IC1

Optimal Execution in a General One-Sided Limit Order Book

We construct an optimal execution strategy for the purchase of a large number of shares of a financial asset over a fixed interval of time. Purchases of the asset have a nonlinear impact on price, and this is moderated over time by resilience in the limit-order book that determines the price. The limit-order book is permitted to have arbitrary shape. The form of the optimal execution strategy is to make an initial lump purchase and then purchase continuously for some period of time during which the rate of purchase is set to match the order book resiliency. At the end of this period, another lump purchase is made, and following that there is again a period of purchasing continuously at a rate set to match the order book resiliency. At the end of this second period, there is a final lump purchase. Any of the lump purchases could be of size zero. A simple condition is provided that guarantees that the intermediate lump purchase is of size zero. This is joint work with Gennady Shaikhet and Silviu Predoiu.

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IC2

Stable Diffusions With Rank-based Interactions, and Models of Large Equity Markets

We introduce and study ergodic diffusion processes interacting through their ranks. These interactions give rise to invariant measures which are in broad agreement with stability properties observed in large equity markets over long time-periods. The models we develop assign growth rates and variances that depend on both the name (identity) and the rank (according to capitalization) of each individual asset. Such models are able realistically to capture critical features of the observed stability of capital distribution over the past century, all the while being simple enough to allow for rather detailed analytical study. The methodologies used in this study touch upon the question of triple points for systems of interacting diffusions; in particular, some choices of parameters may permit triple (or higher-order) collisions to occur. We show, however, that such multiple collisions have no effect on any of the stability properties of the resulting system. This is accomplished through a detailed analysis of collision local times. The models have connections with the analysis of Queueing Networks in heavy traffic, and with competing particle systems in Statistical Mechanics (e.g., Sherrington-Kirkpatrick model for spin-glasses). Their hydrodynamic-limit behavior is governed by generalized porous medium equations with convection, whereas limits of a different kind display phase transitions and are governed by Poisson-Dirichlet laws.

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IC3

Simulation Schemes for Stopped Lvy Processes

Jump processes, and Lvy processes in particular, are notoriously difficult to simulate. The task becomes even harder if the process is stopped when it crosses a certain boundary, which happens in applications to barrier option pricing or structural credit risk models. In this talk, I will present novel adaptive discretization schemes for the simulation of stopped Lvy processes, which are several orders of magnitude faster than the traditional approaches based on uniform discretization, and provide an explicit control of the bias. The schemes are based on sharp asymptotic estimates for the exit probability and work by recursively adding discretization dates in the parts of the trajectory which are close to the boundary, until a specified error tolerance is met.

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IC4

Talk Title TBA - Avellaneda

Abstract not available at time of publication.

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IC5

Optimal Order Placement in Limit Order Books

Abstract not available at time of publication.

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IC6

Quantitative Absence of Arbitrage and Equivalent Changes of Measure

It is well known that absence of arbitrage is a highly desirable feature in mathematical models of financial markets. In its pure form (whether as NFLVR or as the existence of a variant of an equivalent martingale measure R), it is qualitative and therefore robust towards equivalent changes of the underlying reference probability (the "real-world" measure P). But what happens if we look at more quantitative versions of absence of arbitrage, where we impose for instance some integrability on the density dR/dP? To which extent is such a property robust towards changes of P? We discuss these questions and present some recent results. The talk is based on joint work with Tahir Choulli (University of Alberta, Edmonton).

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SP1

AWM-SIAM Sonia Kovalevsky Lecture : The Role of Characteristics in Conservation Laws

Sonya Kovalevsky, in the celebrated Cauchy-Kovalevsky theorem, made clear the significance of characteristics in partial differential equations. In the field of hyperbolic conservation laws, characteristic curves (in one space dimension) and surfaces (in higher dimensions) dominate the behavior of solutions. Some examples of systems exhibit

interesting, one might even say pathological, characteristic behavior. This talk will focus on ways that characteristics in systems of conservation laws give information about the systems being modeled.

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SP2

The John Von Neumann Lecture: Liquid Crystals for Mathematicians

Liquid crystals form an important class of soft matter systems with properties intermediate between solid crystals and isotropic fluids. They are the working substance of liquid crystal displays, which form the basis of a huge multinational industry. The lecture will describe these fascinating materials, and what different branches of mathematics, such as partial differential equations, the calculus of variations, multiscale analysis, scientific computation, dynamical systems, algebra and topology, can say about them.

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SP3

Past President's Address: Reflections on SIAM, Publishing, and the Opportunities Before Us

Upon taking up the post of president I had, of course, formulated my priorities for SIAM. This talk provides a good occasion to revisit some of those. One area turned out to play a vastly larger role than I would have anticipated, namely mathematical publishing and many issues associated with it, ethical, technological, economic, political, and scientific. The future of scholarly publishing is far from clear, but one thing seems certain: big changes are needed and will be coming. We, as mathematicians, are major stakeholders. We should also be major agents in guiding these changes. I will present some of my observations and thoughts as we confront the opportunities before us.

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SP4

W. T. and Idalia Reid Prize Lecture: Large Algebraic Properties of Riccati Equations.

In the eighties there was considerable interest in the algebraic properties of the following Riccati equation

$$A^*X + XA - XBB^*X + C^*C = 0, \qquad (1)$$

where $A, B, C \in A$, a Banach algebra with identity, and the involution operation $*$. Conditions are sought to ensure that the above equation has a solution in A. The results were disappointing and the problem was forgotten until this century when engineers studied the class of spatially distributed systems. One application was to control formations of vehicles where the algebraic property was essential. This case involves matrices A, B, C with components in a scalar Banach algebra. Positive results are obtained for both commutative and noncommutative algebras.

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SP5

I.E. Block Community Lecture: Creating Reality: the Mathematics Behind Visual Effects

Abstract to follow.

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SP6

SIAG/FME Junior Scientist Prize: Market-Based Aapproach to Modeling Derivatives Prices

Most of the existing quantitative methods in Finance rely on the assumptions of the underlying mathematical models. The problem of choosing the appropriate model assumptions is one of the cornerstones of modern Financial Engineering. I am interested in developing modeling frameworks that facilitate the use of historical observations when making the choice of model assumptions. It turns out that, in the markets with a large family of liquid derivative contracts, it is rather hard to construct a model that exploits the information contained in the historical prices of these derivatives. In fact, constructing such models requires the use of the so-called Market-Based Approach. The idea of this approach is to treat the liquid derivatives as generic financial assets and prescribe the joint evolution of their prices in such a way that any future arbitrage-free combination of prices is possible. In this presentation, I will outline the main difficulties associated with the construction of market-based models and will present a general methodology that bypasses these difficulties. Finally, I will illustrate the theory by describing (both mathematically and numerically) a family of market-based models for the European call options of multiple strikes and maturities.

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JP1

Systemic Risk

What is systemic risk, how do we model it, how to we analyze it, and what are the implications of the analysis? I will address these issues both in a larger historical context and within current research mathematical finance. The key property of systems subject to systemic risk is their interconnectivity and the way individual risk can become overall, systemic risk when it is diversified by inter-connectivity. I will discuss theoretical issues that come up with mean-field and other models and will also show results of numerical simulations.

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CP1

Pricing Interest Rate Derivatives in a Multifactor Hjm Model with Time Dependent Volatility

We investigate the partial differential equation (PDE) for pricing interest rate derivatives in a multi-factor Cheyette Model, that involves time-dependent volatility functions with a special structure. The high dimensional parabolic PDE that results is solved numerically via a sparse grid approach, that turns out to be both accurate and efficient. The results are compared to the analytical solution for bonds and caplets and also the Monte Carlo simulation solution for Bermudan Swaptions.

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CP1

A Paradigm Shift in Interest-Rate Modeling

This research starts with a solution for modeling non-negative interest rates in an incomplete bond market. It is the *stochastic-splines model*, in which instantaneous forward rates are almost surely finite and approximately log-normal under both the real-world and the risk-adjusted measures. A unique term structure of convenience yield for the default-free bond market is introduced for the first time to compensate idiosyncratic risk. Addressing on the market completeness issue, the *stochastic-volatility stochastic-splines model* is presented whereby bond convenience yield vanishes. Under this framework, the market price of volatility risk can be computed endogenously. Various applications are given.

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CP1

Pricing Swaptions under Multifactor Gaussian Hjm Models

Several approximations have been proposed in the literature for the pricing of European-style swaptions under multifactor term structure models. However, none of them provides an estimate for the inherent approximation error. Until now, only the Edgeworth expansion technique of Collin-Dufresne and Goldstein (2002) is able to characterize the order of the approximation error. Under a multifactor HJM Gaussian framework, this paper proposes a new approximation for European-style swaptions, which is able to bound the magnitude of the approximation error and is based on the *conditioning approach* initiated by Curran (1994) and Rogers and Shi (1995). All the proposed pricing bounds will arise as a simple by-product of the Nielsen and Sandmann (2002) setup, and will be shown to provide a better accuracy-efficiency trade-off than all the approximations already proposed in the literature.

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CP1

Pricing and Hedging the Smile with Sabr: Evidence from the Interest Rate Caps Market

This is the first comprehensive study of the SABR (Stochastic Alpha-Beta-Rho) model (Hagan et. al (2002)) on the pricing and hedging of interest rate caps. We implement several versions of the SABR interest rate model and analyze their respective pricing and hedging performance using two years of daily data with seven different strikes and ten different tenors on each trading day. In-sample and out-of-sample tests show that in addition to having stochastic volatility for the forward rate, it is essential to recalibrate daily either the vol of vol or the correlation between forward rate and its volatility, although recalibrating both further improves pricing performance. The fully stochastic version of the SABR model exhibits excellent pricing accuracy and more importantly, captures the dynamics of the volatility smile over time very well. This is further demonstrated through examining delta hedging performance based on the SABR model. Our hedging result indicates that the SABR model produces accurate hedge ratios that outperform those implied by the Black model.

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CP2

Swing Options in Commodity Markets: A Model with Multidimensional Jump Diffusions

The objective of this talk is to study the optimal exercise policy of a swing option in the electricity markets. We formulate a model in terms of a stochastic control problem in continuous time, subjected to a total volume constraint. The underlying price process is a linear function depending on a multidimensional Lévy diffusion. The results are illustrated with examples.

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CP2

Decomposing the Risk from Investing in Foreign

Commodities

Several papers show that FX rates and commodity prices are interlinked. When investing in commodities traded in a foreign currency, the investor faces both price risk and FX risk. We investigate how exchange-traded contracts on WTI crude oil and EUR/USD correlate. We propose and estimate a model that accounts for the stochastic correlation between the two. This can be used to price and risk manage foreign commodity positions, e.g., quanto options or oil-linked gas contracts.

