstract ID: 134

Prof. Jiri Witzany (University of Economics in Prague, Faculty of Finance and Accounting)

Quantitative investment strategies are often selected from a broad class of candidate models estimated and tested on historical data. Standard statistical techniques to prevent model over-fitting turn out to be unreliable when selection is based on too many models tested on the holdout sample. There is an ongoing discussion how to estimate the probability of back-test over-fitting and adjust the expected performance indicators in order to reflect properly the effect of multiple testing. We propose a consistent Bayesian MCMC approach that yields the desired robust estimates. The approach is tested on a class of technical trading strategies.

A Fast Optimal Control Algorithm for Multi-Period Portfolio Optimization

Wednesday, 18th July - 12:00 - Computational Finance - Swift - Oral - Abstract ID: 97

Mr. Marc Weibel (Eniso Partners AG)

This paper contributes towards the development of a fast algorithm, relying on the Alternating-Direction of Multipliers (ADMM), for solving scenario-based Model Predictive Control arising in multi-period portfolio optimization problems efficiently.
We enhance the standard two-set splitting algorithm of the ADMM method, by including inequality constraints through a so-called embedded splitting, without recourse to an additional splitting set. We derive an alteration of the termination criterion, using the probabilities assigned to the scenarios and provide a convergence analysis. We show that the proposed criterion outperforms the standard approach and highlight our results with a numerical comparison with a state-of-the-art algorithm.

A Recursive Dual Method for Stochastic Control and Its Applications in Finance

Wednesday, 18th July - 12:30 - Computational Finance - Swift - Oral - Abstract ID: 257

Prof. Nan Chen (The Chinese University of Hong Kong), Mr. Xiang Ma (The Chinese University of Hong Kong)

We use the information relaxation technique to develop a value-and-policy iterative method to solve SDP problems. Each iteration generates a confidence interval estimate for the true value function so we can use the gap between the upper and lower bounds to access the quality of the policy. We show that the resulted sequences of suboptimal policies converge to the optimal one within finite number of iterations. A regression-based Monte Carlo algorithm is introduced to overcome the dimensionality curse in the implementation of this approach for high dimensional cases. As numerical illustrations, we apply the algorithm to optimal order execution problem.

Predicting Influential Recommendation Revisions

Wednesday, 18th July - 13:00 - Computational Finance - Swift - Oral - Abstract ID: 268

Prof. Jose Faias (Catolica Lisbon SBE)

We find that 19% of sell-side analysts' stock recommendation revisions move stock prices significantly on the event date. With a model that predicts influential revisions out-of-sample, we show that these predictions can be used to form long-short one-month portfolios that earn an alpha of 26% per annum in the period between 1999 and 2013. This corresponds to more than five times the annualized returns of price momentum. Contrary to previous evidence, this strategy survives to substantial transaction costs. These findings show that recommendations are an important means by which analysts assimilate information into stock prices.

Multivariate marked Poisson processes and market related multidimensional information ows

Wednesday, 18th July - 11:30 - Information and Commodities - Synge - Oral - Abstract ID: 426

Prof. Patrizia Semeraro (Politecnico di Torino), Dr. Petar Jevtic (Arizona State University), Dr. Marina Marena (Università di)

The class of marked Poisson processes and its connection with subordinated L$\diamond$évy processes allow us to propose a new interpretation of multidimensional information flows and their relation to market movements. The new approach provides a uni ed framework for multivariate asset return models in a L$\diamond$évy economy. In fact, we are able to recover several processes commonly used to model asset returns as subcases. We consider a first application example using the Normal inverse Gaussian specification.

Portfolio optimization for a large investor controlling market sentiment under partial information

Wednesday, 18th July - 12:00 - Information and Commodities - Synge - Oral - Abstract ID: 354

Prof. Katia Colaneri (University of Leeds), Dr. Sühan Altay (Vienna University of Technology), Dr. Zehra Eksi (WU - Vienna University of Economics and Business)

We consider an investor faced with the utility maximization problem in which the risky asset price process has pure-jump dynamics depending on an unobservable Markov chain, with intensity controlled by actions of the investor. Using filtering, we reduce this problem with partial information to one with full information. We apply control theory for piecewise deterministic Markov processes to solve the problem. We provide a toy example with a two-state Markov chain, and discuss how investor's ability to control the intensity of the state process affects the optimal portfolio strategies under both partial and full information.

Should Commodity Investors Follow Commodities' Prices?

Wednesday, 18th July - 12:30 - Information and Commodities - Synge - Oral - Abstract ID: 240

Dr. Antonella Tolomeo (Reale Mutua Assicurazioni), Dr. Paolo Guasoni (Dublin City University), Dr. Gu Wang (Worcester Polytechnic Institute)

Most long-term investors gain access to commodities through diversified funds, though mean-reverting prices and low correlation among commodities returns suggest that two-fund separation does not hold for commodities. Mean-reversion generates an intertemporal-hedging demand for commodities that does not vanish with risk aversion, in contrast to typical models of stock prices. Comparing the utility-maximizing policies of investors observing only the index to those of investors observing all commodities, the welfare gain peaks at risk-neutrality, maximizing additional returns, and at moderate risk aversion, maximizing intertemporal-hedging gains. Additional information is equivalent to an increase in return of multiple percentage points for typical risk-aversion.

The Dynamics of Commodity Spot, Forward, Futures Prices and Convenience Yield

Wednesday, 18th July - 13:00 - Information and Commodities - Synge - Oral - Abstract ID: 220

Dr. Katsushi Nakajima (Ritsumeikan Asia Pacific University)

This paper studies commodity spot, forward, and futures prices under a continuous-time setting. Our model considers a representative firm, which uses an input commodity to produce an output commodity, stores the commodity, and trades forward or futures commodities to hedge. Through the Hamilton-Jacobi-Bellman equation and Feynman-Kac formula, we derive relations between spot, forward, and futures prices. The convenience yield can be interpreted as shadow price of storage, short selling constraints, and limits of risk. We compare our result with the existing models. The optimal production plan and trading strategy for spot commodity and forward are also derived.

Pathwise superhedging on prediction sets

Wednesday, 18th July - 11:30 - Hedging: From Theory to Practice - Ui Chadhain - Oral - Abstract ID: 250

Mr. Daniel Bartl (University of Konstanz), Prof. Michael Kupper (University of Konstanz), Dr. Ariel Neufeld (ETH Zurich)

We provide a pricing-hedging duality for the model-independent superhedging price with respect to a prediction set Ξ C[0, T], on which the superhedging property needs to hold pathwise. This allows to include beliefs in future paths of the price process expressed by the set Ξ, while eliminating all those which are seen as impossible. We provide several examples to justify our setup. The talk is based on joint work with Daniel Bartl and Ariel Neufeld.

Hedging in long memory stochastic volatility models

Wednesday, 18th July - 12:00 - Hedging: From Theory to Practice - Ui Chadhain - Oral - Abstract ID: 407

Mr. Qi Zhao (University of Illinois at Urbana-Champaign), Dr. Alexandra Chronopoulou (University of Illinois at Urbana-Champaign)

Long memory stochastic volatility (LMSV) models have been used to explain the persistence of volatility in the market. In these models, the volatility process is often described by a fractional Ornstein-Uhlenbeck process with Hurst index H, where H>1/2. The goal of this talk is to discuss hedging in the fractional stochastic volatility framework. In particular, we review a Delta-hedging strategy under this framework and we determine when the option is underhedged, overhedged or perfectly hedged.

Expected liquidity cost under delta hedging process

Wednesday, 18th July - 12:30 - Hedging: From Theory to Practice - Ui Chadhain - Oral - Abstract ID: 294

Prof. Kyungsub Lee (Yeungnam University), Prof. Byoung Ki Seo (Ulsan National Institute of Science and Technology)

The expected liquidity cost when performing the delta hedging process of a European option is derived. It is represented by an integration formula that consists of European option prices and a certain function depending on the delta process. We define a unit liquidity cost and show that the liquidity cost is a multiplication of the unit liquidity cost, stock price, supply curve parameter, and the square of the number of options. With this formula, the expected liquidity cost before hedging can be calculated in much faster way than a Monte Carlo simulation.

Consistent Valuation Across Curves using Pricing Kernels

Wednesday, 18th July - 13:00 - Hedging: From Theory to Practice - Ui Chadhain - Oral - Abstract ID: 376

Mr. Obeid Mahomed (University of Cape), Dr. Andrea Macrina (University College London)

The general problem of valuation when discount rates differ from an asset's cash flow accrual rate is considered. A pricing kernel framework models an economy segmented into distinct markets, identified by a yield curve having its own risk characteristics. A curve-conversion factor links all markets in an arbitrage-free manner and an across-curve pricing formula is derived. A multi-curve framework is formulated for emerging and developed markets, highlighting an important dual feature of the conversion process. Existing approaches based on HJM and rational pricing kernel models are recovered, reviewed and extended. FX, inflation-linked and hybrid securities thereof are also valued consistently.

Stochastic volatility asymptotics for optimal subsistence consumption and investment with bankruptcy

Wednesday, 18th July - 14:30 - Optimal Control and Optimal Investment 2 - Beckett 1 - Oral - Abstract ID: 297

Prof. Hoi Ying Wong (The Chinese University of Hong Kong), Dr. Mei Choi Chiu (Education University of Hong Kong), Prof. Yong Hyun Shin (Sookmyung Women's University)

Optimal subsistence consumption and investment problem with bankruptcy is a constrained stochastic optimal control problem in which the consumption rate should be greater than a non-negative subsistence level to maintain a minimal living standard and the wealth level stays positive. When the agent invests in a risky asset which has multiscale stochastic volatility, we extend the framework of Fouque et al. (Portfolio optimization & stochastic volatility asymptotics, Mathematical Finance 27(3), 704-745, 2017) to derived closed-form first-order asymptotic approximation to the optimal consumption-investment strategy and the value function. The major difficulty stems on the subsistence constraint.

Dynamic Portfolio Optimization with Looping Contagion Risk

Wednesday, 18th July - 15:00 - Optimal Control and Optimal Investment 2 - Beckett 1 - Oral - Abstract ID: 91

Mr. Longjie Jia (Imperial College London), Dr. Martijn Pistorius (Imperial College London), Prof. Harry Zheng (Imperial College London)

We consider a utility maximization problem with defaultable stocks and looping contagion risk. We assume that the default intensity of one company depends on the stock prices of itself and another company, and the default of the company induces an immediate drop in the stock price of the surviving company. We prove the value function is the unique continuous viscosity solution of the HJB equation. We also compare and analyse the statistical distributions of terminal wealth of log utility based on two optimal strategies, one using the full information of intensity process, the other a proxy constant intensity process.

A Term Structure Model for Expert Opinions

Wednesday, 18th July - 15:30 - Optimal Control and Optimal Investment 2 - Beckett 1 - Oral - Abstract ID: 275

Dr. Sebastien Lleo (NEOMA Business School), Prof. Mark Davis (Imperial College London)

Expert opinions and analyst views are an invaluable source of information for portfolio allocation models, starting with Black and Litterman's seminal work. In this paper, we propose a continuous-time model for the term structure of expert opinions. The model improves on the Black-Litterman in Continuous Time model by providing a flexible characterization of the behavior of expert opinions. We address five key differences between the term structure of interest rates and that of expert opinions. Our diffusion and jump-diffusion models integrate term structure models, expert opinions, behavioral finance, filtering, and risk-sensitive control in a consistent, prescriptive approach to portfolio optimization.

Dynamic Investment and Financing with Internal and External Liquidity Management

Wednesday, 18th July - 16:00 - Optimal Control and Optimal Investment 2 - Beckett 1 - Oral - Abstract ID: 462

Prof. Nan Chen (The Chinese University of Hong Kong), Prof. Yuan Tian (Ryukoku University), Ms. Jiahui Ji (The Chinese University of Hong Kong)

We develop a theoretical model of dynamic investments, dividend payouts, debt borrowing, external equity financing/bankruptcy, and risk management for financially constrained firms. The model characterizes the central importance of liquidity management in corporate decision making in the presence of external financing costs. Mathematically, we solve the model by simultaneously employing the variational inequality approach for the equity value and the fixed-point approach for the debt value, which is new to the literature. The solution produces several interesting implications in corporate finance.

A generalized Bachelier formula for pricing basket and spread options

Wednesday, 18th July - 14:30 - Asset Pricing - Beckett 2 - Oral - Abstract ID: 383

Ms. Fulvia Fringuellotti (University of Zurich), Dr. Ciprian Necula (University of Zurich)

In this paper we propose a closed-form pricing formula for European basket and spread options. Our approach is based on approximating the risk-neutral probability density function of the terminal value of the basket using a Gauss-Hermite series expansion around the Gaussian density. The new method is quite general as it can be applied for a basket with a large number of assets and for all dynamics where the joint characteristic function of log-prices is known in closed form. We provide a simulation study to show the accuracy and the speed of our methodology.

