

BERUFUNGSVORTRÄGE „Finanzmathematik“

Die Berufungsvorträge schließen folgende Punkte mit ein: Didaktischer Vortrag (20 Minuten)
Fragen/Pause (10 Minuten)
Wissenschaftlicher Vortrag (45 Minuten)
Fragen/Pause (15 Minuten)
Kommissionelles Hearing -
(Dekanatsbesprechungszimmer, 11. Stock)

Die Vorträge finden im Besprechungszimmer 3. Stock, Zimmer 03.136 statt.

Montag, 20. Juni 2016

**Jakša Cvitanić
(Caltech)**

9:30 Uhr: Didaktischer Vortrag

“Duality approach to portfolio optimization”

In this lecture we will consider the problem of finding the optimal portfolio strategy for investing in a financial market. In the so-called complete markets, the optimal portfolio can be found easily by solving an appropriate dual problem. We will illustrate the approach in discrete-time models. We will also briefly discuss the application of the method to incomplete markets.

10:00 Uhr: Wissenschaftlicher Vortrag

“Dynamic Programming Approach to Principal-Agent Problems”

Joint with Nizar Touzi and Dylan Possamai.

We consider a general formulation of the problem in which a principal hires an agent and pays him a lump-sum contract payment at a finite horizon. Our approach is the following: we first find the contract that is optimal among those for which the agent's value process allows a dynamic programming representation and for which the agent's optimal effort is straightforward to find. We then show that, under technical conditions, the optimization over the restricted family of contracts represents no loss of generality. Moreover, the principal's problem can then be analyzed by the standard tools of control theory. Our proofs rely on the Backward Stochastic Differential Equations approach to non-Markovian stochastic control, and more specifically, on the recent extensions to the second order case.

Montag, 20. Juni 2016

**Peter K. Friz
(TU Berlin)**

14:00 Uhr: Didaktischer Vortrag

“The Mathematics of Volatility”

We will introduce various notions of volatility, especially in the context of option pricing, and explain why methods from asymptotic analysis, especially large deviations, have become important tools in Quantitative Finance.

14:30 Uhr: Wissenschaftlicher Vortrag

“Option Pricing in the Moderate Deviations Regime”

We consider call option prices in diffusion models close to expiry, in an asymptotic regime (“moderately out of the money”) that interpolates between the well-studied cases of at-the-money options and out-of-the-money fixed-strike options. First and higher order small-time moderate deviation estimates of call prices and implied volatility are obtained. The expansions involve only simple expressions of the model parameters, and we show in detail how to calculate them for generic stochastic volatility models. (Joint work with S. Gerhold and A. Pinter.)

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Dienstag, 21. Juni 2016

Johannes Muhle-Karbe
(University of Michigan)

08:30 Uhr: Didaktischer Vortrag

“Optimale Liquidation großer Aktienpakete”

Wenn große Aktienpakete schnell aufgelöst werden, hat dies einen negativen Einfluss auf die Verkaufspreise, die dabei erzielt werden können. Die Frage wie ein großes Aktienpaket in mehreren Schritten aufgelöst werden soll, um den Verkaufserlös zu maximieren, hat daher hohe Praxisrelevanz. In diesem Vortrag diskutieren wir ein einfaches mathematisches Modell für dieses Problem, das mit Methoden der Variationsrechnung analysiert werden kann.

9:00 Uhr: Wissenschaftlicher Vortrag

“Sensitivity Analysis of Optimization Problems with Small Frictions”

“Frictions”, such as taxes on trading financial securities or adjustment costs for switching from one industry to another, play a key role in many parts of financial theory. However, they drastically increase the complexity of standard models, ruling out explicit solutions and necessitating the use of numerical models. As a way out, it is often useful to take an asymptotic perspective, and study frictions as small perturbations of the frictionless baseline setting. In this talk, I outline recent results that provide explicit asymptotic solutions for a wide range of such problems. Here, a crucial ingredient is the “risk-tolerance process”, which describes the evolution of agents’ risk appetites by means of a quadratic backward stochastic differential equation.

Dienstag, 21. Juni 2016

Kathrin Glau
(TU München)

11:00 Uhr: Didaktischer Vortrag

“Option Pricing with Fourier Transform Methods”

For trading, hedging and risk assessment prices of hundreds of different options need to be evaluated on a daily basis. Moreover, financial institutions are well-advised to consider a variety of different models in parallel. For these tasks fast and accurate computational methods are indispensable. Which methods serve this goal? In this lecture we introduce the concept of Fourier transformed based option pricing. The application of Fourier transforms has sparked many advancements in different disciplines such as in physics, electric engineering and chemistry. Here, we learn how to exploit its computational power for finance: How can we derive a Fourier representation of an option price? How can we benefit from this representation? What would be an appropriate discretization of the resulting integral?