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CP2

A Real-Time Pricing Model for Electricity Consumption

Input your abstract, including TeX commands, here. The California electric company, i.e., PGE (Pacific Gas and Electric Co.,), has recently announced its intentions to charge small businesses in the state with dynamic prices for electricity consumption. In this regard, we study a real-time electricity pricing model in the paper and compare it with two static pricing models. We show that real-time pricing outplays static pricing when it comes to jointly maximizing provider and consumer welfare.

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CP2

A Resampling Particle Filter Parameter Estimation For Electricity Prices With Jump Diffusion

In this paper we propose a particle ?lter for parameter estimation of jump diffusion models employed for modelling electricity prices 1,2,3,4,5. We consider a jump-diffusion model 4. The jumps has the possibility to give a better explanation of the behaviour of electricity prices, however estimation of parameters becomes more complicated 4.Complications in parameter estimation will be introduced by the inclusion of the jump component. The inclusion of jumps will add several new parameters 4. These parameters will describe the jump frequency and distribution. The jump models are non-Gaussian and this increases the complexity of the models 1,2,3,4. A known ?ltering technique for these models is particle ?lter 1,2,3. Particle ?lter (PF) is a fully non-linear ?lter with Bayesian conditional probability estimation, compared here with the well-known ensemble Kalman lter (EnKF). A Gaussian resampling (GR) method is proposed to generate the posterior analysis ensemble in an effective and efficient way 3. The performance of gaussian particle ?lter to model the jump frequency and distribution parameters will be investigated and benchmarked to other maximum likelihood state estimators.

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CP3

Basket and Spread Options in a Variance Gamma Model

Financial asset returns exhibit higher skewness and kurtosis than those implied by the Normal distribution. Price paths can also exhibit jumps, which is particularly true for emerging and commodity markets. In this case, the Variance Gamma (VG) process is more realistic than the geometric Brownian motion (GBM) to model the asset price dynamics. However, valuation of basket and spread options (common derivatives in commodity, FX and other markets) under this model is a very challenging and time-consuming task. We propose a novel and elegant method for valuation of basket and spread options under VG model, by conditioning the VG processes on a realization of the stochastic Gamma time change and combining it with the Generalized LogNormal (GLN) approximation. We consider a simpler (and easily tractable) case of the identical stochastic time change for all underlying assets, as well as the more general case of dierent (but dependent) Gamma time changes. Numerical study shows that the proposed method performs remarkably well in term of option pricing, even for a simpler model. Our method is intuitive, computationally very fast, ecient and exible enough to allow for basket options on arbitrary number of assets and negative portfolio weights.

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CP3

High-order Short-time Expansions for ATM Option Prices Under the CGMY Model

In this presentation, we derive a novel second-order approximation for ATM option prices under the CGMY Lvy model, and then extend to a model with an addition Brownian motion. The third-order asymptotic behavior of the option prices as well as the asymptotic behavior of the corresponding Black-Scholes implied volatilities are also addressed. Our numerical results show that in most cases the second-order term significantly outperform the first order approximation.

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CP3

Efficiently Simulating the Double-Barrier First-Passage Time in Jump-Diffusion Models

We present a fast and accurate Monte-Carlo simulation to obtain double-barrier first-passage time probabilities in a jump-diffusion model with arbitrary jump size distribution; extending single-barrier results by Metwally and Atiya [2002]. The presented algorithm is unbiased and significantly faster than a brute-force Monte-Carlo simulation on a grid. As an application, we discuss corridor bonus certificates, floor certificates, and digital first-touch options.

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CP3

Numerical Solution of Jump-Diffusion SDEs

Jump-diffusions are ubiquitous in finance and economics. This paper develops, analyzes and tests a discretization scheme for multi-dimensional jump-diffusion SDEs with general state-dependent drift, volatility, and jump intensity function. Unlike conventional schemes, our scheme allows for an unbounded jump intensity–a feature of many standard jump-diffusion models in credit, equity, FX and commodity markets. The convergence of the discretization error is proved to be of weak order one. Numerical experiments illustrate our results.

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CP4

Model Risk Based on the Distribution of the Hedge Error

When pricing and hedging a derivative, we face model risk, that is, the risk of choosing the wrong dynamics for the financial market. We propose a measure of model risk based on the hedge error that can be interpreted as a capital charge. This has several positive implications beyond estimating the riskiness of a claim in terms of model risk. We calculate these model risk measures for several examples and derive its general properties.

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CP4

Why Is It So Hard to Estimate Expected Returns?

A key part of experiment design is determining how much data to collect. When the data comes in the form of a timeseries, the sample size is expressed both by the count N of the observations and the duration T of the historical period over which observations were made. For an asset whose price has continuous sample paths, we demonstrate that the standard error of any unbiased estimator of the price of risk is bounded below by $1/\sqrt{T}$.

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CP4

A New Perspective on Dependence Within Financial Markets

Many financial instruments are inherently multivariate in their origination. A rigorous empirical valuation requires simultaneous analysis of many components. Nonlinear and inter-temporal dependencies, extreme events, and large datasets introduce additional challenges. Independent component analysis is an indispensable tool for finding suitable representations of the complex multivariate information within financial markets. We introduce a novel statistical framework for independent component analysis of financial data and illustrate its use on several important financial applications.

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CP4

The Herd Behavior Index: a New Measure for the Implied Degree of Co-Movement in Stock Markets

We introduce a new measure for the implied degree of herd behavior, one of the driving factors of systemic risk. This forward looking Herd Behavior Index (HIX) is model-independent and based on observed option data. As an illustration, we determine historical values of the 30-days HIX for the Dow Jones Industrial Average.

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CP5

Incorporating Parameter Risk into Derivatives Prices - An Approach to Bid-Ask Spreads

We present a new method based on convex risk measures to incorporate parameter risk (e.g. estimation and calibration risk) into derivative prices. As an application we calculate parameter risk-implied bid-ask spreads of exotics, enabling us to compare the parameter risk of different models and different exotics. Furthermore, we introduce a nonparametric calibration procedure to real bid-ask prices using distortion risk measures, compare our results to given parametric distortion calibrations and present a new parametric family.

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CP5

Analytical Calculation of Risk Measures for Vari-

able Annuity Guaranteed Benefits

With the increasing complexity of investment options in life insurance, more and more insurers have adopted stochastic modeling methods for the assessment and management of insurance and financial risks, with the most prevalent being Monte Carlo simulation. In this paper we propose an alternative analytical method for the calculation of risk measures for variable annuity guaranteed benefits. The techniques for analytical calculations are based on the study of an integral of geometric Brownian motion as well as asymptotic analysis of special functions. As we demonstrate by numerous examples on quantile risk measure and conditional tail expectation, the numerical algorithms developed in this paper appear to be accurate and computationally efficient.

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CP5
Fair Valuation of Drawdown Insurance

Drawdowns are path-dependent measures of risk and have been used extensively in the description of market crashes. We evaluate the market price of a market crash as measured through drawdowns by considering an investor who wishes to insure herself against the risk of a market crash and does so by purchasing insurance claims against drawdowns. We further examine the fair valuation of drawdown insurance in the possibility of early cancellation and identify optimal cancellation strategies.

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CP5
Diversification and Crash-Protection Using Variance Swap Calendar Spreads

Volatility can be also considered an asset class. Variance swaps, one of the main investment vehicles, provide exposure to realized volatility. Implied volatility is often higher than the realized volatility will turn out to be. We explain how a variance swap calendar spread benefits from both negative risk premium and negative correlation with the underlying stock index. Via backtesting we show how the strategy added to a stock/bond portfolio significantly diversifies crash risk.

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CP6
Optimal Cash Holdings in a Firm

The precautionary principle of cash-holdings is empirically well analysed. However, the quantitative modelling of such cash holdings is exceptionally sparse. This is due to the path dependent nature of the problem and the fact that cash holdings may both increase and decrease in time. As such, novel numerical solutions to the problem are required. We show how to model endogenous cash holdings within a Firms valuation and extract numerical solutions. In doing so we provide a solid basis by which Real Options analysis, dividend payments, debt issuance, cash holdings, and corporate finance decisions (investments) can finally all be viewed in a consistent, non-contradictory and more realistic fashion. This analysis and need for consistency has been called for within many papers, and we hope our (economically robust) approach shows how mathematics can provide a more unifying approach to the theory of the Firm.

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CP6
Risk Aversion and Managerial Cash-Flow Estimates in Real Options

While there are a number of academic papers discussing the importance of accounting for risk aversion in real option valuation, none of them are applicable to discrete cash-flow estimates supplied by managers. Here, we develop an approach which explicitly incorporates managerial cash-flow estimates and accounts for risk-aversion through indifference valuation. Interestingly, we find that the real option value not only deteriorates as risk-aversion increases, it drops to zero above a critical risk-aversion level.

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CP6
Irreversible Investment with Regime Switching : Revisit with Linear Algebra

We consider irrevesible investment problems with regime switching feature under a monopoly setting. Several parameters describing the economic environment varies according to a regime switching with general number of states. We present the derivation of the value function via solving a system of simultaneous ordinary differential equations with knowledge of linear algebra. It is found that the functional form of the value function depends on the decomposition of a coefficient matrix.

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CP6

Embedded Currency Exchange Options in Roll-over Loans

In ship and aircraft financing long term roll-over loans are often equipped with the right to change the currency every quarter at spot. The loan taker then pays LIBOR of the respective currency plus a pre-determined constant sales margin. If the capital outstanding exceeds 105% calculated in the original currency, the amortization is required to the level of 105% of the original currency. By clever currency management the loan taker can amortize the loan faster and terminate the loan early. Essentially the loan taker owns a series of options on the cross currency basis spread with unknown notional amounts. We determine the key drivers of risk, an approach to valuation and hedging, taking into consideration the regulatory constraints of a required long term funding. We present a closed-form approximation to the pricing problem and illustrate its stability.

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CP7

Dynamic Quadratic Hedging in the Presence of Partially Hedgeable Assets and Liabilities

We consider an incomplete market where an investor who owns a partially hedgeable asset faces a liability at time T. The investor's aim is to minimize the terminal replication error based on a quadratic loss criterion in this setting. We investigate the solution to the quadratic hedging problem using the stochastic linear-quadratic optimal control approach through the corresponding (stochastic Riccati) BSDEs and provide some examples.

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CP7

BSDEs with BMO Market Price of Risk

We study quadratic semimartingale BSDEs arising in power utility maximization when the market price of risk is of BMO type. In a Brownian setting we provide a necessary and sufficient condition for the existence of a solution but show that uniqueness fails to hold in the sense that there exists a continuum of distinct square-integrable solutions. This feature occurs since, contrary to the classical Ito representation theorem, a representation of random variables in terms of stochastic exponentials is not unique. We study when the BSDE has a bounded solution and derive a new dynamic exponential moments condition which is shown to be the minimal sufficient condition in a general filtration. The main results are complemented by several interesting examples which illustrate their sharpness as well as important properties of the utility maximization BSDE.