SINH-acceleration: efficient evaluation of probability distributions, option pricing, calibration and Monte-Carlo simulations

Wednesday, 18th July - 15:00 - Asset Pricing - Beckett 2 - Oral - Abstract ID: 425

Dr. Sergey Levendorskiy (Calico Science Consulting), Dr. Svetlana Boyarchenko (University of Texas at Austin)

Characteristic functions of several popular classes of distributions and processesadmit analytic continuation into unions of strips and open coni around the real hyperplane. In the paper, we suggest to use the Fourier transform technique and changes of variables of the form $\xi=\sqrt{-1}\om_1+b\sinh (\sqrt{-1}\om+y)$ and the simplified trapezoid rule to evaluate the integrals accurately and fast. We formulate the general scheme, and apply the scheme for calculation probability distributions and pricing European options in L\'evy models, the Heston model, the CIR model, and a subordinated NTS model. We outline applications to fast and accurate calibration procedures and Monte Carlo simulations.

Abnormal energy price movements prior to FOMC announcements

Wednesday, 18th July - 15:30 - Asset Pricing - Beckett 2 - Oral - Abstract ID: 296

Mr. Hyeonung Jang (Ulsan National Institute of Science and Technology), Prof. Byoung Ki Seo (Ulsan National Institute of Science and Technology)

We investigate energy prices during the Federal Open Market Committee (FOMC) announcement periods. This study shows that the energy market has experienced abnormal price movements before the scheduled FOMC announcements, which are proportional to FOMC's monetary policy decisions at the following day. They are affected by expected monetary policy rate changes but not by unexpected changes. We also find that the volatility of the energy prices increases in the pre-FOMC dates only if the expected policy rate change is negative, which can be explained by the asymmetric volatility effect.

Natural hedging with fix and floating strike guarantees

Wednesday, 18th July - 16:00 - Asset Pricing - Beckett 2 - Oral - Abstract ID: 187

Prof. Antje Mahayni (University Duisburg-Essen), Ms. Katharina Stein (University Duisburg-Essen), Mr. Oliver Lubos (University Duisburg-Essen)

We analyze minimum return rate guarantees including fixed guarantee rates prevailing for the whole contract horizon and floating guarantee rates linked to the interest rate evolution. In a complete arbitrage free market, we obtain closed form pricing solutions for both guarantees. Different guarantee costs are explained by the difference of the arbitrage free values of the guarantee schemes and the difference between cumulated volatilities resulting from forward and simple volatilities. We analyze the sensitivities of the asset and liability side against interest rate changes. A combination of fix price and floating strike guarantees enables natural hedging against interest rate changes.

Principal Agent problem with common agency without communication

Wednesday, 18th July - 14:30 - Equilibria and Games - Burke Theater - Oral - Abstract ID: 318

Dr. Thibaut Mastrolia (Ecole Polytechnique-CMAP)

In this paper, we consider a problem of contract theory in which several Principals hire a common Agent in the continuous time setting. We show that optimal contracts should satisfy some equilibrium conditions and we reduce the optimisation problem of the Principals to a system of coupled HJB equations. We provide conditions ensuring that for risk-neutral Principals, the system of coupled HJB equations admits a solution. Further, we apply our study in a more specific linear-quadratic model where two interacting Principals hire one common Agent.
Joint work with Zhenjie Ren.

Open problems in contract theory

Wednesday, 18th July - 15:00 - Equilibria and Games - Burke Theater - Oral - Abstract ID: 444

Dr. Dylan Possamaï (Columbia University)

This talk will be the occasion to present recent progresses made on the treatment of continuous time contract theory, and more importantly to highlight several problems and areas where a general theory is still lacking. This includes notable adverse selection problems, time-inconsistent Agents, and general equilibrium issues between many Principals and many Agents. I will put forward the main difficulties encountered as well as possible approaches to tackle them.

Optimal maker-taker fees for a trading platform

Wednesday, 18th July - 15:30 - Equilibria and Games - Burke Theater - Oral - Abstract ID: 300

Dr. Omar El Euch (Ecole Polytechnique), Prof. Thibaud Mastrolia (Ecole Polytechnique), Prof. Mathieu Rosenbaum (Ecole Polytechnique)

We consider an exchange who wants to define an optimal maker-taker policy. This means it is looking for the best way to reward liquidity provision and apply fees to market participants consuming liquidity. The goal is to ensure a suitable profit and loss for the platform as well as a stable trading environment for investors. We recast this question into a principal-agent problem and show that we can design an optimal policy in explicit form.

Large Tournament Games

Wednesday, 18th July - 16:00 - Equilibria and Games - Burke Theater - Oral - Abstract ID: 495

Prof. Erhan Bayraktar (University of Michigan), Prof. Jaksa Cvitanic (Caltech), Prof. Yuchong Zhang (Columbia University)

We consider a tournament game in which each player is rewarded based on her rank in terms of the time of reaching a goal. We prove existence, uniqueness and stability of the game with infinitely many players, existence of an approximate equilibrium with finitely many players, and find an explicit characterization when players are homogeneous. In our setup we find that:
(i) the welfare may be increasing in cost of effort;
(ii) when the total pie is small, the aggregate effort may be increasing in prize inequality, unlike in Fang, Noe and Strack (2018);
(iii) the welfare may go up with a higher percentage of unskilled workers, as do the completion rates of the skilled and unskilled sub-populations.

Our results lend support to government subsidies for R&D, assuming the profits to be made are substantial. Joint work with Jaksa Cvitanic and Yuchong Zhang. Preprint available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3119212

Measuring systemic risk: The Indirect Contagion Index

Wednesday, 18th July - 14:30 - Systemic Risk - Davis - Oral - Abstract ID: 350

Dr. Eric Schaanning (ETH Zurich), Prof. Rama Cont (Imperial College and CFM)

We introduce a novel micro-founded measure of price-mediated contagion: the Indirect Contagion Index (ICI). It is defined as the Perron-eigenvector of the matrix of liquidity-weighted portfolio overlaps and allows to quantify the notion of “interconnectedness” and “systemicness” of systemically important financial institutions.
Using the same liquidity-weighted portfolio overlaps, we analyse how close the official stress scenario of the 2016 European Banking Authority (EBA) was to the worst-case scenario in terms of contagion. Our results suggest that the EBA scenario did not precisely target the vulnerabilities, as implied by the portfolio holdings of European Banks at the time.

Is more data always better? Optimal data usage in non-stationary systems

Wednesday, 18th July - 15:00 - Systemic Risk - Davis - Oral - Abstract ID: 401

Mr. Jakob Krause (Martin-Luther University Halle-Wittenberg)

Starting from the premise that risk is a notion that changes over time this paper introduces a statistical methodology that is able to identify the amount of data yielding minimal bias estimators. I formalise the issue of representativeness and introduce a trade-off between estimator convergence, incentivising us to use as much data as possible and, and the aforementioned issue of representativeness doing the opposite. As an application an impact study of a paragraph in the banking regulation framework is adressed.

News Sentiment Indices for Sectors and Industries

Wednesday, 18th July - 15:30 - Systemic Risk - Davis - Oral - Abstract ID: 239

Dr. Svetlana Borovkova (Vrije Universiteit Amsterdam)

We present the sector-based news sentiment indices, which track, for a given industry or sector, the current media sentiment about this sector. The sentiment index for a particular sector has a natural relationship to the basket of stocks of publicly traded companies operating in this sector or the corresponding sector's ETF. We empirically investigate this relationship for 11 sectors and show that this relationship is particularly signi cant at times of market downturns. We demonstrate the added value of such sentiment indices in sector-rotation investment strategies.

Dynamic Initial Margin Estimation based on Quantiles of Johnson Distributions

Wednesday, 18th July - 16:00 - Systemic Risk - Davis - Oral - Abstract ID: 301

Prof. Thomas McWalter (University of Cape Town), Dr. Joerg Kienitz (University of Cape Town), Dr. Nikolai Nowaczyk (Quaternion Risk Management), Mr. Ralph Rudd (University of Cape Town), Dr. Sarp Acar (Quaternion Risk Management)

A new accurate approach to estimate dynamic initial margin (DIM) for general portfolios, based on regression using Johnson distributions fitted to conditional moments approximated with least squares MC (JLSMC), is described. It is consistent with DIM estimation using nested MC. DIM values produced under the standard approach (Gaussian portfolio changes) diverge significantly from the better JLSMC estimates. This is due to its superiority when portfolio changes are far from Gaussian. We illustrate JLSMC on the Heston and Hull-White models for Calls, Puts and Bermudan Swaptions. JLSMC only requires quantities that are readily available when computing XVA.

Optimal dividend and investment policy with debt covenants

Wednesday, 18th July - 14:30 - Dividends and Control - Emmet - Oral - Abstract ID: 69

Mr. Etienne Chevalier (Evry University), Mr. Vathana Ly Vath (ENSIIE), Mr. Alexandre Roch (University of Quebec in Montreal)

A firm holds a certain amount of debt to which is associated a financial-ratio covenant between the creditors and the firm. It may be audited at any time and must furnish financial statements to prove that its debt to total assets ratio is less than one. If not, the firm is given a grace period during which it can inject more capital to correct the situation. When its ratio is appropriate, it can also pay out dividends. We consider an optimal control problem in which the value of the assets is controlled by the capital injections and dividends payouts.

Suboptimal Control of Dividends under Exponential Utility

Wednesday, 18th July - 15:00 - Dividends and Control - Emmet - Oral - Abstract ID: 328

Dr. Julia Eisenberg (University of Liverpool), Dr. Paul Krühner (University of Liverpool)

We consider an insurance company modelling its surplus process by a Brownian motion with drift. Our target is to maximise the expected exponential utility of discounted dividend payments, given that the dividend rates are bounded by some constant.
Numerical and theoretical considerations lead us to the conclusion that the optimal strategy must be of a barrier type. That is why, we cannot apply the methods used in the classical case.
Our approach estimates the distance between the performance function corresponding to a non-optimal strategy to the value function. Also, we investigate the two most obvious suboptimal strategies: constant and barrier-type.

Pricing Bounds and Bang-bang Analysis of the Polaris Variable Annuities

Wednesday, 18th July - 15:30 - Dividends and Control - Emmet - Oral - Abstract ID: 276

Mr. Zhiyi Shen (University of Waterloo), Prof. Chengguo Weng (University of Waterloo)

We study the no-arbitrage pricing of Polaris variable annuities recently issued by AIG. Polaris allows the income base to “lock in” the high water mark of the investment account. For rider charge proportional to the investment account, we establish a bang-bang solution for optimal withdrawal strategies and consequently design an innovative LSMC algorithm to efficiently obtain the optimal solution. The resulting value function is proved to be an upper bound of fair value for a contract with insurance fees charged on the income base and its super performance is confirmed by extensive numerical studies.

Stochastic Control and Differential Games with Path-Dependent Controls

Wednesday, 18th July - 16:00 - Dividends and Control - Emmet - Oral - Abstract ID: 13

Prof. Yuri Saporito (Getulio Vargas Foundation)

In this paper we consider the functional Ito calculus framework to find a path-dependent version of the Hamilton-Jacobi-Bellman equation for stochastic control problems with path-dependence in the controls. We also prove a Dynamic Programming Principle for such problems. We apply our results to path-dependence of the delay type. We further study Stochastic Differential Games in this context.

A Scaling Limit for Limit Order Books Driven by Hawkes Processes

Wednesday, 18th July - 14:30 - Limit-order Book - Swift - Oral - Abstract ID: 255

Dr. Wei Xu (Humboldt-Universitat zu Berlin), Prof. Ulrich Horst (Humboldt-Universitat zu Berlin)

In this paper we derive a scaling limit for an infinite dimensional limit order book model driven by Hawkes random measures. The dynamics of the incoming order flow is allowed to depend on the current market price as well as on a volume indicator. With our choice of scaling the dynamics converges to a coupled SDE-ODE system where limiting best bid and ask price processes follows a diffusion dynamics, the limiting volume density functions follows an ODE in a Hilbert space and the limiting order arrival and cancellation intensities follow a Volterra-Fredholm integral equation.

Brownian trading excursions

Wednesday, 18th July - 15:00 - Limit-order Book - Swift - Oral - Abstract ID: 348

Prof. Thorsten Rheinlander (Vienna University of Technology), Prof. Friedrich Hubalek (Vienna University of Technology), Dr. Paul Eisenberg (University of Liverpool)

We study a parsimonious model of the latent limit order book where orders get placed according to some volume density function relative to a center price process, and get executed whenever this center price reaches their level. This mechanism corresponds to the solution of the stochastic heat equation with multiplicative noise for the relative order volume distribution which we relate to some local time functional. We classify various types of trades, and introduce the trading excursion process which is a Poisson point process.