11:30 Uhr: Wissenschaftlicher Vortrag

“Magic Points in Finance: Empirical Interpolation and Applications”

A constantly intensifying market activity urges the need for real-time evaluation methods. Simultaneously we observe an increase in model sophistication on the one hand and growing demands on the quality of risk management on the other. As a result we face new challenges in designing pricing methods that achieve fast run-times while maintaining high accuracy. In this talk we exploit the recurrent nature of the pricing problem to develop a complexity reduction procedure for Fourier transform based option pricing. Our procedure allows for extremely fast real-time option pricing by shifting computationally intensive tasks to an offline phase. Key is the empirical magic point interpolation method by Barrault et al. (2004), by means of which we obtain promising theoretical and empirical results. In particular we find a new type of integral discretization, namely an empirical quadrature rule, which may also be useful for applications in other fields. This is joint work with Maximilian Gaß and Maximilian Mair.

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Dienstag, 21. Juni 2016

Jan Obloj
(University of Oxford)

15:00 Uhr: Didaktischer Vortrag

“Introduction to option pricing in a complete market”

We introduce the binomial model for asset dynamics and use it to discuss the fundamental principles of option pricing in mathematical finance. We identify when the model is efficient (i.e. admits no arbitrage) and derive the evolution of a portfolio value. We show the market is complete any option can be replicated by a dynamic trading strategy and use it to identify the unique fair way to price options. Finally, we introduce martingales as natural objects which allow us to compute these prices efficiently.

15:30 Uhr: Wissenschaftlicher Vortrag

“Robust Pricing and Hedging and its probabilistic counterparts”

Consider a financial market with a continuously traded risky asset and a family of European options available for trading at time $t=0$. When these options have a common maturity T , classical insights of Hobson (1998) allow to express no-arbitrage pricing of an exotic derivative as an optimisation over solutions to the Skorokhod embedding problem. This amounts to an Optimal Transport problem along martingales and the robust hedging strategies which enforce the no-arbitrage price bounds can be seen as the dual optimisers. In this talk, I consider a setting when the market traded options have n different maturities. No-arbitrage pricing then leads to optimisation over an n -fold embedding problem. I present duality results, as well as explicit solutions, for such a problem. In particular, I develop n -marginal versions of the classical Azema-Yor and Root solutions to the Skorokhod embedding problem. The latter is obtained using a novel time-reversal approach and the solution is described through a series of iterated optimal stopping problems. The talk is based on joint works with Alexander Cox, Zhaoxu Hou, Peter Spoida and Nizar Touzi.

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Mittwoch, 22. Juni 2016

**Birgit Rudloff
(WU Wien)**

9:00 Uhr: Didaktischer Vortrag

“On the dual representation of risk measures”

In this lecture we will recall the definition of convex and coherent risk measures and prove a dual representation.

9:30 Uhr: Wissenschaftlicher Vortrag

“Multivariate risks”

Risk measures for multivariate random variables will be considered. This plays a role in illiquid markets (e.g. for markets with transaction costs) or for a network of banks. The last application is important for measuring systemic risk and gained a lot of attention in research after the financial crisis. The value of the risk measure is then a set: the collection of all vectors of capital (in different currencies or of the different banks) that makes the random vector acceptable. In the talk I will present properties, results, and numerical procedures for set-valued risk measures. Time consistency in the dynamic case will be of particular importance, and will lead to a set-valued Bellman principle. The theory has many applications, among them also for one-dimensional risk measures acting on random vectors. Examples, including price bounds in markets with transaction costs and systemic risk, will be discussed.

Mittwoch, 22. Juni 2016

**Francesca Biagini
(LMU München)**

12:30 Uhr: Didaktischer Vortrag

“Complete market models in discrete times”

We characterize market completeness in market models in discrete times and prove the second fundamental theorem of asset pricing in this setting.

This lecture is based on the book Föllmer, H. and Schied, A. Stochastic Finance, De Gruyter, 3rd Edition, 2011.