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CP7

A Continuous Time Bank Run Model for Insolvency, Recovery and Rollover Risks

We propose a continuous time bank run model for incorporating insolvency, recovery and rollover risks. The firm finances by issuing both long and short term debt, and the short term debt holders need to decide whether to roll over or to withdraw their debt (i.e. to run the bank) when their contracts expire. We show there exists a threshold strategy (i.e. the bank run barrier) for the short-term creditors to decide when to run. We decompose the total credit risk into an insolvency component and an illiquidity component based on such an endogenous bank run barrier together with an exogenous insolvency barrier. The short term debt in our model can have either a discrete tenor structure, or a more realistic staggered tenor structure. The problem is reduced to an optimal stopping time problem with constraint, which is solved by the BSDE method.

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CP7

Quadratic Reflected Bsdes with Bounded Conditions. Application to American Options.

In this talk, I present an elementary and totally perturbative method for dealing with the well-posedness of some reflected BSDEs : existence, uniqueness and stability. It works for a smooth coefficient f which has a growth at most quadratic in z, when the terminal condition as well as the lower obstacle are bounded. I then connect these equations with the problem of pricing american options in an incomplete market.

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CP7

A Simple Proof of BichtelerDellacherieMokobodzki Theorem

We give a simple and quite elementary proof of the celebrated BichtelerDellacherieMokobodzki Theorem, which states that a process is a good integrator if and only if it is a semi-martingale. Moreover we reformulate its statement in a way that -we believe- is more natural.

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CP8

Inference for the Fractional Heston Model Using the Auxiliary Particle Filter

The fractional Heston Model is a generalization of the Heston Model obtained by replacing Brownian motion by fractional Brownian motion in the two equations that define the Heston model. After defining the fractional Heston model and showing its representation as a Dynamic state space model, we will use that auxiliary particle filter both to sample the volatility process and to update the posterior distribution of the parameters sequentially as data arrive over time. We apply our approach to simulated and real data with success. Keywords:- Fractional Heston Model, maximum likelihood estimation, particle filter, auxiliary particle filter, sequential Bayesian inference.

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CP8

Non-Parametric Calibration of the Local Volatility Surface for European Options

Assuming the volatility surface is smooth, a second order Tikhonov regularization is applied to the calibration problem. Additionally a new approach for choosing the Tikhonov regularization parameter is proposed. Using the TAPENADE automatic differentiation tool in order to obtain adjoint code of the direct model is employed as an efficient way to obtain the gradient of cost function with respect to the local volatility surface. Finally we perform four numerical tests aimed at assessing and verifying the aforementioned techniques.

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CP8

Small-time Asymptotics For Some Stochastic Volatility Models

In the paper SMALL-TIME ASYMPTOTICS FOR FAST MEAN-REVERTING STOCHASTIC VOLATILITY MODELS they investigate two rates for the mean-reversion time δ in terms of the maturity ϵ, namely $\delta = \epsilon^\gamma$ for $\gamma = 2, 4$. Looking at this model and a few others we characterize the behaviors for $\gamma > 2$ and for $1 < \gamma < 2$ and show how this relates to Moderate Deviations and Superlarge Deviations, respectively. This argument also shows why $\gamma = 2$ is special.

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CP8

Stochastic Calibration to Implied Volatility Surfaces

This paper provides a two-step method to fully calibrate the implied volatility surface in the environment of random volatility. The first step consists of the Fourier transform method (Malliavin and Mancino (2009)) for estimating model parameters of stochastic volatility models, and the second step solves an optimization problem by means of Monte Carlo simulation with variance reduction techniques. We compare fitting accuracies with the fast Fourier transform method (Carr and Madan (1999)) and perturbation method (Fouque et al. (2003, 2011)). In addition, it is natural to generalize our calibration procedure to the implied volatility surface of American options.

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CP8

Understanding Jumps in the High-Frequency VIX

This article provides a comprehensive nonparametric high-frequency analysis of jumps in the VIX (S&P500 volatility index). A comparison of the VIX and the S&P500 futures time series (1992-2010) shows that 97% of jumps in the VIX are spurious. This finding not only leads to a new interpretation of the broadly used VIX dataset but also extends the literature on volatility jumps and on the return-volatility relationship.

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CP8

Implied Volatiltiy from Black-Scholes and Other Formulas

We show that if the parameters of an arbitrary stock price model are used in the Black-Scholes formula for calculating option prices for finitely many strikes, the implied volatility (a function of time t) will be bounded by a value which depends only on strikes. Our model-free results, which can be used in calibration, provide sets of constraints limiting the acceptable values of the implied volatility parameters. We use the Heston model for illustration.

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CP9

Extensions of the Lt Method for Option Pricing

Monte Carlo (MC) and quasi-Monte Carlo (QMC) methods are often used in pricing complex derivatives. The merit of QMC is that, theoretically at least, higher convergence rates can be obtained than regular MC. The payoff function is usually high-dimensional and non-smooth, elim-

inating the advantage of using QMC. Imai & Tan (2006) introduced the LT method which minimizes the effective dimension of the problem by transforming the normal variates using an orthogonal transformation, thereby improving the QMC method. We extended their method for valuing options that have a barrier feature on an underlying asset, incorporating and extending an idea from Staum & Glasserman (2001). These options have a payoff that depends on whether the asset does or does not cross a certain level during the life of the option. If the probability of (not) hitting is large enough, then much more paths have to be sampled for reliable results. Our method greatly reduces the required number of paths and our aim is to extend this method to Levy market models.

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CP9

Variance Reduction for Monte Carlo Simulation of European Call Options Under the Coupled Additive-Multiplicative Noise Model

We propose a variance reduction method for Monte Carlo computation of option prices in the context of the Coupled Additive-Multiplicative Noise model. Four different schemes are applied for the simulation. The methods select control variates which are martingales in order to reduce the variance of unbiased option price estimators. Numerical results for European call options are presented to illustrate the effectiveness and robustness of this martingale control variate method.

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CP9

Central Limit Theorem for the Multi-Level Monte Carlo Algorithm and Applications to Option Pricing

This paper deals with the problem of the multi-level Monte Carlo method, introduced by Giles (Multilevel Monte Carlo path simulation Operations Research, 2008; 56:607-617) as an extended method of the statistical Romberg one introduced by Kebaier (Romberg Extrapolation: A New Variance Reduction Method and Applications to Option Pricing. Ann. Appl. Probab. 15 (2005), no. 4, 2681-2705). When approximating the expected value of a function of a stochastic differential equation solution, these methods improve efficiently the computational complexity of standard Monte Carlo. In this work, we analyze the asymptotic error of this algorithm and establish a central limit theorem based on a new stable functionalcentral limit theorem on the error in the Euler scheme for a given level. This allows us to obtain the optimal choice of the parameters method.Then, weinvestigate the application of this method to the pricing of Asian options. In this setting, the approximation relies on the discretization of the integral of the price process over a time interval. We also analyze the error process and prove a stable functional central limit theorem. Finally, We use our result in order to optimize the choice of the parameters, which are different from the ones in the Euler scheme. Numerical simulations were processed.

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CP9

A Hybrid Pricing Method for Options with Multi Assets

A numerical method is studied for options with multi-underlying assets. Instead of imposing artificial boundary condition for the multi-dimensional Black-Scholes equation, we calculate certain one-dimensional model equation at each time-step using pre-simulated Monte-Carlo time series. With standard finite difference method using nine point stencil, our method reduce the computational domain of the governing equation (the two dimensional Black-Scholes equation) exceedingly. As benchmark tests, we consider the call on the maximum option which has an analytic solution, and a complicated structured note from the derivative market.

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CP9

Control Variate Methods and Applications in Asian and Basket Options Pricing and Hedging under Jump-Diffusion Models

We discuss control variate methods with applications to Asian and basket option pricing under exponential jump diffusion models for the underlying asset prices. We first revisit the single control variate method and then discuss the multivariate control variate method in detail. Conditions which ensure the variance of an $m-$variate control variates is smaller than that of a $k-$variate control variates ($1 \leq k < m$) are given and proved. Based on these conditions, more efficient control variates can be constructed. For arithmetic Asian and basket options, control variates conditional on geometric means of asset prices are constructed. Numerical results show that the constructed control variate is much more efficient than the classical control variate when pricing Asian options even in high dimensional cases.

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CP9

Taylor-Like Anova Expansion for High Dimensional Pdes Arising in Finance

The solution of high dimensional problems in short time as well as with high precision is of great importance in finance. For this purpose we propose an approximation to an ANOVA decomposition of the problem, which is only of linear order in the dimension of the full problem and superior in precision. We will call this approximation Taylor-like ANOVA. We develop this approximation up to higher orders and show its efficiency by numerical experiments.

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CP10

Optimal Order Routing in Limit Order Markets

When executing a trade, traders in electronic equity markets can choose to submit a limit order or a market order, as well as the venue to submit this order, if the stock is traded in several exchanges. This decision is influenced by the order flow characteristics and queue sizes in each limit order book, as well as the structure of transaction fees and rebates across exchanges. We show that this optimal order routing problem may be formulated as a convex optimization problem and propose a stochastic algorithm for solving it. We study this problem under various statistical assumptions on the order flow and show the interplay between the fee structure, the order flow and the risk preferences of the trader in determining the optimal routing decision.

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CP10

Optimal Trade Execution with Dynamic Risk Measures

We propose a model for optimal trade execution in an illiquid market that minimizes a coherent dynamic risk of the sequential transaction costs. The prices of the assets are modeled as a discrete random walk perturbed by both temporal and permanent impacts induced by the trading volume. We show that the optimal strategy is time-consistent and deterministic if the dynamic risk measure satisfies a Markovian property. We also show that our optimal execution problem can be formulated as a convex program, and propose an accelerated first-order method that computes its optimal solution. The efficiency and scalability of our approaches are illustrated via numerical experiments.

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CP10

An Optimal Trading Rule under Switchable Mean Reversion Market

This work provides an optimal trading rule that allows buying or selling of an asset whose price is governed by mean-reversion model. In the model, the equilibrium level is controlled by an 2-state Markov chain. With the slippage cost imposed, the goal is to maximize the overall return. The value functions are characterized by considering the associated HJB equations. This paper also shows that the solution of the original optimal problem can be obtained by solving four quasi-algebraic equations. Finally, numerical examples are given for demonstration.