Spread crossing in a limit order book: optimal strategies and asymptotic analysis

Wednesday, 18th July - 15:30 - Limit-order Book - Swift - Oral - Abstract ID: 121

Prof. Xuefeng Gao (The Chinese University of Hong Kong), Prof. Nan Chen (The Chinese University of Hong Kong), Mr. Xiang Ma (The Chinese University of Hong Kong)

We study when a precommitted trader converts a limit order to a market order in algorithmic executions of orders. We formulate the problem as an optimal stopping problem. We present structural properties of the optimal strategy and show how it depends on market conditions. We derive and rigorously prove high order asymptotic expansions for the optimal exercise boundary near expiry. Numerical experiments illustrate the accuracy of the approximation.

Second order approximations for limit order books

Wednesday, 18th July - 16:00 - Limit-order Book - Swift - Oral - Abstract ID: 212

Prof. Dörte Kreher (Humboldt-Universitat zu Berlin), Prof. Ulrich Horst (Humboldt-Universitat zu Berlin)

We derive a second order approximation for an infinite dimensional Markovian limit order book model under two different scaling regimes. In the first case we suppose that price changes are really rare, yielding a constant first order approximation for the price and a measure valued SDE driven by an infinite dimensional Brownian motion in the second order approximation of the volume process. In the second case we use a slower rescaling rate, which leads to a non-degenerate first order approximation and gives a PDE with random coefficients in the second order approximation for the volume process.

Investor Information Choice with Macro and Micro Information

Wednesday, 18th July - 14:30 - Macro Models - Synge - Oral - Abstract ID: 457

Prof. Paul Glasserman (Columbia University), Prof. Harry Mamaysky (Columbia University)

We study information and portfolio choices in a market of securities whose dividends depend on an aggregate (macro) risk factor and idiosyncratic (micro) shocks. Investors can acquire information about dividends at a cost. We establish a general result showing that investors endogeneously specialize in either macro or micro information. We then develop a specific model with this specialization and study the equilibrium mix of macro-informed and micro-informed investors and the informativeness of macro and micro prices. We discuss empirical implications for price volatility and covariance. Our results favor Samuelson's dictum, that markets are more micro efficient than macro efficient.

A Model of Banks' Asset Securitization Programs

Wednesday, 18th July - 15:00 - Macro Models - Synge - Oral - Abstract ID: 232

Prof. Masahiko Egami (Kyoto University), Dr. Kaoru Hosono (Gakushuin University)

We propose a new framework to analyze banks' securitization programs. Our contributions include to provide an easy-to-use measure to determine how banks use proceeds, and to analyze their profit-maximizing behavior in securitization. Specifically, we compute leverage before and after securitization by estimating their unobservable firm value. If the leverage does not improve, they may intend to pay out a dividend using sales proceeds, so we incorporate dividend payout as an optimal control problem of banks' shareholders. We separate banks' securitization to reduce leverage level from securitization to harvest profit earlier. Our model provides insights into why banks securitize their assets.

Capital Allocation under Fundamental Review of Trading Book

Wednesday, 18th July - 15:30 - Macro Models - Synge - Oral - Abstract ID: 303

Mr. Luting Li (London School of Economics and Political Science), Dr. Hao Xing (London School of Economics and Political Science)

The Fundamental Review of Trading Book (FRTB) from the Basel Committee overhauls the regulatory framework for minimum capital requirements for market risk. Facing the tightened regulation, banks need to allocate their capital to each of their risk positions to evaluate the capital efficiency of their strategies. This paper proposes two computational efficient allocation methods under the FRTB framework. Simulation analysis shows that both these two methods provide more liquidity horizon weighted, more stable, and less negative allocations than the standard methods under the current regulatory framework.

Optimal timing for governmental control of the debt-to-GDP ratio

Wednesday, 18th July - 16:00 - Macro Models - Synge - Oral - Abstract ID: 434

Dr. Neofytos Rodosthenous (Queen Mary University of London), Prof. Giorgio Ferrari (Bielefeld University)

We study the problem of a government wishing to control the country's debt-to-GDP ratio. The debt-to-GDP ratio evolves stochastically and the interest on debt is affected by an N-state continuous-time Markov chain, representing the country's credit ratings. The debt-to-GDP ratio can be reduced through fiscal interventions or increased by public investments. The government aims to choose a policy minimising the total expected cost of having debt and fiscal interventions counterbalanced by the gain from public investments. The problem is modelled by a bounded-variation stochastic control problem, that we explicitly solve through the analysis of an associated Dynkin game.

Chebyshev interpolation for multivariate real-time problems in finance

Wednesday, 18th July - 14:30 - Approximating the Volatility Smile - Ui Chadhain - Oral - Abstract ID: 307

Dr. Kathrin Glau (Queen Mary University of London), Dr. Mirco Mahlstedt (Technical University of Munich), Dr. Maximilian Gaß (Technical University of Munich), Mr. Maximilian Mair (Technical University of Munich), Mr. Francesco Statti (EPFL), Prof. Daniel Kressner (EPFL)

Real-time methods for option pricing and the computation of risk quantities in multivariate settings are required in order to pave the way for innovation in financial digitalization. The development of such methods poses a serious challenge. Considering Parametric Option Pricing (POP) we show that polynomial interpolation in the parameter space considerably reduces run-times while maintaining accuracy. The attractive properties of Chebyshev interpolation and its tensorized extension enable us to identify broadly applicable criteria for (sub)exponential convergence. Combined with Monte Carlo simulation and low rank tensor techniques the Chebyshev method turns out to yield very promising result for high dimensional problems.

Efficient Long-dated Swaption Volatility Approximation in the Forward-LIBOR Model

Wednesday, 18th July - 15:00 - Approximating the Volatility Smile - Ui Chadhain - Oral - Abstract ID: 325

Mr. Jacques van Appel (University of Johannesburg), Prof. Thomas McWalter (University of Cape Town)

We provide an efficient swaption volatility approximation in the lognormal forward-LIBOR model to accurately price for longer maturities and tenors. In particular, we approximate the swaption volatility with a mean update of the spanning forward rates. Since the joint distribution of the spanning forward rates is not known we resort to numerical discretisation techniques. More specifically, we approximate the mean forward rates with a multi-dimensional weak order 2.0 Itō-Taylor scheme. We test our approximation with a quasi-Monte Carlo study and find it to be substantially more effective when compared to existing approximations for longer maturities and tenors.

Optimal contours and controls in semi-analytical option pricing revisited

Wednesday, 18th July - 15:30 - Approximating the Volatility Smile - Ui Chadhain - Oral - Abstract ID: 435

Dr. Roger Lord (Cardano), Dr. Christian Kahl (FINCAD)

For models with analytically available characteristic functions, Fourier inversion is an important computational method for a fast and accurate calculation of plain vanilla option prices. To improve the numerical stability of the inversion, Lord and Kahl [2007] suggested a method to find an optimal contour of integration. Joshi and Yang [2011] built on Andersen and Andreasen's [2002] suggestion, and used the Black-Scholes formula as a control variate.

At the 9th World Congress we showed some initial results on the effectiveness of combining controls and contours. In this paper we extend this work by considering other quadratures, payoffs and controls.

The Chebyshev method for the implied volatility

Wednesday, 18th July - 16:00 - Approximating the Volatility Smile - Ui Chadhain - Oral - Abstract ID: 165

Mr. Christian Poetz (Queen Mary University of London), Dr. Kathrin Glau (Queen Mary University of London), Mr. Paul Herold (Technical University of Munich), Prof. Dilip Madan (Robert H. Smith School of Business)

The implied volatility is a crucial element of any financial toolbox, since it is used for quoting and the hedging of options as well as for model calibration. We propose a bivariate interpolation of the implied volatility surface based on Chebyshev polynomials. This yields a closed-form approximation of the implied volatility, which is easy to implement and to maintain. We prove a subexponential error decay. This allows us to obtain an accuracy close to machine precision with polynomials of a low degree. Numerical experiments confirm a considerable increase in efficiency, especially for large data sets.

Risk Sharing with Higher Dimensional Security Spaces

Thursday, 19th July - 11:30 - Risk Measures - Beckett 1 - Oral - Abstract ID: 131

Mr. Felix-Benedikt Liebrich (University of Munich), Dr. Gregor Svindland (University of Munich)

We discuss the risk sharing problem in a Riesz space economy where the commodities are aggregated financial losses a system of finitely many agents may incur. We analyse the problem using a notion of risk measurement which extends the classical cash-additive case and prove the existence of Pareto optimal and equilibrium allocations for polyhedral agent systems and law-invariant acceptance criteria. Moreover, we will present results on continuity properties of set-valued maps mapping an aggregated initial loss or a loss endowment to its optimal allocations.

Capital Allocations for classical and set-valued risk measures

Thursday, 19th July - 12:00 - Risk Measures - Beckett 1 - Oral - Abstract ID: 161

Dr. Francesca Centrone (University of Piemonte-Orientale), Prof. Emanuela Rosazza Gianin (University of Milano-Bicocca)

Tsanakas (2009) defined and studied a Capital Allocation Rule (C.A.R.) for Gâteaux-differentiable risk measures inspired to the game theoretic concept of Aumann and Shapley value. His analysis leaves anyway open the case of non Gateaux differentiable risk measures as well as of quasi-convex ones.
We propose and study a family of C.A.R. (for real-valued risk measures) based on their dual representations and on subdifferentials, reducing to Tsanakas' one under Gateaux-differentiability. We also discuss the suitability of the use of quasi-convex risk measures for capital allocation purposes.
We then define and extend capital allocations to set-valued risk measures.

Time-consistency of risk measures: how strong is such a property?

Thursday, 19th July - 12:30 - Risk Measures - Beckett 1 - Oral - Abstract ID: 368

Dr. Elisa Mastrogiacomo (Insubria), Prof. Emanuela Rosazza Gianin (University of Milano-Bicocca)

In the present work we study time-consistency for general dynamic risk measures where either only cash-invariance or both cash-invariance and convexity are dropped. This analysis is motivated by the recent papers of El Karoui and Ravanelli (2009) and Cerreia-Vioglio et al. (2011) who discussed and weakened the axioms above by introducing cash-subadditivity and quasi-convexity. In particular, we investigate and discuss whether the notion of timeconsistency is too restrictive, when considered in the general framework of quasi-convex and cash-subadditive risk measures. Finally, we provide some conditions guaranteeing timeconsistency in this more general framework.

Multivariate risk measures as quasiconvex compositions

Thursday, 19th July - 13:00 - Risk Measures - Beckett 1 - Oral - Abstract ID: 391

Dr. Cagin Ararat (Bilkent University)

We consider multivariate risk measures that are defined as compositions of set-valued functions. Such class of risk measures is rich enough to cover many examples of systemic risk measures studied recently as well as their scalarizations. We pay special attention to properties of the constituent set-valued functions that guarantee quasiconvexity of the composite risk measure. The so-called natural quasiconvexity property, an old but not so well-known property between convexity and quasiconvexity, plays a key role in the study of these risk measures. Our main results provide dual representations for compositions in terms of the dual representations of the constituents.

Optimal consumption and investment under transaction costs

Thursday, 19th July - 11:30 - Portfolio Optimisation with Transaction Costs - Beckett 2 - Oral - Abstract ID: 32

Prof. David Hobson (University of Warwick), Dr. Alex Sing-lam Tse (University of Cambridge), Dr. Yeqi Zhu (Credit Suisse)

We consider the Merton problem in a market with a single risky asset and proportional transaction costs and give a complete solution of the problem up to the solution of a first-crossing problem for a first-order differential equation. A precise condition for when leverage occurs is provided. One new and unexpected result is if the model parameters are such that the solution to a standard Merton problem involves a leveraged position, and when transaction costs are large, the location of the boundary at which sales of the risky asset occur is independent of the transaction cost on purchases.

Robust utility maximization with proportional transaction costs

Thursday, 19th July - 12:00 - Portfolio Optimisation with Transaction Costs - Beckett 2 - Oral - Abstract ID: 230

Dr. Ngoc Huy Chau (Alfred Renyi Institute of Mathematics), Prof. Miklós Rásonyi (MTA Alfred Renyi Institute of Mathematics)

The existence of solutions of the robust utility maximization problem under proportional transaction costs is discussed. Utility functions are defined either on R+ or on R, risky asset prices have continuous trajectories and admit consistent price systems. Our model assumes that there is a parametrization for the dynamics of risky assets. The primal problem is studied directly. More precisely, we introduce an appropriate topological space for finite variation processes and then study convex compactness of certain sets in this space. We furthermore rely on a recent convex compactness result of Delbaen and Owari in Orlicz spaces.