13:00 Uhr: Wissenschaftlicher Vortrag

“Mathematical models for financial asset bubbles”

In this talk we present some recent results concerning the mathematical modelization of financial asset bubbles. We study a flow in the space of equivalent martingale measures and the corresponding shifting perception of the fundamental value of a given asset. We then extend the concept of financial bubble in a market model endowed with a set of probability measures, typically mutually singular to each other. We conclude by considering a mathematical model for the birth and evolution of bubbles in a network of investors. The talk is based on the following papers:

[1] Biagini, F., Föllmer, H. and Nedelcu, S. Shifting martingale measures and the slow birth of a bubble as a submartingale, Finance and Stochastics: Volume 18, Issue 2, Page 297-326, 2014.

[2] Biagini, F. and Mancin, J., Robust Financial Bubbles, Preprint LMU, 2016.

[3] Biagini, F., Mazzon, A. and Meyer-Brandis, T. Financial Bubbles in Networks, Work in Progress, 2016.

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Donnerstag, 23. Juni 2016

**Stefan Gerhold
(TU Wien)**

9:30 Uhr: Didaktischer Vortrag

“Local volatility and the Dupire formula”

A local volatility model is a diffusion model that reproduces a given call price surface (call prices indexed w.r.t. strike and maturity). In a classical paper, B. Dupire (1994) showed how to compute the diffusion coefficient of such a model from the call prices. In this lecture we will discuss the Breeden-Litzenberger formulas for density and distribution function of the underlying, and then proceed to Dupire's formula for the local volatility.

10:00 Uhr: Wissenschaftlicher Vortrag

“Asymptotic approximations of implied and local volatility”

Small-time asymptotics of option prices have received considerable attention in the literature. In diffusion models, two small-time regimes have been studied extensively so far: At-the-money (related to central limit theorems) and fixed-strike out-of-the-money (related to large deviations). In the first part of the talk, we present a recent paper that aims to fill the gap in between of these regimes. We thus consider "moderately out of the money" strikes that vary with maturity. For small maturity, call prices then exhibit moderate deviations behavior, with a quadratic rate function. Our approximations are easy to evaluate numerically, and involve the model parameters in a transparent way. They also reflect the market reality that strikes far out of the money are not traded at short expiry. First and higher order small-time moderate deviation estimates of call prices and implied volatility are obtained. They lead to a novel relation between implied volatility and the small-time at-the-money implied variance skew. In the second part of the talk, we present asymptotic estimates for local volatility. We present a formula for local volatility asymptotics that works for various asymptotic regimes and discuss its numerical application. The talk is based on joint work with S. De Marco, P. Friz, A. Pinter, and M. Yor.

Donnerstag, 23. Juni 2016

**Marcel Nutz
(University of Columbia)**

14:00 Uhr: Didaktischer Vortrag

“The Law of Large Numbers”

In this elementary lecture, we will discuss the Law of Large Numbers, one of the most fundamental results in probabilistic modeling. While we shall emphasize the methods that lead to the classical result, we also present a continuum version (called the Exact Law) that is particularly useful in game theory.

14:30 Uhr: Wissenschaftlicher Vortrag

“Perspectives in Mathematical Finance”

In this talk, we present current challenges in Mathematical Finance and their connections to Probability, Analysis, Game Theory, and Economics. We shall touch upon questions of model uncertainty, the formation of bubbles in asset prices, and herd behavior in financial markets.

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Freitag, 24. Juni 2016

**Mathias Beiglböck
(TU Wien)**

9:30 Uhr: Didaktischer Vortrag

“Martingales, Inequalities, and Model-Free Finance”

Martingales are stochastic processes which represent fair games in the following sense: today's value is the best estimator for the outcome of tomorrow's experiment. These processes are foundational for mathematical finance, where they are used to represent the evolution of an asset price. Mathematically, their behaviour is controlled through "martingale inequalities". We present a new elementary approach to the theory of martingale inequalities. On the one hand this allows to use intuition from mathematical finance to derive classical results in probability. On the other hand, this approach enables us to compare prices of financial derivatives in a model-free way, i.e. without assuming that the asset price follows a particular mathematical model.

10:00 Uhr: Wissenschaftlicher Vortrag

“The Geometry of Model Risk”

Starting with the "Black Monday" 1987 (if not earlier) and down to the present day, the over-confidence in mathematical models and the failure to account for model risk have frequently been blamed for their infamous role in financial crises. Serious consideration of model ambiguity is vital not only in the financial industry and for proficient regulation but also for university level teaching. Remarkably, it remains an open challenge to quantify the effects of model risk in a coherent way. From a mathematical perspective, this is a delicate issue which touches on deep classical problems of stochastic analysis. In recent work, we establish a new link to the field of optimal transport. This yields a powerful geometric approach to the problem of model risk and, more generally, the theory of stochastic processes.