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CP10

Price Impact and Market Indifference Prices with Power Utilities

We investigate the price impact of large transactions in an equilibrium pricing model with HARA utility functions. A market maker trades with a large investor at a price that allows him to preserve his expected utility, the so-called market indifference price. In this setting we look at marginal prices and illiquidity premia in comparison to the Black-Scholes model as well as hedging and replication of non-traded (OTC) claims.

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CP10

A Self-exciting Point Process Model for Limit Order Books

The statistical properties of events affecting a limit order book -market orders, limit orders and cancellations- reveal strong evidence of clustering in time, significant cross-correlation across event types and significant dependence of the order flow on the bid-ask spread. We show that these dependencies may be adequately represented by a multi-dimensional self-exciting point process, for which a tractable parameterization is proposed. Using high-

frequency data from the Trades and Quotes database, we perform a Maximum Likelihood Estimation of the model and assess its predictive performance for a variety of stocks.

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CP10

Evolutionary Game Dynamics Using a Non-Equilibrium Price Formation Rule for Trading with Market Orders

Markets have dynamics that may result in excess volatility and other phenomena that are a challenge to explain using rational expectation models. Following Farmer (2002) and identifying trading strategies with species and capital invested in a strategy with a population, we use the replicator equation to identify the evolutionary game dynamics between the relevant agents. We then extend the dynamics spatially in order to examine the progression toward market efficiency caused by the evolution of capital. We observe interesting dynamics including the phenomenon that the market becomes efficient as new strategies find them and cause them to disappear.

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CP11

On the Existence of Shadow Prices.

For utility maximization problems under proportional transaction costs, it is known that the original market with transaction costs can sometimes be replaced by a frictionless shadow market that yields the same optimal strategy and utility. In this paper we present a counterexample which shows that shadow prices may fail to exist. We then prove that short selling constraints are a sufficient condition for their existence, even in very general multicurrency market models with discontinuous bid-ask-spreads.

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CP11

Indifference Pricing with Uncertainty Averse Preferences

We consider the indifference valuation of an uncertain monetary payoff from the perspective of an uncertainty averse decision-maker. We study how the indifference valuation depends on the decision-maker's attitudes toward uncertainty. We obtain a characterization of comparative uncertainty aversion and various characterizations of increasing, decreasing, and constant uncertainty aversion.

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CP11

Portfolio Optimization Based on Independent Sets of Market Cliques

We consider the problem of selecting an optimal market portfolio that maximizes expected return and includes highly correlated disjoint market cliques (i.e., members within a clique are pairwise highly correlated) which are pairwise anticorrelated based on a correlation function defined on the set of cliques. We present integer programming models that can be effectively used to construct such an optimal portfolio that satisfies given clique correlation thresholds.

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CP11

Portfolio Optimization under Convex Incentive Schemes

We consider the utility maximization problem of terminal wealth from the point of view of a portfolio manager paid by an incentive scheme given as a convex function g of the terminal wealth. The manager's own utility function U is assumed to be smooth and strictly concave, however the resulting utility function $U \circ g$ fails to be concave. As a consequence, this problem does not fit into the classical portfolio optimization theory. Using duality theory, we prove wealth-independent existence and uniqueness of the optimal wealth in general (incomplete) semimartingale markets

as long as the unique optimizer of the dual problem has a continuous law. In many cases, this fact is independent of the incentive scheme and depends only on the structure of the set of equivalent local martingale measures. We provide explicit examples for complete and incomplete market models.

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CP11

Optimal Portfolios for Hedge Funds and Their Managers

Hedge fund managers receive fees proportional to profits, and may reinvest them. We find the fund and personal portfolio that maximize managers' expected utility from personal wealth, when relative risk aversion is constant, and investment opportunities constant and separate, but correlated. Managers do not reinvest fees, allocating excess personal wealth in Merton portfolio. But they manage funds like Merton investors with risk aversion shrunk towards one. Managers do not hedge fund exposure with personal positions.

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CP11

An Equilibrium Approach to Utility-Based and Indifference Pricing

The utility-based and utility indifference pricing are frameworks for pricing contingent claims. Since these principles are based on utility maximization principle, prices are optimal for each investor with utility function. Our purpose is to expand these frameworks for deducing the equilibrium price. Another purpose is to clarify the relationship between utility-based and utility indifference framework. This discussion will be also done in the setting of the market with transaction costs.

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CP12

Optimal Decumulation: An Investment-Consumption Models for Retirees

We consider the optimal investment-consumption problem for retirees with uncertain lifespan. We assume that their initial wealth can spread between both risky and riskless (liquid) investments and an income-producing (irrevocable) life annuity with default risk. We examine whether default risk (or the perception of default risk) rationally affects a retirees decision to purchase an annuity upon retirement. We formulate our problem as a Hamilton-Jacobi-Bellman equation and do a thorough numerical study for CRRA investors.

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CP12

Voluntary Retirement and Annuity Contract

We consider an optimal financial planning problem of an economic agent who has an option to retire from labor voluntarily. The economic agent with labor income determines his/her investment strategy, consumption, and retirement strategy along with annuity. We investigate the relation between the annuity contract and the condition for the voluntary retirement. We also analyze how the presence of voluntary retirement option affects the purchase of an annuity and the annuity market.

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CP12

Bang-Bang Controls on Some Optimal Insurance Problems

In this talk, we are interested in finding an optimal solution for a large class of optimal insurance problems. This class of problems includes those whose risks are measured by Value at Risk, Average Value at Risk, Conditional Tail Expectation and law-invariant convex risk measures. We have found that Bang-Bang controls are optimal to all of them. This result also holds for multi-dimensional optimal insurance problems such as those in adverse selections.

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CP12

Optimal Consumption and Portfolio Choice with Life Insurance under Uncertainty and Borrowing

Constraints

We develop a duality approach to study a family's optimal consumption, portfolio choice and life insurance purchase when the family receives deterministic labor income which may be terminated due to premature death or retirement of the family's wage earner. The family faces a borrowing constraint and the wage earner has an uncertain lifetime. We establish the existence of an optimal solution to the optimization problem and solve the problem explicitly for several cases.

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CP12

Optimal Dividend Payments for the Piecewise-Deterministic Compound Poisson Risk Model

This work deals with optimal dividend payment problem for a piecewise-deterministic compound Poisson insurance risk model. The objective is to maximize the expected discounted dividend payout up to ruin time. When the dividend payment rate is restricted, the value function is shown to be a solution of the corresponding HJB equation. For the case of unrestricted payment rate, the value function and an optimal barrier strategy are determined explicitly with exponential claim size distributions.

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CP13

On the Credit Risk of Secured Loans

We use stochastic control techniques to analyze the credit risk of secured revolving loans, whose collateral cannot be liquidated immediately. The objective function is a trade-off between the expected loss due to a liquidation event and the shortfall due to the borrower drawing on the credit line less than the full amount available. We exhibit the lender's optimal strategies and compare them with the standard LTV-based lending policy favored by practitioners.

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CP13

Conditional Expected Default Rate Calculations for Credit Risk Applications

Calculation of portfolio loss distributions for large numbers of correlated losses (e.g. credit risk applications) typically use brute force Monte Carlo simulation. We use an asymptotic probabilistic model based on the Central Limit Theorem for solving the portfolio risk aggregation problem for credit risky portfolios. We then prove a theorem that enables efficient computation of the conditional expectation of the default rate for any subportfolio, conditioned on the total portfolio loss. This theorem enables us to solve the capital allocation problem (using expected shortfall as the risk measure) without resorting to Monte Carlo simulation. The approach is very efficient, even for portfolios with several million positions.

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CP13

Measure Changes for Reduced-Form Affine Credit Risk Models

We consider a reduced-form credit risk model, with default intensity driven by an affine process. We fully characterize the family of all locally equivalent probability measures which preserve the structure of the model, providing necessary and sufficient conditions on their density process. In particular, this allows for a rigorous treatment of diffusive and jump-type risk premia. As an application, we characterize the family of all risk-neutral measures for a jump-to-default Heston model.

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CP13

Killed Brownian Motion with a Prescribed Lifetime Distribution and Models of Default

The inverse first passage time problem asks for some distribution whether there is a barrier such that the first time a Brownian motion crosses the barrier has the given distribution. We consider a 'smoothed' version of this problem in which the first passage time is replaced by the first instant that the time spent below the barrier exceeds an independent exponential random variable. We show that any distribution results from some unique barrier.

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CP13

Analysis of Recovery Rate of Non-Performing Consumer Credit

There have been more studies on recovery rate modeling of bonds than on recovery rate modeling of personal loans and retail credit. Little to no research have been conducted on recovery rates in non-performing retail credit with emphasis on third-party buyers. From an empirical point of view, in order to analyze the recovery rate distributions across the different industries, over nine million defaulted or non-performing consumer credit data provided by a German

debt collection company are used. A variety of statistical and data mining methods will be examined with respect to prediction and classification. A two-stage model which first classifies debts as extreme or non-extreme with respect to recovery rate is applied; then, the extreme debts are classified into full payment and non-payment. Moreover, the non-extreme recovery rates are predicted in the entire unit interval [0,1].

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CP13

Maximum Likelihood Estimation for Large Interacting Stochastic Systems

Parameter estimation for a large system is facilitated by use of the asymptotic SPDE to which the system weakly converges. Standard particle filtering methods are often not applicable for parameter estimation of the SPDE. A method of moments reduces the SPDE into an SDE system. We then develop a particle filtering method for the SDE system. Theoretical convergence of the finite system's likelihood to the asymptotic likelihood is discussed. Important credit risk and mortgage applications motivate the method.

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MS1

Price Dynamics in Limit Order Markets: Limit Theorems and Diffusion Approximations

We propose a queueing model for the dynamics of a limit order book in a liquid market where buy and sell orders are submitted at high frequency. We derive a functional central limit theorem for the joint dynamics of the bid and ask queues and show that, when the frequency of order arrivals is large, the intraday dynamics of the limit order book may be approximated by a Markovian jump-diffusion process in the positive outhunt, whose characteristics are explicitly described in terms of the statistical properties of the underlying order flow [Cont Larrard 2011]. This result allows to obtain analytical expressions for the probability of a price increase or the distribution of the duration until the next price move, conditional on the state of the order book and characterize various other quantities as solutions of elliptic PDEs in the positive orthant [Cont Larrard 2012]. Our results allow for a wide range of distributional and dependence assumptions in the orders and apply to a wide class of stochastic models proposed for order book dynamics, including Poisson point processes, self-exciting point processes [Cont, Andersen Vinkovskaya 2011] and models of the ACD-GARCH family.