Utility Maximization with Constant Costs

Thursday, 19th July - 12:30 - Portfolio Optimisation with Transaction Costs - Beckett 2 - Oral - Abstract ID: 359

Dr. Christoph Belak (University of Trier), Prof. Sören Christensen (University of Hamburg), Prof. Frank Seifried (University of Trier)

We study the problem of maximizing expected utility of terminal wealth for an investor facing constant and proportional transaction costs in a multidimensional diffusion market. One of the main challenges is that the value function turns out to be piecewise but not globally continuous. We establish this result via a combination of the stochastic Perron's method and a local comparison principle for viscosity solutions of nonlocal PDEs. We then use a characterization of the value function as the pointwise infimum of a suitable set of superharmonic functions to construct optimal trading strategies.

Sensitivity analysis of the utility maximization problem with respect to model perturbations

Thursday, 19th July - 13:00 - Portfolio Optimisation with Transaction Costs - Beckett 2 - Oral - Abstract ID: 138

Prof. Oleksii Mostovyi (University of Connecticut), Prof. Mihai Sirbu (University of Texas at Austin)

We study the sensitivity of the expected utility maximization problem ina continuous semi-martingale market with respect to small changes in the market priceof risk. Assuming that the preferences of a rational economic agent are modeled witha general utility function, we obtain a second-order expansion of the value function, afirst-order approximation of the terminal wealth, and construct trading strategies thatmatch the indirect utility function up to the second order. If a risk-tolerance wealthprocess exists, using it as a num´eraire and under an appropriate change of measure, wereduce the approximation problem to a Kunita-Watanabe decomposition.

On the Joint Calibration of SPX and VIX Options

Thursday, 19th July - 11:30 - Calibrating Stochastic Volatility Models - Burke Theater - Oral - Abstract ID: 256

Dr. Julien Guyon (Bloomberg L.P.)

Since VIX options started trading in 2006, many researchers have attempted to build a model for the SPX that jointly calibrates to SPX and VIX options. Many have argued that jumps in the SPX were needed. Does there exist a continuous model on the SPX that jointly calibrates to SPX and VIX options? In the case of instantaneous VIX, the answer is clear and involves convex ordering and a novel application of martingale transport to finance. The real case of 30-day VIX is more involved, and we show that rough volatility models have the potential for jointly calibrating.

Volatility options in rough volatility models

Thursday, 19th July - 12:00 - Calibrating Stochastic Volatility Models - Burke Theater - Oral - Abstract ID: 273

Dr. Antoine Jacquier (Imperial College), Dr. Blanka Horvath (Imperial College), Prof. Peter Tankov (ENSAE ParisTech)

We discuss the pricing and hedging of volatility options in some of the recently introduced rough volatility models. First, we develop efficient Monte Carlo methods and asymptotic approximations for computing option prices and hedge ratios in models where log-volatility follows a Gaussian Volterra process. While providing a good fit for European options, these models are unable to reproduce the VIX option smile observed in the market, and are thus not suitable for VIX products. To accommodate VIX options we therefore introduce modulated Volterra processes, and show that these models successfully capture the skew of VIX products.

Exponentiation of Conditional Expectations Under Stochastic Volatility

Thursday, 19th July - 12:30 - Calibrating Stochastic Volatility Models - Burke Theater - Oral - Abstract ID: 422

Prof. Jim Gatheral (Baruch College, CUNY), Prof. elisa alos (University of Pompeu Fabra), Prof. Radoš Radoičić (Baruch College, CUNY)

We use the Alòs Decomposition Formula to express certain conditional expectations as exponentials of iterated integrals. As one application, we compute an exact formal expression for the leverage swap for any stochastic volatility model expressed in forward variance form. As another, we show how to extend the Bergomi Guyon expansion to all orders in volatility of volatility. Finally, we compute exact expressions under rough volatility, obtaining in particular the fractional Riccati equation for the rough Heston characteristic function. As a corollary, we compute a closed-form expression for the leverage swap in the rough Heston model.

VIX derivatives in rough forward variance models

Thursday, 19th July - 13:00 - Calibrating Stochastic Volatility Models - Burke Theater - Oral - Abstract ID: 423

Dr. Stefano De Marco (Ecole Polytechnique-CMAP)

Recently proposed models for the forward variance and the spot value of the SP500 based on fractional Volterra processes - specifically, the so called rough Bergomi model of [Bayer, Gatheral, Friz 2016] - are not able to account for smiles of options on VIX (the major implied volatility index on the SP500). Indeed, the VIX process induced by this model is essentially log-normal: any calibration to the VIX market instruments is, then, out of reach. We will discuss solutions, building on the work of Bergomi [2008,2016], to overcome this limitation.

Doubly Reflected BSDEs and non-linear Dynkin games: beyond right-continuity

Thursday, 19th July - 11:30 - Equilibria, Games and BSDEs - Davis - Oral - Abstract ID: 347

Dr. Miryana Grigorova (University Bielefeld), Prof. Peter Imkeller (Humboldt-Universitat zu Berlin), Prof. Youssef Ouknine (Universite Cadi Ayyad), Prof. Marie-Claire Quenez (Universite Paris-Diderot)

We formulate a notion of doubly reflected BSDE in the case where the barriers ξ and ζ are completely irregular. Under a Mokobodzki-type condition, we show existence and uniqueness of the solution. When ξ is
right-upper-semicontinuous and ζ is right-lower-semicontinuous, the solution is characterized in terms of the value of a non-linear Dynkin game over stopping times. In the general case where the barriers are completely irregular, the solution is related to the value of “an extension” of the previous non-linear game problem over a larger set of “stopping strategies” than the set of stopping times.

General Incomplete-Market Equilibria in Continuous Time

Thursday, 19th July - 12:00 - Equilibria, Games and BSDEs - Davis - Oral - Abstract ID: 141

Prof. Andrew Lyasoff (Boston University, Questrom School of Business)

The paper develops the continuous-time (infinite state space) counterpart of the discrete-time general incomplete-market equilibrium model from (Dumas and Lyasoff, 2012). It is shown that the main conclusions from (DL) carry over to the infinite dimensional case: the requirements that all market participants can solve their investment-consumption problems, that their individual pricing measures produce identical prices for all traded streams of stochastic payoffs, and the markets clear, generate the same number of restrictions as there are degrees of freedom in fixing the equilibrium (choice of asset prices, consumption plans, and investment strategies) – regardless of the degree of market incompleteness.

A Mean Field Game of Optimal Portfolio Liquidation

Thursday, 19th July - 12:30 - Equilibria, Games and BSDEs - Davis - Oral - Abstract ID: 252

Mr. Guanxing Fu (Humboldt-Universitat zu Berlin), Prof. Ulrich Horst (Humboldt-Universitat zu Berlin), Dr. Paulwin Graewe (Humboldt-Universitat zu Berlin), Prof. Alexandre Popier (Universite du Maine)

We consider a MFG of optimal portfolio liquidation under asymmetric information. We prove that the solution of the MFG can be characterised in terms of a FBSDE with possibly singular terminal condition on the backward component or, equivalently, in terms of a FBSDE with finite terminal condition, yet singular driver. We introduce a weighted space to accommodate the solution. Finally, we prove our MFG can be approximated by a sequence of MFGs without state constraint.

The coordination of centralised and distributed generation

Thursday, 19th July - 13:00 - Equilibria, Games and BSDEs - Davis - Oral - Abstract ID: 208

Prof. René Aid (University of Paris-Dauphine), Dr. Matteo Basei (University of California, Berkeley), Prof. Huyên Pham (Paris Diderot University (Paris 7))

Consumers satisfy their electricity demand by self-production (solar panels) and centralized production (energy companies). We consider the point of view of a consumer, an energy company, a social planner: we characterize the production strategies which minimize the costs and look for an equilibrium price, in the sense of Pareto and Stackelberg. Mathematically, we deal with non-standard McKean-Vlasov control problem with stochastic coefficients. Our results do not depend on the model chosen for the market price of electricity.

On the calibration of jump-diffusion models in finance

Thursday, 19th July - 11:30 - Numerics, PDEs and Option Pricing - Emmet - Oral - Abstract ID: 374

Dr. Vinicius Albani (Federal University of Santa Catarina), Dr. Jorge Zubelli (National Institute of Pure and Applied Mathematics), Dr. Sabrina Mulinacci (University of Bologna)

We apply a splitting strategy to identify simultaneously the local volatility surface and the jump-size distribution of a jump-diffusion driven asset from quoted European call option prices. This is done by means of a Tikhonov-type regularization technique. We also present numerical examples with synthetic, as well as, real data illustrating the robustness of this method.

Pricing Barrier Options in the Heston Model using the Heath-Platen Estimator

Thursday, 19th July - 12:00 - Numerics, PDEs and Option Pricing - Emmet - Oral - Abstract ID: 201

Dr. Sema Coskun (University of Kaiserslautern), Prof. Ralf Korn (University of Kaiserslautern)

Both barrier options and the Heston stochastic volatility model are omnipresent in real-life applications of financial mathematics. Therefore, we apply the Heath-Platen (HP) estimator (as first introduced in D. Heath and E. Platen (2002) A variance reduction technique based on integral representations. Quantitative Finance, 2(5):362–369) to price barrier options in the Heston model setting as an alternative to conventional Monte Carlo methods and PDE based methods. We demonstrate the superior performance of the HP estimator via numerical examples and explain this performance by a detailed look at the underlying theoretical concept of the HP estimator.

Analysis of Markov Chain Approximation for Option Pricing and Hedging: Grid Design and Convergence Behavior

Thursday, 19th July - 12:30 - Numerics, PDEs and Option Pricing - Emmet - Oral - Abstract ID: 79

Prof. Lingfei Li (The Chinese University of Hong Kong), Prof. Gongqiu Zhang (Wuhan University)

Continuous time Markov chain approximation is an intuitive and powerful method for pricing options in general Markovian models. This paper analyzes how grid design affects the convergence behavior of barrier and European options in general diffusion models. Using the spectral method, we obtain sharp estimates for the convergence rate of option price, delta and gamma for non-uniform grids. Our analysis inspires us to propose a novel class of non-uniform grids, which ensures that convergence is not only second order, but also smooth, which makes extrapolation applicable to achieve even higher convergence rate. The extrapolation also works in jump models.

Branching diffusion simulation for stochastic control problems with friction

Thursday, 19th July - 13:00 - Numerics, PDEs and Option Pricing - Emmet - Oral - Abstract ID: 287

Dr. Ibrahim Ekren (University of Michigan), Mr. Max Reppen (ETH Zurich)

Using branching processes, we give a numerical method for the simulation of solutions of systems of nonlinear PDEs where the nonlinearity is polynomial on the unknown functions. Under some integrability assumption we show the convergence of the method. Using a transformation, we apply these methods for the simulation of solutions of a class of degenerate parabolic PDEs coming from stochastic control problems with frictions. In this case, we also exhibit assumptions proving the convergence of the method.

Forecasting security's volatility using low-frequency and high-frequency historical data and option-implied information

Thursday, 19th July - 11:30 - Forecasting - Swift - Oral - Abstract ID: 292

Dr. Huiling Yuan (Shanghai University of Finance and Economics), Prof. Yong Zhou (Shanghai University of Finance and Economics), Prof. Zhiyuan Zhang (Shanghai University of Finance and Economics), Prof. Xiangyu Cui (Shanghai University of Finance and Economics)

Low-frequency historical data, high-frequency historical data and option data are three major sources of forecasting the underlying security's volatility. In this paper, we propose a unified GARCH-Ito-OI model to integrate three information sources. Instead of using options' price data directly, we extract the option-implied information, such as implied volatility, from the option data and consider it as an exogenous variable. We provide the quasi-maximum likelihood estimators for the parameters and establish the asymptotic theory for the estimators. The empirical analysis shows that the proposed GARCH-Ito-OI model has better out-of-sample forecasting performances than the models, which rely on two information sources.

Modeling Technical Analysis

Thursday, 19th July - 12:00 - Forecasting - Swift - Oral - Abstract ID: 50

Mr. Jun Maeda (University of Warwick), Prof. Saul Jacka (University of Warwick)

We model the behaviour of a stock price process under the assumption of the existence of a support/resistance level, which is one of the most popular approaches in the field of technical analysis.
We obtain optimal dynamic trading strategies under the setup.