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MS1

Information and the Value of Guaranteed Trade Execution

In many markets, uncertainty about whether a trade is executed can be removed by paying a price premium. We use financial markets as a particular setting in which to study this trade-off. In particular, we assess the role of information in the choice between certain trade at a price premium in an intermediated market such as a dealer market or a limit order book and contingent trade in a dark pool. Our setting consists of intrinsic traders and speculators, each endowed with heterogeneous fine-grained private information as to an assets value, that endogenously decide between these two venues. We solve for an equilibrium in this setting, and address three main questions: First, we illustrate how the choice between certain and contingent trade depends on information available to an individual agent, as well as the overall distribution of information across all agents. Second, we analyze how the premium for certain trade over contingent trade affects the strategic behavior of traders. Finally, we demonstrate how the option for contingent trade affects the ability of intermediating market makers to set transaction costs to maximize profit.

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MS1

Mean-variance Optimal Adaptive Order Execution and Dawson-Watanabe Superprocesses

It is well-known that the mean-variance optimization of adaptive order execution strategies is not dynamically consistent. By localizing the mean-variance criterion, one is led to the optimization of the mean versus quadratic variation, which is a dynamically consistent stochastic control problem with fuel constraint. We show how this latter

problem can be solved by means of Dawson-Watanabe superprocesses.

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MS1

Optimal Liquidation in a Limit Order Book

We consider an asset liquidation problem at the market microstructure level, conditional on observing the limit order book. The optimization problem is formulated in terms of a sequence of stopping times, at which we submit market sell orders. We describe the shape of the trade and no trade regions for various assumptions on the price process and the latency of the trader. In the empirical section, we show that our optimal policy significantly outperforms a benchmark TWAP algorithm on US treasury bonds. In addition we can efficiently calculate the cost of latency in the trade execution.

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MS2

Pricing a Contingent Claim Liability with Transaction Costs Using Asymptotic Analysis for Optimal Investment

We price a contingent claim liability using the utility indifference argument. We consider an agent, who invests in a stock and a money market account with the goal of maximizing the utility of his investment at the final time T in the presence of a proportional transaction cost in two cases with and without the liability. In both cases, we provide a rigorous derivation of the asymptotic expansion of the value function and obtain a "nearly optimal" strategy. Additionally, we derive the asymptotic price of the contingent claim liability.

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MS2

Shadow Prices and Well Posedness in the Optimal Investment and Consumption Problem with Transaction Costs

We revisit the optimal investment and consumption model of Davis and Norman (1990) and Shreve and Soner (1994), following a shadow-price approach similar to that of Kallsen and Muhle-Karbe (2010). Making use of the completeness of the model without transaction costs, we reformulate and reduce the HJB equation for this singular stochastic control problem to a free-boundary problem for a first-order ODE with an integral constraint. Having shown that the free boundary problem has a twicely differenciable solution, we use it to construct the solution of the original optimal investment/consumption problem without any recourse to the dynamic programming principle. Furthermore, we provide an explicit characterization of model parameters for which the value function is finite.

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MS2

Optimal Investment with Small Transaction Costs and General Stochastic Opportunity Sets

For an investor with constant absolute risk aversion, we informally derive the first-order asymptotics of the optimal investment strategy as the bid-ask spread becomes small. For general Itô processes, the first order correction term is expressed in terms of the quadratic variation of the frictionless optimizer. This result allows to quantify the impact of, e.g., predictability and stochastic volatility on portfolio choice in the presence of transaction costs. Applied to an investor holding a random endowment, it also leads to a generalization of the asymptotic utility-based hedging strategies determined by Whalley and Wilmott (1997) for a constant opportunity set. This is joint work with Jan Kallsen.

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MS2

The Optimal Use of Options to Reduce the Effect of Transaction Costs in a Portfolio

Options are redundant in a portfolio of cash and stock if we assume the market of Black and Scholes, which includes no transaction costs. When we include transaction costs, however, options, when used correctly, can become quite useful in reducing the ill-effects these costs create. Specifically, let ε represent the scale of a small proportional loss from any trade. Given an investor's utility preference, the loss in expected utility due to transaction costs in a cash and stock portfolio is, at best, $O\left(\varepsilon^{\frac{2}{3}}\right)$. However, by including options in the portfolio, we can improve this to $O\left(\varepsilon^{\frac{6}{7}}\right)$, which is much closer to the $O(\varepsilon)$ loss guaranteed by even one trade. We detail the specific optimal strategy that accomplishes this.

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MS3

Modeling and Simulation of Systemic Risk in Insurance-Reinsurance Networks

We propose a dynamic insurance network model that allows to deal with reinsurance counter-party default risks with a particular aim of capturing cascading effects at the time of defaults.An equilibrium allocation of settlements is found as the unique optimal solution of a linear programming problem. This equilibrium allocation recognizes 1) the correlation among the risk factors, which are assumed to be heavy-tailed, 2) the contractual obligations, which are assumed to follow popular contracts in the insurance industry (such as stop-loss and retro-cesion), and 3) the interconnections of the insurance-reinsurance network. We are able to obtain an asymptotic description of the most likely ways in which the default of a specific group of insurers can occur, by means of solving a multidimensional Knapsack integer programming problem. Finally, we propose a class of provably strongly efficient estimators for computing the expected loss of the network conditioning the failure of a specific set of companies.

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MS3

Pricing of Path-Dependent Vulnerable Claims in Regime Switching Markets

We study pricing of path-dependent vulnerable claims in regime-switching markets. The key theoretical tool underlying our results is a Poisson series representation of vulnerable claims, which we develop using a change of probability measure technique. We employ such a representation, along with a short-time asymptotic expansion of the claim's price in terms of the Laplace transforms of the symmetric Dirichlet distribution, to develop an efficient method for pricing claims which may depend on the full path of the underlying Markov chain. The proposed approach is applied to price not only simple European claims such as defaultable bonds, but also a new type of path-dependent claims that we term self-decomposable, as well as the important class of vulnerable call and put options on a stock. We provide a detailed error analysis and illustrate the accuracy and computational complexity of our algorithms on market traded instruments, such as defaultable bond prices, barrier options, and vulnerable European options.

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MS3

Default and Systemic Risk in Equilibrium

In a finite horizon continuous time market model, we consider risk averse utility maximizers who invest dynamically in a risk-free money market account, a stock written on a default-free dividend process, and a defaultable bond. Prices are determined via equilibrium. We analyze contagion arising endogenously between the stock and the defaultable bond via the interplay between equilibrium behavior of investors, risk preferences, and cyclicality properties of the default intensity. The equilibrium price of the stock experiences a jump at default, despite that the default event has no causal impact on the dividend process. We characterize the direction of the jump in terms of a relation between investor preferences and the cyclicality properties of the default intensity. A similar analysis is performed for the market price of risk and investor wealth processes. The impact of heterogeneity of preferences on the default exposure carried by different investors is also investigated.

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MS3

Filtered Likelihood for Point Processes

We develop likelihood estimators of the parameters of a marked point process and of incompletely observed explanatory factors that influence the arrival intensity along with the point process itself. The factors follow jump-diffusions whose drift, diffusion, and jump coefficients are allowed to depend on the point process. We provide conditions guaranteeing consistency and asymptotic normality as the sample period grows. We also establish an approximation to the likelihood and analyze the convergence and asymptotic properties of the associated estimators. Numerical results illustrate our approach.

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MS4

Excursions in Atlas Models of Equity Market

Let us consider an equity market of finite number of stocks where behavior of their capitalization is a multidimensional diffusion characterized with their rankings. Such model can capture flows of market capitalizations as it was observed by Fernholz et al. In this talk we consider some questions on excursion measure and time-reversibility for these flows of market capitalization with application to portfolio management under such abstract equity market.

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MS4

Optimal Investment for All Time Horizons and Martin Boundary of Space-time Diffusion

I review the definition and basic properties of the forward performance processes, including their relation to the more standard investment criteria, and the associated SPDE characterization. I, then, concentrate on the problem of constructing the forward investment performance processes in a Markovian setting. In this case, the problem reduces to the so-called "forward Hamilton-Jacobi-Bellman equation", which, in some cases, can be transformed into a time-reversed linear parabolic equation. I characterize the solutions of this (ill-posed) problem explicitly, extending the classical Widders theorem on positive solutions to the time-reversed heat equation. Finally, I consider closed-form examples of the Markovian forward performance processes in some specific stochastic volatility models, including the mean-reverting log-price (Schwartz) model.

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MS4

Volatility-Stabilized Markets

We consider models which generalize the Volatility-stabilized markets introduced in Fernholz and Karatzas (2005). We show how to construct a weak solution of the underlying system of stochastic differential equations, express the solution in terms of time changed squared-Bessel processes, and argue that this solution is unique in distribution. Moreover, we discuss sufficient conditions for the existence of a strong solution and show that strong relative arbitrage opportunities exist in these markets.

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MS4

Generalizations of Functionally Generated Portfolios

I will present generalizations on functionally generated portfolios (FGPs) of stochastic portfolio theory. The assets and the benchmark may be any strictly positive wealth processes, as opposed to merely the stocks and the market portfolio, respectively. Another generalization is that the generating function may be stochastic, so that the generated portfolio can be adjusted to changing market conditions. These FGPs can be applied to arbitrary cointegrated market modes exploiting their mean-reversion in a risk-controlled manner.

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MS5

Optimal Investment in the Presence of High-water Mark Fees

In this talk, we consider the Merton problem for an agent who may invest in a money market fund, a stock, and a hedge fund that is subject to a performance fee. This fee is assessed each time the cumulative profit-to-date derived from the investment in the hedge fund reaches a new running maximum. We will study the associated HJB equation and examine some qualitative properties of the optimal strategy.

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MS5

A Uniqueness Theorem for a Degenerate QVI Appearing in An Option Pricing Problem

We prove the missing uniqueness theorem for the viscosity solution of a degenerate quasi-variational inequality, which makes the probability-free theory of option pricing in the interval market model, essentially complete.

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MS5

Existence, Uniqueness, and Global Regularity for Degenerate Obstacle Problems in Mathematical Finance

The Heston stochastic volatility process, which is widely used as an asset price model in mathematical finance, is a paradigm for a degenerate diffusion process where the degeneracy in the diffusion coefficient is proportional to the square root of the distance to the boundary of the half-plane. The generator of this process with killing, called the elliptic Heston operator, is a second-order degenerate elliptic partial differential operator whose coefficients have linear growth in the spatial variables and where the degeneracy in the operator symbol is proportional to the distance to the boundary of the half-plane. With the aid of weighted Sobolev spaces, we prove existence, uniqueness, and global regularity of solutions to stationary variational inequalities and obstacle problems for the elliptic Heston operator on unbounded subdomains of the half-plane. In mathematical finance, solutions to obstacle problems for the elliptic Heston operator correspond to value functions for perpetual American-style options on the underlying asset.

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MS5

Approximate Solutions to Second Order Parabolic Equations with Time-dependent Coefficients

We consider second order parabolic equations with coefficients that vary both in space and in time (non-autonomous). We derive closed-form approximations to the associated fundamental solution by extending the Dyson-Taylor commutator method that we recently established for autonomous equations. We establish error bounds in Sobolev spaces and show that by including enough terms, our approximation can be proven to be accurate to arbitrary high order in the short-time limit. We show how our method extends to give an approximation of the solution for any fixed time and within any given tolerance. Some applications to option pricing are presented. In particular, we perform several numerical tests, and specifically include results on Stochastic Volatility models.

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MS6

Mixed Deterministic Monte-Carlo Simulations for Finance

Mixing Monte-Carlo and PDE methods can substantially speed-up computations because it allows use of closed form solutions for some of the components. It can also solve problems like unknown boundary conditions for complex stochastic volatility models. Applying the method combined with Longstaff-Schwartz projection can lead to efficient computations of early exercise contracts. The convergence of the methods will be established with error estimates and we shall report performance on multi-dimensional problems.

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MS6

Two-dimensional Fourier Cosine Series Expansion Method for Pricing Financial Options

The COS method for pricing European and Bermudan options with one underlying asset was developed by Fang and Oosterlee (2008, 2009). We extend the method to higher dimensions, with a multi-dimensional asset price process. The algorithm can be applied to, for example, pricing two-color rainbow options, but also to pricing under the Heston stochastic volatility model. For smooth density functions, the method converges exponentially in the number of terms in the Fourier cosine series summations.

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MS6

Risk-Neutral Valuation of Real Estate Options

We propose a novel and intuitive risk-neutral valuation model for real estate derivatives. The resulting index behavior can easily be analyzed and closed-form pricing solutions are derived for forwards, swaps and European put and call options. We demonstrate the application of the model by valuing a put option on a house price index. Autocorrelation in the index returns appears to have a large impact on the option value. We also study the effect of an over- or undervalued real estate market. The observed effects are significant and as expected.

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MS6

Efficient Option Pricing of Asian Options based on Fourier Cosine Expansions

In this talk we present an efficient pricing method for Asian options under Lévy processes, based on Fourier–cosine expansions and Clenshaw–Curtis quadrature. The pricing method has been developed for both European–style and American–style Asian options, written on different types of average (arithmetic, geometric and harmonic), and for discretely and continuously monitored versions. Fast convergence of Fourier cosine expansions and Clenshaw–Curtis quadrature ensures exponential convergence in the Asian option prices in most cases, which reduces the computing time of the method to milliseconds for geometric Asian options and a few seconds for arithmetic Asian options. The method's convergence behavior is explained by an error analysis. Its performance is further demonstrated by various numerical examples, where we also show the power of an implementation on the Graphics Processing Unit (GPU) where hundreds of speedup is achieved for pricing early–exercise Asian options, in particular.

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MS7

Sampling Error of the Supremum of a Levy Process

Lvy processes are often used in finance to model the dynamics of asset prices. The supremum of a Lvy process is of interest when one is pricing financial contracts whose payoffs depend on the supremum of the underlying asset price process. While the maximum of a discretely sampled Lvy process can often be handled very efficiently using numerical methods, not much is known about the continuous supremum of a general Lvy process. We present results on the discrepancy between the discrete maximum and continuous supremum of a Lvy process. Using Spitzers identity and results from analytic number theory, we derive explicit expressions for the sampling errors for various commonly used Lvy processes. The results help us better understand the error of approximating the continuous supremum of a Lvy process by a discrete maximum.

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MS7

Positive Subordinate CIR Processes with Two-Sided Mean-Reverting Jumps

We present the SubCIR jump-diffusion process. The SubCIRsdiffusion dynamics are those of a CIR process. The SubCIRs jump componentincludes two-sided mean-reverting (state-dependent) jumps. The process remainsstrictly positive if the CIR process satisfies Fellers condition. Theanalytical tractability of the SubCIR process makes it a richer extension tothe CIR process (compared to previous models) and it is also a naturalalternative for interest rates and credit models.

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MS7

Default Swap Games

We consider the valuation of game-type credit default swaps that allow the protection buyer and seller to raise or reduce the respective position once prior to default. Under a structural credit risk model based on spectrally negative Levy processes, we analyze the existence of the Nash equilibrium and derive the associated saddle point. Using the principles of smooth and continuous fit, we determine the buyer's and seller's equilibrium exercise strategies, which are of threshold type.

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MS7

Multifactor Term Structure of Interest Rates under Regime Shifts and Levy Jumps

We develop a tractable dynamic term structure models under jump-diffusion with Levy Jumps and regime shifts with time varying transition probabilities. The model allows for regime-dependent jumps while both jump risk and regime-switching risk are priced. Two types solutions, including (log-linear) approximate solutions and exact solutions for the term structure are obtained for affine-type models under different conditions. For the approximate solutions, we derive the error bound, which is in the first order only. For the exact solutions, we further obtain closed-form expressions for special cases. Joint work with Xiangdong Liu, Lawrence C. Evans, and Shu Wu.

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MS8

Risk Measures and Fine Tuning of High Frequency Trading Strategies

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MS8

New Models for Optimal Execution and High-frequency Market Making

Two related papers will be presented that rely on the same mathematical finding. The first one "Dealing with the inventory risk" solves the Avellaneda-Stoikov problem. It corresponds to the case of a market maker who has to continuously set a bid and a ask quote and we derive the optimal quotes with closed-form approximations based on spectral ideas. The second one deals with the classical subject of optimal liquidation and is one of the first attempts to solve the problem with limit orders instead of liquidity-consuming market orders. This second paper will be presented for very general intensity functions.

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MS8

Optimal HF Trading in a Prorata Microstructure

We propose a framework to study optimal trading policies in a one-tick pro-rata limit order book, as typically arises in short-term interest rate futures contracts. The high-frequency trader has the choice to trade via market orders or limit orders, which are represented respectively by impulse controls and continuous controls. We model and discuss the consequences of the two main features of this particular microstructure: first, the limit orders sent by the high frequency trader are only partially executed, and therefore she has no control on the executed quantity. For this purpose, cumulative executed volumes are modelled by compound Poisson processes. Second, the high frequency trader faces the overtrading risk, which is the risk of brutal variations in her inventory. The consequences of this risk are investigated in the context of optimal liquidation. The optimal trading problem is studied by stochastic control and dynamic programming methods, which lead to a characterization of the value function in terms of an integro quasi-variational inequality. We then provide the associated numerical resolution procedure, and convergence of this computational scheme is proved. Next, we examine several situations where we can one one hand simplify the numerical procedure by reducing the number of state variables, and on the other hand focus on specific cases of practical interest. We examine both a market making problem and a best execution problem in the case where the mid-price process is a martingale. We also detail a high frequency trading strategy in the case where a (predictive) directional information on the mid-price is available. Each of the resulting strategies are illustrated by numerical tests.

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MS9

Stochastic Perron's Method and Verification without Smoothness using Viscosity Comparison: Obstacle Problems and Dynkin Games

We adapt the Stochastic Perron's method in Bayraktar and Sirbu (to appear in the Proceedings of the American Mathematical Society) to the case of double obstacle problems associated to Dynkin games. We construct, symmetrically, a viscosity sub-solution which dominates the upper value of the game and a viscosity super-solution lying below the lower value of the game. If the double obstacle problem satisfies the viscosity comparison property, then the game has a value which is equal to the unique and continuous viscosity solution. In addition, the optimal strategies of the two players are equal to the first hitting times of the two stopping regions, as expected. The (single) obstacle problem associated to optimal stopping can be viewed as a very particular case. This is the first instance of a non-linear problem where the Stochastic Perron's method can be applied successfully. (Joint work with Mihai Sirbu. Available on ArXiv.)

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MS9

Optimal Consumption and Investment in Incomplete Markets with General Constraints

We study an optimal consumption and investment problem in a possibly incomplete market with general, not necessarily convex, stochastic constraints. We give explicit solutions for investors with exponential, logarithmic and power utility. Our approach is based on martingale methods which rely on recent results on the existence and uniqueness of solutions to BSDEs with drivers of quadratic growth.

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MS9

Dynamic Portfolio Choice with Multiple Decentralized Agents

Abstract not available at time of publication.

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MS9

Constructing Sublinear Expectations on Path Space

We provide a general construction of time-consistent sublinear expectations on the space of continuous paths. It yields the existence of the conditional G-expectation of a Borel-measurable (rather than quasi-continuous) random variable, a generalization of the random G-expectation, and an optional sampling theorem that holds without exceptional set.

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MS10

Resilience to Contagion in Financial Networks

Propagation of balance-sheet or cash-flow insolvency across financial institutions may be modeled as a cascade process on a network representing their mutual exposures. We derive rigorous asymptotic results for the magnitude of contagion in a large financial network and give an analytical expression for the asymptotic fraction of defaults, in terms of network characteristics. Our results extend previous studies on contagion in random graphs to inhomogeneous directed graphs with a given degree sequence and arbitrary distribution of weights. We introduce a criterion for the resilience of a large financial network to the insolvency of a small group of financial institutions and quantify how contagion amplifies small shocks to the network. Our results emphasize the role played by "contagious links' and show that institutions which contribute most to network instability in case of default have both large connectivity and a large fraction of contagious links. The asymptotic results

show good agreement with simulations for networks with realistic sizes.

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MS10
Coupled Diffusions, Swarming and Systemic Risk

Abstract not available at time of publication.

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MS10
Failure and Rescue in an Interbank Network

This paper is concerned with systemic risk in the interbank market. We model this market as a directed graph in which the banks represent the nodes and the liabilities between the banks represent the edges. Our work builds on the modelling paradigm of Eisenberg and Noe (2001), extending it by introducing default costs in the system. We provide a rigorous analysis of those situations in which banks have incentives to bailout distressed banks. Such incentives exist under very mild conditions. We illustrate our results with some simple examples, and go on to discuss possible measures of soundness of a financial system, together with possible policy implications for resolution of distress.

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MS10
Feedback Effects and Endogenous Risk in Financial Markets

We present a mathematical model which allows to quantify the impact of fire sales of assets of a fund undergoing losses on the volatilities and correlations of assets held by the fund. Our model shows that the liquidation of large positions by funds may result in spikes in volatilities and correlations, even in absence of liquidity dry-up, and gives plausible explanations for the large hedge fund losses of August 2007. We show that our model can be used for forensic analysis of financial data, to recover characteristics of the portfolio undergoing fire sales from public data, by solving an inverse problem. We show the consistency of the estimator obtained and apply it to simulated and empirical data.