Towards Deep Linear Networks for Financial Forecasting

Thursday, 19th July - 12:30 - Forecasting - Swift - Oral - Abstract ID: 427

Prof. David Edelman (University College Dublin)

The concepts of Deep Learning traditionally associated with nonlinear forecasting and estimation are applied here to provide linear forecasting solutions. The methodology of Linear Deep Learning is here applied to a daily-cycle technical trading problem and found to yield simple yet powerful results, as demonstrated by hypothetical out-of-sample trading of the FTSE100 and other indices.

Option-Implied Correlations, Factor Models, and Market Risk

Thursday, 19th July - 13:00 - Forecasting - Swift - Oral - Abstract ID: 159

Mr. Lorenzo Schoenleber (Frankfurt School of Finance and Management), Prof. Adrian Buss (INSEAD), Prof. Grigory Vilkov (Frankfurt School of Finance and Management)

Implied correlation and variance-risk-premium stand out in predicting market returns. However, while the predictive ability of implied correlation lasts for up to a year, the variance-risk-premium predicts market returns only for one quarter ahead. Contrary to the accepted view, implied correlation predicts the market return not through a diversification risk channel, but by predicting a concentration of market exposure, which defines the level of nondiversificable market risk (in the form of market betas dispersion). Newly developed implied correlations for nine economic sectors provide industry related information and are used to extract option-implied risk factors from sector-based covariances.

Optimal Learning under Robustness and Time Consistency

Thursday, 19th July - 11:30 - Time Consistency and Inconsistency - Synge - Oral - Abstract ID: 109

Prof. Larry Epstein (Boston University), Prof. Shaolin Ji (Shandong University)

A decision-maker chooses between actions whose payoffs depend on both exogenous randomness and on an unknown parameter θ. She can postpone the action choice, at a per-unit-time cost, so as to learn about θ by observing the realization of a signal modeled by a Brownian motion with drift. There is prior ambiguity about θ and the decision-maker seeks to make robust choices of both stopping time and action by solving a maxmin problem. By extending the continuous-time version of maxmin utility in Chen and Epstein (2002) to accommodate learning, the model captures robustness to model uncertainty, learning and time consistency.

Robust Time-Inconsistent Stochastic Control Problems

Thursday, 19th July - 12:00 - Time Consistency and Inconsistency - Synge - Oral - Abstract ID: 162

Dr. Chi Seng Pun (Nanyang Technological University)

This paper establishes a general analytical framework for continuous-time time-inconsistent stochastic control problems for ambiguity-averse agent, who is not confident in the reference model of the state process and rather considers similar alternative models. We adopt a game-theoretic framework to derive an extended dynamic programming equation and extended Hamilton–Jacobi–Bellman–Isaacs equations for characterizing the robust dynamically optimal control of the problem. We also prove a verification theorem to theoretically support our construction of robust control. To illustrate the tractability, we study an example of robust dynamic mean-variance portfolio selection under two cases: 1. constant risk aversion; and 2. state-dependent risk aversion.

Hyperfinite construction of G-expectation

Thursday, 19th July - 12:30 - Time Consistency and Inconsistency - Synge - Oral - Abstract ID: 228

Dr. Tolulope Rhoda Fadina (University of Freiburg), Prof. Frederik Herzberg (Universitat Bielefeld)

The*hyperfinite G-expectation* is a nonstandard discrete analogue of G-expectation (in the sense of Robinsonian nonstandard analysis). A *lifting* of a continuous-time G-expectation operator is defined as a hyperfinite G-expectation which is infinitely close, in the sense of nonstandard topology, to the continuous-time G-expectation. We develop the basic theory for hyperfinite G-expectations and prove an existence theorem for liftings of (continuous-time) G-expectation. For the proof of the lifting theorem, we use a new discretization theorem for the G-expectation (also established in this paper, based on the work of Dolinsky, Nutz and Soner [Stoch. Proc. Appl. 122, (2012), 664–675]).

Time consistency of the mean-risk problem

Thursday, 19th July - 13:00 - Time Consistency and Inconsistency - Synge - Oral - Abstract ID: 372

Ms. Gabriela Kovacova (WU - Vienna University of Economics and Business), Prof. Birgit Rudloff (WU - Vienna University of Economics and Business)

Consider the dynamic mean-risk problem. Typically, the problem is scalarized and well known not to satisfy the Bellman principle. Thus, the classical dynamic programming methods are not applicable.
We will show that when we do not scalarize the problem, but leave it in its original form as a vector optimization problem, the upper images, whose boundary is the efficient frontier, recurse backwards in time under very mild assumptions. Thus, the dynamic mean-risk problem does satisfy a Bellman principle, but a more general one. This opens the door for a new branch in mathematics: dynamic multivariate programming.

A UNIFIED FRAMEWORK TO ROBUST MODELLING OF FINANCIAL MARKETS IN DISCRETE TIME

Thursday, 19th July - 11:30 - No-Arbitrage Theory and FTAP - Ui Chadhain - Oral - Abstract ID: 180

Mr. Johannes Wiesel (University of Oxford), Prof. Jan Obloj (University of Oxford)

We prove a Fundamental Theorem of Asset Pricing and a Superhedging Theorem in discrete time, which comprises the pathwise and quasisure formulation of [BN15] and [BFH+16]. Furthermore we explain how to extend a quasisure superhedging duality result on a set Ω to a pathwise duality without changing the superhedging price.

Arbitrage Theory under Integer Constraints

Thursday, 19th July - 12:00 - No-Arbitrage Theory and FTAP - Ui Chadhain - Oral - Abstract ID: 277

Prof. Stefan Gerhold (TU Wien), Dr. Paul Krühner (University of Liverpool)

We investigate discrete time trading under integer constraints, that is, we assume that the offered goods or shares are traded in entire quantities instead of the usual real quantity assumption. For rational asset prices this has little effect on the core of the theory of no-arbitrage pricing. For price processes not restricted to the rational numbers, a novel theory of integer arbitrage free pricing and hedging emerges. We establish an FTAP, involving a set of absolutely continuous martingale measures satisfying an additional property. Finally, we discuss superhedging with integral portfolios.

The Black-Scholes Equation in Presence of Arbitrage

Thursday, 19th July - 12:30 - No-Arbitrage Theory and FTAP - Ui Chadhain - Oral - Abstract ID: 291

Prof. Hideyuki Takada (Toho university), Dr. Simone Farinelli (Core Dynamics GmbH)

The celebrated Black-Scholes PDE, allowing to price a derivative in term of the underlying, relies on the no arbitrage assumption. In this work, we utilize a market model, where portfolio rebalancing and discounting are seen as a parallel transport in some geometric space, whose curvature quantifies the arbitrage possibilities. On this basis we derived an extension of Black-Scholes' PDE, where a non linear term depending explicitly on the arbitrage measure appears. We provide an approximated solution for the price of a European call option by means of perturbation theory with respect to this arbitrage measure.

Arbitrage-Free Regularization

Thursday, 19th July - 13:00 - No-Arbitrage Theory and FTAP - Ui Chadhain - Oral - Abstract ID: 403

Mr. Anastasis Kratsios (Concordia University), Dr. Cody Hyndman (Concordia University)

We introduce a path-dependent geometric framework which generalizes the HJM modeling approach to a wide variety of other asset classes. A machine learning regularization framework is developed with the objective of removing arbitrage opportunities from models within this general framework. The regularization method relies on minimal deformations of a model subject to a path-dependent penalty that detects arbitrage opportunities. We prove that the solution of this regularization problem is independent of the arbitrage-penalty chosen, subject to a fixed information loss functional. This paper is focused on placing machine learning methods in finance on a sound theoretical basis.

An application of time reversal to credit risk management

Thursday, 19th July - 14:30 - Credit Risk 2 - Beckett 1 - Oral - Abstract ID: 122

Prof. Masahiko Egami (Kyoto University), Ms. Rusudan Kevkhishvili (Kyoto University)

This article develops a new risk management framework. We use time reversal, last passage time, and the h-transform of linear diffusions. For general diffusions with killing, we obtain the probability density of the last passage time to a certain alarming level and analyze the distribution of the time left until killing after the last passage time to that level. We then apply these results to the leverage process of the company. Finally, we suggest how a company should determine the aforementioned alarming level. Specifically, we construct a relevant optimization problem and derive an optimal alarming level as its solution.

From Az\'ema supermartingales of finite honest times to optional semimartingales of class-(Σ)}

Thursday, 19th July - 15:00 - Credit Risk 2 - Beckett 1 - Oral - Abstract ID: 210

Dr. Libo Li (University of New South Wales)

Given a finite honest time, we derive representations for the additive and multiplicative decomposition of it's Az\'ema supermartingale in terms of optional supermartingales and its running supremum. We extend the notion of semimartingales of class-(Σ) to optional semimartingales with jumps in its finite variation part, allowing one to establish formulas similar to the Madan-Roynette-Yor option pricing formulas for larger class of processes.

Pricing of CoCo Bonds with Unexpected Write-Down Risk

Thursday, 19th July - 15:30 - Credit Risk 2 - Beckett 1 - Oral - Abstract ID: 377

Prof. José Fajardo (FGV/EBAPE), Prof. José Manuel Corcuera (University of Barcelona), Prof. Wim Schoutens (University Katholic of louvain)

Contingent Convertibles (CoCo) are contingent capital instruments which convert into shares, or have a principal write down, if a trigger event takes place. In this paper we analyse “unexpected Write-Down risk”. It is a risk in faced by CoCos, when CoCo with no write-down contract specification are subject to it during the lifetime of the note, mainly due to the intervention of market regulators. We provide pricing formulas for CoCos considering this new type of risk.

When Capital is a Funding Source: The XVA Anticipated BSDEs

Thursday, 19th July - 16:00 - Credit Risk 2 - Beckett 1 - Oral - Abstract ID: 357

Prof. Stéphane Crépey (Evry University), Prof. Romuald Elie (University Paris Est), Dr. Wissal Sabbagh (Evry), Prof. Shiqi Song (University of Evry)

Economic capital (EC) can be used as a funding source by banks, at a risk-free cost instead of the additional credit spread of the bank in the case of unsecured borrowing. This intertwining of EC and FVA leads to an anticipated BSDE (ABSDE) for the FVA. Accounting further for the KVA (capital valuation adjustment) component of economic capital yields an (FVA, KVA) system of ABSDEs. We show that the (FVA, KVA) system of ABSDEs is well-posed, first for a bank without debt, and then in the realistic case of a defaultable bank, with all equations stopped before bank default.

An Expanded Local Variance Gamma model and ultrafast calibration of volatility smile

Thursday, 19th July - 14:30 - New Models for Option Pricing - Beckett 2 - Oral - Abstract ID: 28

Prof. Andrey Itkin (NYU), Prof. Peter Carr (NYU)

We propose an expansion of the LVG model that allows for a non-zero drift in the underlying process. A forward ODE is derived that plays a role of Dupire's equation for the standard local volatility model. Assuming the local variance to be a piecewise linear function of strike and piecewise constant function of time we solve this ODE in closed form. Calibration of the model to the market smiles doesn't require solving any optimization problem. In contrast, it can be done term-by-term by solving a system of non-linear algebraic equations for each maturity, and thus is ultrafast.

A scaled version of the double-mean-reverting model for VIX derivatives

Thursday, 19th July - 15:00 - New Models for Option Pricing - Beckett 2 - Oral - Abstract ID: 221

Dr. Jeonggyu Huh (Yonsei University), Mr. Jaegi Jeon (Yonsei University), Prof. Jeong-Hoon Kim (Yonsei University)

As the Heston model is not consistent with VIX data in real market, alternative stochastic volatility models including the double-mean-reverting model of Gatheral have been developed to overcome its limitation. The double-mean-reverting model is a three factor model reflecting the empirical dynamics of the variance but there is no closed form solution for VIX derivatives and thus calibration may be slow. In this paper, we propose a fast mean-reverting version of the double-mean-reverting model. We obtain a closed form approximation for VIX derivatives and show how it is effective by comparing it with the Heston model and the double-mean-reverting model.

A Self-Excited Switching Jump Diffusion (SESJD): properties, calibration and hitting time.

Thursday, 19th July - 15:30 - New Models for Option Pricing - Beckett 2 - Oral - Abstract ID: 244

Prof. Griselda Deelstra (Universite libre de Bruxelles), Prof. Donatien Hainaut (Universite catholique de Louvain)

A way to model the clustering of jumps in asset prices consists in combining a diffusion process with a jump Hawkes process. This article proposes a new alternative model based on regime switching processes, referred to as a self-excited switching jump diffusion (SESJD) model. In this model, jumps in the asset prices are synchronized with changes of states of a hidden Markov chain. The matrix of transition probabilities of this chain is designed in order to approximate the dynamics of a Hawkes process. This model presents several advantages compared to other jump clustering models.