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MS11
Dynamic Modeling of Systemic Risk

We generalize the Eisenberg-Noe model to allow for multiple clearing dates, as well as uncertainty in future liabilities and cash inflows. The clearing payment vectors are sequentially recovered as the solutions of robust linear programming problems solved over the planned horizon. We show existence and uniqueness of the clearing payment vectors over time. We perform a sensitivity analysis of the loss and payment vector with respect to borrowing and equity constraints. We employ the Shapley value methodology to dynamically attribute the systemic risk to the individual nodes in the network. We conclude with a numerical assessment of the proposed methodology on a systemic network consisting of a large number of highly interconnected financial institutions.

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MS11
Estimating Hedge Fund Risk Factors

The estimation of hedge fund returns and the risk factors that impact them is a critical step in the construction of portfolios. In particular, so called fund-of-funds have the arduous task of building portfolios of hedge fund strategies based on limited and low frequency observations. This is quite daunting in the hedge fund space due to the generally small sample sizes and opaque nature of that industry's data. To overcome these difficulties, it is desired to estimate risk factors based on market observables and reverse engineer a hedge fund exposure to those factors. The model that we propose will be used to analyze and decompose the risk of various hedge fund indices on common factors at a high frequency (e.g., daily, or intra-day) based on their habitual low frequency observations (typically monthly). Specifically, we will jointly model the risk-factors (e.g., stock returns) and the asset returns (e.g., a hedge fund strategy) in a fat-tailed, stochastic volatility environment implemented with a Bayesian approach via a Rao-Blackwellised (R-B) particle filter. We utilize a vector Stochastic-Volatility model with smoothed observable returns to extract the potentially time-varying exposure of low frequency hedge fund performance on high frequency data. By making use of a particle filter with Rao-Blackwellization, we reduce the parameter space significantly resulting in a more accurate estimate of the distibution of the parameter state. This approach can be used for analyzing hedge fund performance and their advertized strategies as well as in forensic risk-management. The latter of which is a critical need given the generally

low transparency of the hedge fund industry.

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MS11

Smooth and Monotone Covariance Estimation for Elliptical and Generalized Hyperbolic Distributions

We consider the problem of high-dimensional covariance estimation from severely limited observations. Strong assumptions on the structure of the underlying random vector have to be made for the problem to be well-defined. Some examples developed in the literature include: covariance selection models with sparse inverse covariances, low-rank structures (PCA models and factor analysis), sparse plus low-rank structures, multi-scale structures. We consider another assumption which is important for a variety of applications including term-rate risk-modeling in computational finance: smoothness and monotonicity. We review our previous formulation for multivariate Gaussian random vectors based on semi-definite programming, and extend the method for elliptical and generalized hyperbolic distributions. We use efficient convex optimization algorithms and compare the methods using various penalized Bregman divergences as objective functions with examples from interest rate modeling.

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MS11

Nonparametric Prediction in a Limit Order Book

We propose a novel non-parametric approach to short-term forecasting of the mid-price in a limit order book. We introduce a state vector describing the state of the order book at each time. The predictor is based on two features, computed for each value of the state vector. Implicit assumptions of our method are very mild and are supported by our preliminary real-data experiments on NYSEs OpenBook which yield promising empirical results.

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MS12

Dynamic Assessment Indices

Measuring performance and risk of cash flows is a crucial issue in finance. A Dynamic Assessment Index (DAI) is a quasiconcave, monotone function, mapping cash flows into processes which represent their risk or performance evaluations in time. Using L^0-separation theorems, we provide an upper semicontinuous robust representation and study the impact of different time consistency conditions; in particular, how past performances may impact the present assessment of risk. Illustrative examples will be discussed.

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MS12

Minimal Supersolutions of BSDEs and Robust Hedging

We study minimal supersolutions of BSDEs - related to Peng's g-expectation - which can be seen as superhedging functionals. We prove existence, uniqueness, monotone convergence, Fatou's Lemma and lower semicontinuity of our functional. Unlike usual BSDE methods, based on fixed point theorems, the existence relies on compactness methods. We then study some robust extensions which correspond to the problem of superhedging under volatility uncertainty. The talk is based on joint works with Samuel Drapeau and Gregor Heyne.

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MS12

Set-valued Dynamic Risk Measures in Markets with Transaction Costs

Set-valued risk measures appear naturally when markets with transaction costs are considered and capital requirements can be made in a basket of currencies or assets. In this talk we study dual representation and time consistency properties of dynamic set-valued risk measures. It turns out that only a stronger time consistency called multi-portfolio time consistency is equivalent to a recursive form of the risk measure as well as to an additive property for the acceptance sets, which is a central result in the scalar case.

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MS12

Portfolio Choice with Time-consistent Dynamic Risk Measures

We study portfolio selection based on time-consistent dynamic risk measures in a general continuous-time setting. The setting features discontinuities in the asset price processes, with a general and possibly infinite activity jump part besides a continuous diffusion part, and general and possibly non-convex trading constraints. We characterize the minimal risk processes as solutions to Backward Stochastic Differential Equations (BSDEs). We prove existence and uniqueness of the solution in the general class of jump BSDEs having a driver function that grows at most quadratically. We further compute these solutions in a few examples by numerically solving the corresponding BSDEs using regression techniques.

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MS13

The Valuation of Double Barrier Options under Multifactor Pricing Models

The (vast) literature on the pricing of barrier options is mainly focused on the valuation of European-style contracts under single-factor option pricing models (such as the geometric Brownian motion and the CEV processes). This paper extends the literature in two directions. First, European-style (double) barrier options are priced under a multifactor and Markovian financial model that is able to accommodate stochastic volatility, stochastic interest rates, endogenous bankruptcy, and time-dependent barriers. Second and more importantly, quasi-analytical pricing solutions are also proposed for American-style (double) barrier option contracts under the same general financial model. The proposed pricing solutions are shown to be accurate, easy to implement, and efficient.

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MS13

Exponential Time Differencing Methods for Pricing and Hedging American Options

Exponential time differencing (ETD) methods based on the Cox and Matthews approach are developed to solve a nonlinear BlackScholes model for pricing and hedging American options with transaction cost. Each of these methods avoids solving nonlinear systems, whilst, well known standard methods would require solving nonlinear systems at each time step. Numerical experiments are performed on exotic path-dependent American options with transaction cost to demonstrate the computational efficiency, accuracy and reliability of the methods.

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MS13

Efficient and Robust Time Stepping Under Jump-diffusion Models

Partial-integro differential (PIDE) formulations are often used to solve option pricing problems where the underlying asset follows a jump-diffusion process. The main challenge lies in the efficient treatment of the jump term resulting a full matrix. We discuss some efficient, robust, and accurate time discretization methods including schemes treating the jump term explicitly.

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MS13

Pricing American Options Under Jump-diffusion Models

Under jump-diffusion models, a linear complementarity problem (LCP) with a partial-integro differential operator can formulated for the price of an American option. As the discretization of the jump term leads to a full matrix, it preferable to use special techniques to solve the resulting LCPs. We discuss various efficient methods for these LCPs.

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MS14

Efficient Laplace Inversion, Wiener-Hopf Factorization and Pricing Lookbacks

We construct very fast and accurate methods of approximate Laplace inversion, calculation of the Wiener-Hopf factors for wide classes of Levy processes with exponentially decaying Levy densities, and pricing lookback options. In all cases, we use appropriate conformal changes of variables, which allow us to apply the simplified trapezoid rule with small number of terms. The same technique is applicable for calculation of pdf's of the supremum and infimum processes, and prices and sensitivities of options with lookback and barrier features.

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MS14

Quadratic Hedging of Barrier Options under Leptokurtic Returns Driven by an Exponential Lvy Model

We examine quadratic hedging of barrier options in a model realistically calibrated to reflect the leptokurtic nature of equity returns. We compute the hedging error of the optimal hedging strategy andevaluate prices that yield reasonable risk-adjusted performance for the hedger. Our main finding is that the impact of hedging errors on prices is several times higher than the impact of other pricing biases studied in the literature, in particular the effect of barrier

misalignment and of discrete monitoring.

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MS14
Exact Simulation of the Heston Jump-Diffusion

In this talk, we extend the Heston stochastic volatility model to include state-dependent jumps in the price and the volatility, and develop a method for the exact simulation of this model. The jumps arrive with a stochastic intensity that may depend on time, price, volatility and jump counts. They may have an impact on the price or the volatility, or both. The random jump size may depend on the price and volatility. Numerical experiments illustrate the features of the exact method. This is a joint work with Prof. Erhan Bayraktar at the University of Michigan and Prof. Kay Giesecke at Stanford University.

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MS14
Efficient Pricing and Reliable Calibration in the Heston Model and its Generalizations

We suggest a general scheme for improvement of FT-pricing formulas for European option and give efficient recommendations for the choice of the parameters of the numerical scheme, which allow for very accurate and fast calculations. We demonstrate that an indiscriminate choice of parameters of a numerical scheme leads to an inaccurate pricing and calibration. As applications, we consider the Heston model and its generalization, and several other affine models. For many parameter sets documented in empirical studies of financial markets, relative accuracy better than 0.01 % can be achieved by summation of less than 10-20 terms even in the situations in which the standard approach requires more than 200. In some cases, the one-term formula produces an error of several percent, and the summation of two terms — less than 0.5 %. Typically, 10 terms and fewer suffice to achieve the error tolerance of several percent and smaller.high-level commands.

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MS15
Central Clearing Mechanisms for Credit Default Swaps

Central clearing of Credit default swaps through Central Counterparties (CCPs) has been proposed as a tool for mitigating systemic risk and counterpart risk in CDS markets. The design of CCPs for CDS involves the implementation of margin requirements and a clearing fund (or default fund), for which various designs have been proposed. We study the impact of the design of these requirements on the risk of the CCP and the incentives for CDS clearing.

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MS15
Central Clearing of OTC Derivatives : Bilateral vs Multilateral Netting

We study the impact of a central counterparty (CCP) for OTC derivatives on expected interdealer exposures. The results are sensitive to assumptions on heterogeneity of risk across asset classes as well as correlation of exposures across asset classes; empirically plausible specifications of these parameters lead to the conclusion that the gain from multilateral netting in a CCP largely overweighs the loss of netting across asset classes in bilateral netting agreements.

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MS15
Measuring Contagion in Financial Networks

Liabilities between financial entities form a network. The clearing of liabilities and thereby contagion of risk and default depend on this network structure. We provide a mathematical model to understand clearing and propagation of default in such financial networks. This yields a precise measure for the systemic risk induced by individual financial entities. The model allows to compute optimal bailout strategies that either minimize the cost of the intervention or maximize the stabilizing effect for a given bailout budget. Finally, the computational efficiency of the model allows to analyze large scale networks quickly.

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MS15
Are CDS Auctions Biased?