Multivariate factor-based processes with Sato margins

Thursday, 19th July - 16:00 - New Models for Option Pricing - Beckett 2 - Oral - Abstract ID: 411

Dr. Andrea Romeo (Universita di Torino), Dr. Patrizia Semeraro (Politecnico di Torino), Dr. Marina Marena (Universita di Torino)

We introduce a class of multivariate factor-based processes with the dependence structure of Lévy rhoalpha-models and Sato marginal distributions. We focus on variance gamma and normal inverse Gaussian marginal specifications for their analytical tractability and fit properties. We explore if Sato models, whose margins incorporate more realistic moments term structures, preserve the correlation flexibility in fitting option data. Since rhoalpha -models incorporate nonlinear dependence, we also investigate the impact of Sato margins on nonlinear dependence and its evolution over time. Further, the relevance of nonlinear dependence in multivariate derivative pricing is examined.

Attention to Bitcoin

Thursday, 19th July - 14:30 - Machine Learning - Burke Theater - Oral - Abstract ID: 389

Mr. Amirhossein Sadoghi (University of Hohenheim)

In this paper, we investigate different channels of information to predict Bitcoin's volatility and abnormal returns. We analyze the textual data in news about blockchain technology, major currencies and macroeconomic, and we investigate the predictive and causal power of extracted information to model the dynamic of bitcoin price. We apply Latent Dirichlet Allocation technique to classify and decompose news text into topics, we then show how the sentimental value and time dimensional of the topics can predict market characteristics of bitcoin. We find that the uncertainty of economy can shift the attention of traders to an unregular market like bitcoin.

Machine Learning for Portfolio Tail Risk Measurement

Thursday, 19th July - 15:00 - Machine Learning - Burke Theater - Oral - Abstract ID: 313

Prof. Mike Ludkovski (University of California, Santa Barbara), Prof. Jimmy Risk (Cal Poly Pomona)

We consider calculation of VaR/TVaR capital requirements when the underlying economic scenarios are determined by simulatable risk factors. This problem involves computationally expensive nested simulation, since evaluating expected portfolio losses of an outer scenario requires inner-level Monte Carlo. We introduce statistical learning techniques to speed up this computation, in particular by properly accounting for the simulation noise. Our main workhorse is an advanced Gaussian Process regression approach to efficiently learn the relationship between the stochastic factors defining scenarios and corresponding portfolio value. Leveraging this emulator, we develop sequential algorithms that adaptively allocate inner simulation budgets to target the quantile region.

CDS Rate Construction Methods by Machine Learning Techniques

Thursday, 19th July - 15:30 - Machine Learning - Burke Theater - Oral - Abstract ID: 55

Mr. Zhongmin Luo (birkbeck, University of London), Prof. Raymond Brummelhuis (University of Reims Champagne-Ardenne)

To price and risk-manage OTC derivatives, banks should estimate counterparty default risks based on liquidly quoted CDS rates,which aren't available for the vast majority of counterparties.Thus,banks construct proxy CDS rates using methods ignoring counterparty-specific default risks.Our CDS Proxy methods using Machine Learning Techniques achieve high accuracy based on tests from 156 classifiers out of 8 most popular classifier families including feature correlations on classification. It is a first systematic study of CDS Proxy Construction using Machine Learning Techniques,first systematic classifier comparison study based exclusively on financial market data and can extend for the construction of proxies for other financial variables.

Empirical Asset Pricing via Machine Learning

Thursday, 19th July - 16:00 - Machine Learning - Burke Theater - Oral - Abstract ID: 460

Mr. Shihao Gu (University of Chicago), Prof. Bryan Kelly (Yale University), Prof. Dacheng Xiu (University of Chicago)

We synthesize the field of machine learning with the canonical problem of empirical asset pricing: Measuring asset risk premia. We use the widely understood empirical setting of predicting the time series and cross section of stock (and portfolio) returns to perform a comparative analysis of methods in the machine learning repertoire. At the broadest level, we find that machine learning has great promise for describing asset price behavior. We identify the best performing methods and trace their predictive gains to allowance of non-linear predictor interactions that are missed by other methods.

Zeros

Thursday, 19th July - 14:30 - Markets Stylized Facts and Econometrics - Davis - Oral - Abstract ID: 399

Prof. Federico Bandi (Johns Hopkins Carey Business School), Dr. Davide Pirino (Universita degli Studi di Roma Tor Vergata), Prof. Roberto Reno (University of Verona)

Asset prices can be stale. We define price "staleness" as lack of price adjustments yielding zero returns. The term "idleness" (resp. "near idleness") is, instead, used to define staleness when trading activity is absent (resp. close to absent). We show that zeros are a genuine economic phenomenon linked to trading volumes and liquidity. Zeros are, in general, not the result of institutional features, like price discreteness. Spells of idleness or near idleness are stylized facts suggestive of a key, omitted market friction in the modeling of asset prices.

Jumps or flatness?

Thursday, 19th July - 15:00 - Markets Stylized Facts and Econometrics - Davis - Oral - Abstract ID: 258

Dr. Aleksey Kolokolov (SAFE Center, University of Frankfurt), Prof. Roberto Reno (University of Verona)

We show that flatness, that is the pervasive presence of zero returns in high-frequency data, is heavily detrimental for reliable jump inference. Even moderate levels of flatness, compatible with those observed in actual prices, imply a large number of false positives when detecting jumps, and a sizable negative bias in the measurement of the jump activity index. We provide limit theorems for multipower variation under flat trading which allow to quantify the bias, and propose a simple recipe for its correction. We use the flatness-robust multipowers to reappraise the statistical features of jumps in empirical finance.

The behaviour of high-frequency traders under different market stress scenarios

Thursday, 19th July - 15:30 - Markets Stylized Facts and Econometrics - Davis - Oral - Abstract ID: 345

Ms. Pamela Saliba (Ecole Polytechnique-CMAP and AMF (Autorite Des Marches Financiers)), Mr. Nicolas Megarbane (AMF (Autorite des Marches Financiers)), Prof. Mathieu Rosenbaum (Ecole Polytechnique-CMAP), Prof. Charles-Albert Lehalle (CFM (Capital Fund Management))

This empirical study on European stocks gives evidence about the practices of high-frequency traders (HFTs) under market stress. In the absence of significant news, whatever the market conditions, they are the main contributors to liquidity with a participation of 80% in the market depth. They constitute 60% of the traded amounts, with an aggressive/passive ratio around 53%. We identify a change of regime in the presence of scheduled news that goes beyond the expected reaction to volatility variations. Moreover, in extreme situations, when non-HFTs have time to adjust their tactics, they act as liquidity providers in place of HFTs.

No arbitrage and lead-lag relationships

Thursday, 19th July - 16:00 - Markets Stylized Facts and Econometrics - Davis - Oral - Abstract ID: 366

Prof. Takaki Hayashi (Keio University), Prof. Yuta Koike (University of Tokyo)

The existence of time-lagged cross-correlations between the returns of a pair of assets, which is known as the lead-lag relationship, is a well-known stylized fact in financial econometrics. Recently some continuous-time models have been proposed to take account of the lead-lag relationship. Such a model does not follow a semi-martingale as long as the lead-lag relationship is present, so it admits an arbitrage without market frictions. In this paper we show that they are free of arbitrage if we take account of market frictions such as the presence of minimal waiting time on subsequent transactions or transaction costs.

Statistical Inference for Fractional Volatility

Thursday, 19th July - 14:30 - Rough volatility and Simulations - Emmet - Oral - Abstract ID: 339

Mr. Tetsuya Takabatake (Osaka University), Prof. Masaaki Fukasawa (Osaka University), Ms. Rebecca Westphal (ETH Zurich)

We consider a statistical inference problem for a continuous-time fractional volatility model based on high frequency observations of a quadratic variation of an asset price. Our contribution is to construct a consistent estimator of the Hurst and diffusion parameters in the instantaneous volatility process. In order to take volatility proxy errors into account, we work under a certain noisy observation model derived from a stable convergence theorem for a quadratic variation of a semimartingale. Some empirical results using our estimator are also given, supporting rough volatility models.

Multi-factor approximation of rough volatility models

Thursday, 19th July - 15:00 - Rough volatility and Simulations - Emmet - Oral - Abstract ID: 358

Dr. Omar El Euch (Ecole Polytechnique), Mr. Eduardo Abi Jaber (University of Paris-Dauphine)

Rough volatility models are very appealing because of their fit of both historical and implied volatilities. However due to the non-Markovian and non-semimartingale nature of the volatility process, there is no obvious way to simulate efficiently such models, which makes risk management of derivatives an intricate task. In this paper, we design tractable multi-factor stochastic volatility models approximating rough volatility models and enjoying a Markovian structure. Furthermore, we apply our procedure to the case of the rough Heston model. This enables us to derive a numerical method for solving fractional Riccati equations appearing in the characteristic function of the log-price.

Short-time near-the-money skew in rough volatility models

Thursday, 19th July - 15:30 - Rough volatility and Simulations - Emmet - Oral - Abstract ID: 73

Dr. Blanka Horvath (Imperial College), Mr. Benjamin Stemper (TU Berlin), Dr. Christian Bayer (TU Berlin), Prof. Peter K Friz (TU Berlin), Prof. Archil Gulisashvili (Ohio University)

We consider rough stochastic volatility models where the driving noise of volatility has fractional scaling, in the “rough” regime of Hurst parameter H<1/2. This regime recently attracted a lot of attention both from the statistical and option pricing point of view. With focus on the latter, we sharpen the large deviation results of Forde-Zhang (2017) in a way that allows us to zoom-in around the money while maintaining full analytical tractability.

Functional central limit theorems for rough volatility

Thursday, 19th July - 16:00 - Rough volatility and Simulations - Emmet - Oral - Abstract ID: 151

Mr. Aitor Muguruza Gonzalez (Imperial College London), Dr. Antoine Jacquier (Imperial College), Dr. Blanka Horvath (Imperial College)

We extend Donsker's approximation of Brownian motion to fractional Brownian motion with Hurst exponent H□(0,1) and related processes. Some of the most relevant consequences of our 'rough Donsker (rDonsker) Theorem' are convergence results for discrete approximations of a large class of rough models. This justifies the validity of simple Monte-Carlo methods, for which we provide numerical recipes. We find remarkable agreement with the current benchmark Hybrid scheme. In addition we provide a weak convergence proof for the Hybrid scheme itself, and construct binomial trees, the first available scheme (in the rough volatility context) for early exercise options such as American.

Canonical Markovian representations of stochastic Volterra equations

Thursday, 19th July - 14:30 - Polynomial Models and Volterra Equations - Swift - Oral - Abstract ID: 395

Dr. Christa Cuchiero (University of Vienna), Prof. Josef Teichmann (ETH Zurich)

We introduce canonical Markovian representations of stochastic Volterra processes in terms of transport stochastic partial differential equations (SPDEs). Solution theories are equivalent but the Markovian representation allows for novel numerical techniques as well as solution concepts that are hard to guess from the Volterra equations' point of view. If the instantaneous characteristics of the Volterra process are affine or polynomial the Markovian lift is affine or polynomial as well, providing another explanation of certain affine or polynomial techniques present in the Volterra world. Examples from rough volatility modeling are included.

Generators of measure-valued jump-diffusions

Thursday, 19th July - 15:00 - Polynomial Models and Volterra Equations - Swift - Oral - Abstract ID: 353

Prof. Martin Larsson (ETH), Ms. Sara Svaluto-Ferro (ETH Zurich)

Measure-valued jump-diffusions provide useful approximations of large stochastic systems in finance, such as large sets of equity returns, limit order books, and particle systems with mean-field interaction. The dynamics of a measure-valued jump-diffusion is governed by an integro-differential operator of Levy type, expressed using a notion of derivative that is well-known from the superprocess literature, but different from the Lions derivative frequently used in the context of mean-field games. General and easy-to-use existence criteria for jump-diffusions valued in probability measures are derived using new optimality conditions for functions of measure arguments. Further applications include optimal control of measure-valued state processes.

Markovian structure of the Volterra Heston model

Thursday, 19th July - 15:30 - Polynomial Models and Volterra Equations - Swift - Oral - Abstract ID: 430

Mr. Eduardo Abi Jaber (Universite Paris Dauphine), Dr. Omar El Euch (Ecole Polytechnique)

We unravel the Markovian structure of the Volterra Heston model. The model belongs to the class of affine Volterra processes as introduced in Abi Jaber, Larsson and Pulido (2017) and nests as special cases the *standard Heston model* and the *rough Heston model* of El Euch and Rosenbaum (2016) able to capture the roughness of the volatility. We provide two infinite dimensional Markovian representations explaining the affine structure of the *Volterra Heston model* and leading to new numerical approximation schemes.

Probability-valued polynomial diffusions

Thursday, 19th July - 16:00 - Polynomial Models and Volterra Equations - Swift - Oral - Abstract ID: 439

Ms. Sara Svaluto-Ferro (Sara), Prof. Martin Larsson (ETH), Dr. Christa Cuchiero (University of Vienna)

We introduce polynomial diffusions taking values in the space of probability measures on a locally compact Polish space. We provide a representation of the corresponding extended generators, and prove well-posedness of the associated martingale problems. In particular, we obtain uniqueness by establishing a formula for the conditional moments of the solution, which in the finite-dimensional case reduces to a matrix exponential.

Approximating option prices and implied volatilities under stochastic volatility jump diffusion models

Thursday, 19th July - 14:30 - Volatility - Synge - Oral - Abstract ID: 227

Dr. Josep Vives (Universitat de Barcelona)

This is a survey of the papers cited below, where a decomposition formula for Heston and Bates models is obtained. This type of decomposition is useful to obtain approximated closed formulas for option prices, approximations of the implied volatility surface and to develop new model calibration methodologies.

E. Alòs, R. De Santiago, J. Vives (2015): Calibration of stochastic volatility models via second order approximation: the Heston case. International Journal of Theoretical and Applied Finance 18 (6).

R. Merino, J. Pospísil, T. Sobotka, J. Vives (2017): Decomposition formula for jump diffusion models. Submitted.

Construction and Properties of Maximum Volatility Portfolio

Thursday, 19th July - 15:00 - Volatility - Synge - Oral - Abstract ID: 419

Prof. Jan Vecer (Charles University), Mr. Robert Navrátil (Charles University)

We study a problem of constructing a portfolio using N assets that has the largest distributional distance from the index. Such a portfolio - among other interesting properties - maximizes risk neutral probability of outperforming the index within a fixed time. The construction of this portfolio is mathematically a rather complicated problem and we show its solution based on stochastic optimal control techniques. It turns out that the resulting portfolio always invests in a single asset and it departs from the index only in a small way. We illustrate our findings on a selection of currencies and NASDAQ100 index.

Decomposition formula for rough fractional stochastic volatility model

Thursday, 19th July - 15:30 - Volatility - Synge - Oral - Abstract ID: 274

Mr. Raúl Merino (University of Barc), Dr. Jan Pospíšil (University of West Bohemia), Mr. Tomáš Sobotka (University of West Bohemia), Dr. Tommi Sottinen (University of Vaasa), Dr. Josep Vives (Universitat de Barcelona)

In this talk we introduce a decomposition of the option pricing formula for the rough fractional stochastic volatility models where the volatility process is modelled as the exponential fractional Brownian motion. We further derive an approximation for the price. Numerical comparison is performed against the Monte Carlo simulations results.

Option price decomposition in spot-dependent volatility models and some applications

Thursday, 19th July - 16:00 - Volatility - Synge - Oral - Abstract ID: 264

Mr. Raúl Merino (University of Barcelona), Dr. Josep Vives (Universitat de Barcelona)

In this talk, we show a Hull and White price decomposition formula proved by Merino and Vives (2017) for a general local volatility model. We apply the obtained formula to CEV model. We further derive an approximation for the price and the implied volatility surface. As an application, we use the approximation of the implied volatility surface to estimate model parameters. Numerical comparison is performed for our new method with exact and approximated formulas existing in the literature.

On Overconfidence, Bubbles and the Stochastic Discount Factor

Thursday, 19th July - 14:30 - Equilibria: Bubbles and Transaction Costs - Ui Chadhain - Oral - Abstract ID: 449

Ms. Hyejin Cho (University of Paris 1 - Pantheon Sorbonne)

This study is intended to provide a continuous-time equilibrium model in which overconfidence generates disagreements among 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 stock's price will tend to move to the average price over time. I represent the difference between a false belief and a stochastic stationary process which does not change when shifted in time.

A Regime Switching Equilibrium Model for Asset Bubbles

Thursday, 19th July - 15:00 - Equilibria: Bubbles and Transaction Costs - Ui Chadhain - Oral - Abstract ID: 311

Mr. Georg Wehowar (Montanuniversität Leoben), Prof. Erika Hausenblas (Montanuniversität Leoben)

Our model combines an equilibrium approach for asset bubbles with a Markovian regime switching environment affecting the interest rate. An asset bubble is here defined as the difference between the minimal equilibrium price and the intrinsic value that can be computed explicitly. We consider a dividend rate given by an Ornstein-Uhlenbeck process as the only source of income from the asset. A solution of a hypergeometric matrix differential equation is constructed using matrix special functions. This can, under some restrictions, be identified as an minimal equilibrium price. As a result, a bubble can be calculated explicitly.

Equilibrium Returns with Transaction Costs

Thursday, 19th July - 15:30 - Equilibria: Bubbles and Transaction Costs - Ui Chadhain - Oral - Abstract ID: 262

Dr. Martin Herdegen (University of Warwick), Prof. Johannes Muhle-Karbe (Carnegie Mellon University), Prof. Bruno Bouchard (University of Paris-Dauphine), Prof. Masaaki Fukasawa (Osaka University)

We study how trading costs are reflected in equilibrium returns. To this end, we develop a tractable continuous-time risk-sharing model, where heterogeneous mean-variance investors trade subject to a quadratic transaction cost. The corresponding equilibrium is characterized as the unique solution of a system of coupled but linear forward-backward stochastic differential equations. Explicit solutions are obtained in a number of concrete settings. The sluggishness of the frictional portfolios makes the corresponding equilibrium returns mean-reverting. Compared to the frictionless case, expected returns are higher if the more risk-averse agents are net sellers or if the asset supply expands over time.

Equilibrium with transaction costs

Thursday, 19th July - 16:00 - Equilibria: Bubbles and Transaction Costs - Ui Chadhain - Oral - Abstract ID: 309

Dr. Kim Weston (Rutgers University)

I will discuss the existence of a Radner equilibrium in a model with proportional transaction costs and the effects of transaction costs on the endogenously-derived interest rates. Two agents receive exogenous, unspanned income and choose between consumption and investing into an annuity. The model provides an explicit formula for the equilibrium interest rate in terms of the transaction cost parameter. In equilibrium, welfare always decreases while the interest rate can be both increasing and decreasing in the transaction cost parameter.

Asset fire sales and strategic trading by regulated banks

Friday, 20th July - 10:00 - Risk Spirals - Beckett 1 - Oral - Abstract ID: 437

Prof. Tom Hurd (McMaster University), Dr. Tuan Tran (Ryerson University), Dr. Quentin Shao (Scotiabank)

This paper aims to understand how regulatory constraints such as liquidity and capital requirements affect the behaviour of banks participating in and impacting the open market for banking assets. Strategies that account for the trading of other banks can replace the naive bank behaviour assumptions currently adopted in systemic risk models. A multi-agent game is introduced, where each agent is a bank that trades a single risky asset while satisfying requirements set up by the regulator. Each bank's trades are assumed to have a significant impact on the price, which must be taken into account in all other banks' strategies.

Behavioural XVA

Friday, 20th July - 10:30 - Risk Spirals - Beckett 1 - Oral - Abstract ID: 206

Dr. Chris Kenyon (MUFG Securities EMEA plc), Mr. Hayato Iida (MUFG Securities EMEA plc)

Behavioural effects in XVA occur in the typical case of hedging a client trade: on client default the hedge (effects) will be removed, alternatively if the hedge counterparty defaults the hedge will be replaced. Thus the default probability driving MVA hedge costs, for example, is from the client not the hedge counterparty. This breaks the usual assumption that counterparty XVAs can be computed independently of each other. For another example on the hedge side, multiple CVA costs should be included as replacement hedge counterparties can also default. Numerical examples demonstrate that client XVA prices ignoring behaviour can be materially incorrect.

The Risk Spiral: The Effects of Bank Capital and Diversification on Risk Taking

Friday, 20th July - 11:00 - Risk Spirals - Beckett 1 - Oral - Abstract ID: 469

Dr. Alon Raviv (Bar Ilan University), Dr. Sharon Peleg (Tel Aviv University)

We present a model where bank assets are a portfolio of risky debt claims and analyze equityholders' risk-taking behavior while considering the strategic interaction between debtors and creditors. We find that: (1) as the leverage of a bank increases, risk shifting by borrowers increases, even if their leverage is unchanged (zombie lending). (2) While the literature demonstrates that an increase in comovement of a loan portfolio increases the bank's cost of default directly, we find that the increase prevails through a second channel: an increase in risk shifting. (3) Risk shifting decreases with the diversification of a loan portfolio.

Probabilistic Interpretation of an Implied Volatility Smile

Friday, 20th July - 10:00 - Variance, Implied Volatility and Pricing - Burke Theater - Oral - Abstract ID: 458

Prof. Peter Carr (New York University), Prof. Liuren Wu (Baruch College, CUNY)

When the variance rates implied from option prices differ across strike prices, at most one of them can be interpreted as the variance rate of the underlying security price. We develop an arbitrage-free option pricing model with four stochastic state variables, one of which is the underlying security price. We show how to successively explicitly determine the other three state variables from three given co-terminal arbitrage-free implied variance rates. The resulting calibrated implied variance rate smile is given a simple probabilistic representation. To our knowledge, this is the first non-flat implied variance rate smile enjoying any probabilistic interpretation.

Statistics of VIX & VSTOXX Futures with Applications to Trading Volatility Exchange-Traded Products

Friday, 20th July - 10:30 - Variance, Implied Volatility and Pricing - Burke Theater - Oral - Abstract ID: 475

Prof. Andrew Papanicolaou (NYU)

We study the dynamics of both VIX and VSOTXX futures and ETNs/ETFs. We find that contrary to classical commodities, futures curves for VIX and VSTOXX exhibit large volatility and skewness, consistent with the absence of cash-and-carry arbitrage. The constant-maturity futures (CMF) term-structure can be modeled as a stationary stochastic process in which the most likely state is a contango with a mode the index approximately at 12\% and a long-term futures price at approximately 20\%. We analyze the behavior of ETFs and ETNs based on constant-maturity rolling futures strategies, such as VXX, XIV, VXZ, EVIX and EXIV.

Extracting Latent States from High Frequency Option Prices

Friday, 20th July - 11:00 - Variance, Implied Volatility and Pricing - Burke Theater - Oral - Abstract ID: 86

Dr. Diego Amaya (Wilfrid Laurier University), Dr. Jean-Francois Begin (Simon Fraser University), Dr. Genevieve Gauthier (HEC Montreal)

We propose the realized option variance as a new observable variable to integrate high frequency option prices in the inference of option pricing models. Using simulation and empirical studies, this paper documents the incremental information offered by this realized measure. Our empirical results show that the information contained in the realized option variance improves the inference of model variables such as the instantaneous variance and variance jumps of the S\&P 500 index. Parameter estimates indicate that the risk premium breakdown between jump and diffusive risks is affected by the omission of this information.

Deep OTM implied Variance Can Never Rise

Friday, 20th July - 11:30 - Variance, Implied Volatility and Pricing - Burke Theater - Oral - Abstract ID: 472

Prof. Bruno Dupire (Bloomberg LP)

Market participants commonly extrapolate the implied volatility skew for far out of the money strikes with a flat asymptote. We show that if it were possible to trade in a frictionless way options priced according to this assumption, the asymptotical level of the corresponding implied variance (square of the implied volatility times the residual maturity) could never rise. It echoes the result of Dybvig-Ingersoll-Ross on the long term interest rates that can never fall, although the condition is on the strikes, not on the maturities. Actually the long term variance swap rate can fall or rise with no restriction.

Is the Hawkes graph approach applicable for examining the bankruptcy risk dependence structure? An empirical analysis of firms' bankruptcies in Japan

Friday, 20th July - 10:00 - Credit Risk 3 - Davis - Oral - Abstract ID: 183

Dr. Hidetoshi Nakagawa (Hitotsubashi University), Mr. Teruo Kemmotsu (Hitotsubashi University (graduated))

We examine the types of bankruptcy risk dependence structures of Japanese firms by using a multidimensional Hawkes process. For this purpose, we concentrate on a new approach called the Hawkes graph introduced by Embrechts and Kirchner (2018) to estimate the intensity of the multidimensional Hawkes process and assess whether the Hawkes graph approach is applicable for examining bankruptcy risk dependence structures, using historical data on firms' bankruptcies in Japan.We find that the approach can be used to analyze such credit risk dependence compared with the maximum likelihood method for the conventional Hawkes intensity specified by an exponentially decaying function.

A factor-model approach for correlation scenarios and correlation stress-testing

Friday, 20th July - 10:30 - Credit Risk 3 - Davis - Oral - Abstract ID: 190

Prof. Natalie Packham (Berlin School of Economics and Law), Mr. Fabian Woebbeking (Goethe University Frankfurt)

A factor-model is developed for parameterising correlation matrices of financial portfolios. The factor-model structure allows to understand various drivers of correlation amongst portfolio constituents. The approach can be used to translate economic scenarios into constraints and changes on the dependence structure allowing to measure the impact of specific scenarios on portfolio risk. As an example, we apply the factor-model approach to the credit derivatives trading strategy by JP Morgan Chase, dubbed the London Whale, that led to losses in the magnitude of 6.2 bln USD in 2012.

Time-changed affine models: fitting interest-rates and CDS term-structures without shift

Friday, 20th July - 11:00 - Credit Risk 3 - Davis - Oral - Abstract ID: 242

Mr. Cheikh Mbaye (Universite catholique de Louvain), Dr. Frédéric Vrins (Universite catholique de Louvain)

The class of affine short-rate or intensity models are very popular in finance for tractability reasons. For instance, time-homogeneous models like Vasicek, CIR and JCIR are clearly the most popular models to describe short-rate or default intensity dynamics. However, they are too scarce to allow for a perfect fit to a specified term-structure. In this paper, we propose a method based on change of times. By speeding up or slowing down the clock, we can make sure to fit any valid zero-coupon bond or CDS curves without affecting the range of the initial time-homogeneous model.

Lapse risk in life insurance: correlation and contagion effects among policyholders' behaviors

Friday, 20th July - 11:30 - Credit Risk 3 - Davis - Oral - Abstract ID: 355

Dr. Flavia Barsotti (UniCredit Spa), Dr. Xavier Milhaud (ISFA), Dr. SALHI Yahia (ISFA)

We model lapse risk in life insurance by integrating the dynamic aspects of policyholders' behaviors and the dependency of the lapse intensity on macroeconomic conditions. We introduce a mathematical framework where the lapse intensity follows a dynamic contagion process, see Dassios and Zhao (2011), in order to capture both contagion and correlation potentially arising among insureds' behaviors. An external market driven jump component affects the lapse intensity process as function of interest rates. Closed-form expressions and analytic sensitivities for the moments of the lapse intensity are provided, showing the impacts of massive copycat behaviors.

Banking networks and the circuit theory of money

Friday, 20th July - 10:00 - Systemic Risk: Network Models - Emmet - Oral - Abstract ID: 394

Prof. Matheus Grasselli (McMaster University), Dr. Alexander Lipton (Stronghold Labs)

We consider a network of interconnected banks coupled with a macroeconomic model. The key feature of the model is that money is created endogenously to satisfy the demand for loans and deposits of the other economic agents. The macroeconomic model is driven by stochastic consumption and stock-flow consistence provide the total amount of external loans and deposits for the banking sector. We distribute these aggregate quantities among the banks using a preferential attachment mechanism and study the stability of the resulting network. Crucially, the amplification of shocks within the banking network can drive the model away from its stable equilibrium.

Dynamic clearing and contagion in financial networks

Friday, 20th July - 10:30 - Systemic Risk: Network Models - Emmet - Oral - Abstract ID: 137

Mr. Tathagata Banerjee (Washington University in St. Louis), Mr. Alex Bernstein (University of California, Santa Barbara), Dr. Zachary Feinstein (Washington University in St. Louis)

We will consider an extension of the Eisenberg-Noe model of financial contagion to allow for time dynamics in both discrete and continuous time. Mathematical results on existence and uniqueness of firm wealths under discrete and continuous-time will be provided. The financial implications of time dynamics will be considered, with focus on how the dynamic clearing solutions differ from those of the static Eisenberg-Noe model.

Adjustable Network Reconstruction with Applications to CDS Exposures

Friday, 20th July - 11:00 - Systemic Risk: Network Models - Emmet - Oral - Abstract ID: 145

Prof. Axel Gandy (Imperial College London), Dr. Luitgard Veraart (London School of Economics and Political Science)

We develop an empirical Bayesian methodology to reconstruct weighted directed networks from the total in- and out-weight of each node. This problem arises in the analysis of systemic risk of partially observed financial networks. Importantly, our methodology can be adjusted such that the generated networks satisfy certain desired global topological properties such as a given mean density. We apply our methodology to a novel data set containing 89 financial networks of credit default swap exposures. Our methodology performs well under a wide range of performance criteria and also compared to other existing methods.

A dynamic asymmetric information equilibrium

Friday, 20th July - 10:00 - Information Models - Swift - Oral - Abstract ID: 204

Mr. Luca Bernardinelli (Dublin City University), Dr. Paolo Guasoni (Dublin City University), Prof. Eberhard Mayerhofer (University of Limerick)

In a market with a risk-free rate and a traded dividend stream driven by one latent variable, several agents make consumption and investment decisions based on public prices and on individual private signals. We derive in closed form the asymptotic equilibrium price of the dividend claim, assuming that each investor has constant absolute risk aversion. Price volatility depends on the volatility of dividends and on the volatility of the estimate of the latent variable, which is revealed to all agents through prices.

Optimal redeeming strategy of stock loans under drift uncertainty

Friday, 20th July - 10:30 - Information Models - Swift - Oral - Abstract ID: 218

Dr. Zuo Quan Xu (The Hong Kong Polytechnic University), Prof. Fahuai Yi (Guangdong University of Foreign Studies)

We consider the optimal redeeming problem of stock loans under incomplete information presented by the uncertainty trend of underlying stock. Due to the unavoidable estimating of the trend when making decisions, the HJB equation turns out to be a degenerate parabolic PDE which is very hard to obtain its regularity by standard approaches, making the problem distinguish from the existing ones without drift uncertainty. We provide a thorough and delicate probabilistic analysis to obtain the regularity and the optimal redeeming strategies. The latter is shown to be significantly different for the bull and bear trends.

Optimal trade execution under endogenous pressure to liquidate: theory and numerical solutions

Friday, 20th July - 11:00 - Information Models - Swift - Oral - Abstract ID: 171

Prof. Pavol Brunovský (Comenius University Bratislava), Prof. Aleš Černý (Cass Business School, City, University of London), Prof. Ján Komadel (Comenius University Bratislava)

We study optimal liquidation of a trading position (so-called-block-order or meta-order) in a market with a linear temporary price impact (Kyle, 1985). We endogenize the pressure to liquidate by introducing a downward drift in the unaffected asset price while simultaneously ruling out short sales. In this setting the liquidation time horizon becomes a stopping time determined endogenously, as part of the optimal strategy. We find that the optimal liquidation strategy is consistent with the square-root impact per share law.
Mathematically, the Hamilton-Jacobi-Bellman equation of our optimization leads to a severely singular and numerically unstable ordinary differential equation initial value problem.

A continuous auction model with insiders and random time of information release

Friday, 20th July - 10:00 - Dynamic Information - Synge - Oral - Abstract ID: 196

Prof. José Manuel Corcuera (University of Barcelona), Prof. Giulia Di Nunno (University of Oslo), Dr. Gergely Farkas (University of Barcelona), Prof. Bernt Øksendal (Univeristy of Oslo)

In a unified framework we study equilibrium in presence of an insider having information on the firm value, announced at random time. The release-time is either predictable for the insider, or it is fully unknown. Consistently with Kyle original idea, market-makers give prices via a pricing-rule based on the asset aggregate-demand.

We aim at studying the equilibrium structure, described by the optimal insider strategy (OIS), the rational pricing-rule, and the price-pressure. We provide necessary conditions for the OIS under general asset dynamics, we study efficiency, we characterise the equilibrium both when the release-time is predictable and when it is not.

Entropy and additional utility of a discrete information disclosed progressively in time

Friday, 20th July - 10:30 - Dynamic Information - Synge - Oral - Abstract ID: 468

Dr. Anna Aksamit (University of Sydney)

The additional information carried by enlarged filtration and its measurement was studied by several authors. Already Meyer (*Sur un theoreme de J. Jacod*, 1978) and Yor (*Entropie d'une partition, et grossissement initial d'une filtration*, 1985), investigated stability of martingale spaces with respect to initial enlargement with atomic sigma-field.

We extend these considerations to the case where information is disclosed progressively in time. We define the entropy of such information and we prove that its finiteness is enough for stability of some martingale spaces in progressive setting. Finally we calculate additional logarithmic utility of a discrete information disclosed progressively in time.

Kyle equilibrium under random price pressure.

Friday, 20th July - 11:00 - Dynamic Information - Synge - Oral - Abstract ID: 198

Prof. José Manuel Corcuera (University of Barcelona), Prof. Giulia Di Nunno (University of Oslo)

We study the equilibrium in the model proposed by Kyle in 1985 and extended to the continuous time setting by Back in 1992. The novelty of this paper is that we consider a framework where the price pressure can be random. We also allow for a random release time of the fundamental value of the asset. This framework includes all the particular Kyle models proposed in the literature. The results enlighten the equilibrium properties shared by all these models and guide the way of finding equilibriums in this context.

Proactive and Reactive Investments via Meyer-σ-fields

Friday, 20th July - 11:30 - Dynamic Information - Synge - Oral - Abstract ID: 278

Mr. David Besslich (TU Berlin), Prof. Peter Bank (TU Berlin)

Stochastic control problems search optimal strategies given some information flow. Imagine a moment information is known to become available. Controller will make a precautionary action right before and a reaction right afterwards depending on the own expectations. This suggests neither predictable nor merely adapted controls. We use Meyer-σ-fields to capture this and apply it in an irreversible investment problem with inventory risk, where we construct optimal policies in a Lévy process setting, which depend on a generalized version of a representation problem of Bank & El Karoui (2004). For this extension we used the théorie générale des processus stochastiques.

American Step Options

Friday, 20th July - 10:00 - American-style derivatives - Ui Chadhain - Oral - Abstract ID: 380

Dr. Souleymane Laminou Abdou (Boston University, Questrom School of Business), Prof. Jerome Detemple (Boston University, Questrom School of Business), Prof. Franck MORAUX (University Rennes 1, IGR-IAE & CREM)

This paper examines the valuation of American knock-out and knock-in step options. The structures of the immediate exercise regions of the various contracts are identified. Typical properties of American vanilla calls, such as up-connectedness of the exercise region, convexity of its t-section or uniqueness of the optimal exercise boundary, are shown to fail in some cases. Early exercise premium representations of step option prices, involving the Laplace transforms of the joint laws of Brownian motion and its occupation times, are derived. Systems of coupled integral equations for the components of the exercise boundary are deduced.

Early Exercise Boundaries for American-Style Knock-Out Options

Friday, 20th July - 10:30 - American-style derivatives - Ui Chadhain - Oral - Abstract ID: 29

Prof. Joao Pedro Ruas (Sociedade Gestora dos Fundos de Pensoes do Banco de Portugal), Prof. Joao Pedro Nunes (ISCTE-IUL), Prof. Jose Carlos Dias (ISCTE-IUL)

This paper proposes a novel representation for the early exercise boundary of American-style double knock-out options in terms of the simpler optimal stopping boundary of a nested single barrier American-style contract. Additionally, and as a by-product of the novel representation obtained for the optimal stopping boundary, we are able to provide new *put-call duality* relations for American-style double knock-out options, under the whole class of exponential Lévy models. To illustrate the practical relevance of our novel results, we extend the *static hedge portfolio approach* as well as the *COS approximation* to the valuation of American-style double knock-out options.

Generalized exponential basis for efficient solving of homogeneous diffusion free boundary problems: Russian option pricing

Friday, 20th July - 11:00 - American-style derivatives - Ui Chadhain - Oral - Abstract ID: 251

Mr. Igor Kravchenko (ISCTE-IUL), Dr. Vladislav Kravchenko (CINVESTAV del IPN), Dr. Sergii Torba (CINVESTAV del IPN), Dr. José Carlos Dias (ISCTE-IUL)

This paper proposes a new method for efficiently and accurately price finite horizon Russian options. The method is based on the application of the transmutation operators theory and allows the construction of a complete system of solutions of the partial differential equation under consideration. This approach can be generalized for the large class of optimal stopping problems that can be reduced to free boundary problems.

American Options by Perturbing Closed Form Solutions

Friday, 20th July - 11:30 - American-style derivatives - Ui Chadhain - Oral - Abstract ID: 473

Prof. Andrew Smith (University College Dublin)

The pricing and hedging of American options generally requires the numerical solution of optimal stopping problems. This paper reveals analytical solutions for a class of optimal stopping problems, specifically maximising the expected product of a Wiener process and the survival function of a generalised Pareto distribution (GPD). The solution emerges because of a self-similarity property of the GPD, which is a consequence of the Pickands–Balkema–de Haan theorem. The property allows us to reduce the partial differential equation with movable boundary, to an ordinary differential equation. The same approach also works when the Wiener process is reflected at zero.

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