We study settlement auctions for credit default swaps (CDS). We find that the one-sided design of CDS auctions used in practice gives CDS buyers and sellers strong incentives to distort the final auction price, in order to maximize payoffs from existing CDS positions. Consequently, these auctions tend to overprice defaulted bonds conditional on an excess supply and underprice defaulted bonds conditional on an excess demand. We propose a double auction to mitigate this price bias. We find the predictions of our model on bidding behavior to be consistent with data on CDS auctions.

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MS16

Endogenous Equilibria in Liquid Markets with Frictions and Boundedly Rational Agents

We propose a simple binary mean field game, where N boundedly rational agents may decide to trade or not a share of a risky asset in a liquid market. Agents' utility depends on returns, which are endogenously determined taking into account observed and forecasted demand and an exogenous transaction cost. The explicit dependence on past demand generates endogenous dynamics of the system. It is shown that pure strategy Nash equilibria exist. We study under a rather general setting (risk attitudes, pricing rules and noises) the aggregate demand for the asset, the emerging returns and the structure of the equilibria of the asymptotic game. We prove that boom and crash cycles may arise and that transaction costs have a stabilizing effect on the market.

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MS16

Large Portfolio Asymptotics for Loss From Default

We prove a law of large numbers for the loss from default and use it for approximating the distribution of the loss from default in large, potentially heterogenous portfolios. The density of the limiting measure is shown to solve a non-linear SPDE, and the moments of the limiting measure are shown to satisfy an infinite system of SDEs. The solution to this system leads to the distribution of the limiting portfolio loss, which we propose as an approximation to the loss distribution for a large portfolio. Numerical tests illustrate the accuracy of the approximation, and highlight its computational advantages over a direct Monte Carlo simulation of the original stochastic system.

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MS16

Branching and Interacting Particle Models of Systemic Risk

We propose an interacting particle system description of the banking system. While net bank assets evolve independently under normal conditions, defaults trigger a mean-field type interaction that creates systemic risk. We work with a stochastic size of the economy, with new banks added spontaneously according to a mean-field birth process. We present some preliminary results about system stability and the properties of the corresponding mean-field limit.

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MS16

Most Likely Path to Systemic Failure

In this talk, I will present recent results on modeling the dynamics of correlated default events in the financial market. An empirically motivated system of interacting point processes is introduced and we study how different types of risk, like contagion and exposure to systematic risk, compete and interact in large-scale systems. Large deviation arguments are used to approximate the tail of the default loss in large portfolios and to identify the way that atypically large (i.e. "rare') default clusters are most likely to occur. The results give insights into how different sources of default correlation interact to generate atypically large portfolio losses.

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MS17

Quasi-convex Dynamic Programming for Storage Evaluation

The value of a storage facility can often be represented as a quasi-convex function of the market price and current capacity utilization. This talk will describe a dynamic programming procedure to take advantage of this structure. The method relies on progressive refinement of outer approximations of the sub-level sets of the value function

in each stage.

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MS17

A Kernel Based Approach to Gas Storage and Swing Contracts Valuations in High Dimensions

We are expanding upon our previous work [Boogert and Mazieres, "A Radial Basis Function Approach to Gas Storage Valuation", 2011], by introducing multi-factor price and volume dimensions encountered in both gas storage and swing contracts. This is achieved by introducing new multivariate methods (Kernel based: Radial Basis Functions and the Tensor of Radial Basis Functions) to the multi-dimensional Least-Squares Monte Carlo method used to value these contracts with the spot approach.

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MS17

Approximate Linear Programming Relaxations for Commodity Storage Real Option Management

The real option management of commodity conversion assets based on high dimensional forward curve evolution models commonly used in practice gives rise to intractable Markov decision processes. Focusing on commodity storage, we derive approximate dynamic programs from relaxations of approximate linear programs formulated using low dimensional value function approximations. We evaluate the performance of our approximate dynamic programs on natural gas and oil instances.

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MS17

Natural Gas Storage Valuation, Optimization, Market and Credit Risk Management

We present a model for the valuation, optimization, and pricing of the credit risk of gas storage contracts. A reduced form term structure model of the curve dynamics is derived that facilitates dimension reduction without sacrificing realism. A system of PDEs is derived and solved using RBF collocation. When the number of injection/withdrawal opportunities is large, RBF-PDE method can solve problems where heuristic approaches would be impractical. The RBF expansions facilitate pricing of credit risk.

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MS18

Small-time Expansions for Stochastic Volatility Models with Lévy Jumps

We analyze the short-time (equivalently, near expiration) behavior of the tail distributions and option prices of a class of stochastic volatility (SV) models obtained by superposing a classical continuous SV process (say, the Heston process) with an independent pure-jump Lévy process. Polynomial expansions in time of arbitrary order are obtained for the tail distributions and out-of-the money option prices, assuming certain smoothness conditions on the Lévy density of the jump component and a small-time large deviation principle for the continuous component. As a result, we are able to disentangle the effects of the various model parameters in the short-time behavior of the option prices and rank their contribution according to the first power at which they appear in the polynomial expansion. This talk is based on a joint work with C. Houdré and R. Gong.

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MS18

Large Deviations and Stochastic Volatility with Jumps: Asymptotic Implied Volatility for Affine Models

We consider the implied volatility of European options in an affine stochastic volatility model with jumps, as time tends to infinity. We show that under a simultaneous rescaling of the option strike a non-degenerate limiting volatility smile exists and describe it by a formula which can be expressed in terms of the parameters of the underlying model. The result is based on a large-deviation principle for affine stochastic volatility models, that is derived via the Gärtner-Ellis theorem. We exhibit some specific examples including a Heston model with and without jumps, Bates' model with state-dependent jump intensity and the Barndorff-Nielsen-Shephard model.

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MS18

A New Look at Short-term Implied Volatility in Models with Jumps

This talk analyses the behaviour of the implied volatility smile for short-dated options in semimartingale models with jumps. We introduce a new renormalization of the strike variable such that the implied volatility for short-maturity options converges to a nonconstant finite limit, characterised by the diffusion and jump components of the

model. This limit yields calibration algorithms for short-dated options and sheds new light on the difference between finite and infinite variation jumps in pricing models.

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MS18

Parametric Inference and Dynamic State Recovery from Option Panels

We develop parametric estimation procedure for option panels observed with error. We provide semiparametric tests for the option price dynamics based on the distance between the spot volatility extracted from the options and the one obtained nonparametrically from high-frequency data on the underlying asset. We further construct new formal tests of the model fit for specific regions of the volatility surface and for the stability of the risk-neutral dynamics over a given period of time.

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MS19

A Decomposition Formula for Option Prices in the Heston Model and Applications to Option Pricing Approximation

By means of classical Its calculus we decompose option prices in the Heston volatility framework as the sum of the classical Black-Scholes formula with volatility parameter equal to the root-mean-square future average volatility plus a term due to correlation and a term due to the volatility of the volatility. This decomposition formula allows us to construct first and second order option pricing approximation formulas that are extremely easy to compute, as well as to study their accuracy for short maturities. Moreover we see the corresponding approximations for the implied volatility are linear (first-order approximation) and quadratic (second-order approximation) in the log-stock price variable.

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MS19

Small-noise Expansion for Projected Diffusions and Implied Volatility Asymptotics

Given a diffusion in R^n, we prove a small-noise expansion for the density of its projection on a subspace of dimension $p \leq n$. Our proof relies on the Laplace method on Wiener space and stochastic Taylor expansions in the spirit of Azencott-Benarous-Bismut. Our result (assuming Hörmander's condition on the vector fields) applies to (i) small-time asymptotics, (ii) tails of the distribution and (iii) small-noise expansions. In the context of stochastic volatility models, we recover the Busca-Berestycki-Florent formula (applying (i)) and Gulisashvili-Stein expansion (from (ii)). This is a joint work with J.D. Deuschel (TU Berlin), P. Friz (TU Berlin) and S. Violante (Imperial College London).

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MS19

Asymptotics of Implied Volatility to Arbitrary Order

In a unified model-free framework that includes long-expiry, short-expiry, extreme-strike, and jointly-varying strike-expiry regimes, we find asymptotic implied volatility and implied variance formulas in terms of L, with rigorous error estimates of order $1/L$ to any given power, where L denotes the absolute log of an option price that approaches zero. Our results therefore sharpen, to arbitrarily high order of accuracy, the model-free asymptotics of implied volatility in extreme regimes. We then apply these general formulas to particular examples: Lévy and Heston. Joint work with Kun Gao.

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MS19

Multi-Factor Stochastic Volatility Models for Options and Options on Variance

Through perturbation methods we reconcile skews of implied volatilities for options and options on variance in the context of multi-scale stochastic volatility models.

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MS20

On the Multi-Dimensional Controller and Stopper Games

We consider a zero-sum stochastic differential controller-and-stopper game in which the state process is a controlled

diffusion evolving in a multi-dimensional Euclidean space. In this game, the controller affects both the drift and the volatility terms of the state process. Under appropriate conditions, we show that the game has a value and the value function is the unique viscosity solution to an obstacle problem for a Hamilton-Jacobi-Bellman equation.

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MS20

Numerical Solutions of Optimal Risk Control and Dividend Optimization Policies

This work develops numerical methods for finding optimal dividend pay-out and reinsurance policies. The surplus is modeled by a regime-switching process subject to both regular and singular controls. Markov chain approximation techniques are used to approximate the value function and optimal controls. The proofs of the convergence of the approximation sequence to the surplus process and the value function are given. Examples are presented to illustrate the applicability of the numerical methods.

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MS20

Outperformance Portfolio Optimization via the Equivalence of Pure and and Randomized Hypothesis Testing

We study the portfolio problem of maximizing the outperformance probability over a random benchmark through dynamic trading with a fixed initial capital. Under a general incomplete market framework, this stochastic control problem can be formulated as a composite pure hypothesis testing problem. We analyze the connection between this pure testing problem and its randomized counterpart, and from latter we derive a dual representation for the maximal outperformance probability. Moreover, in a complete market setting, we provide a closed-form solution to the problem of beating a leveraged exchange traded fund. For a general benchmark under an incomplete stochastic factor model, we provide the Hamilton-Jacobi-Bellman PDE characterization for the maximal outperformance probability.

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MS20

Optimal Trend-following Trading Rules under a Three-state Regime-switching Mode

Assume the market follows a regime switching model with three states, a set of sufficient conditions are developed to guarantee the optimality of trend-following trading strategies. A dynamic programming approach is used to verify these optimality conditions. The value functions are characterized by the associated HJB equations. The results in this paper will help an investor to identify market conditions and to avoid trades which might be unprofitable even under the best market information.

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MS21

Evaluating Callable and Putable Bonds: An Eigenfunction Expansion Approach

Abstract not available at time of publication.

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MS21

Building Financial Models with Time Changes

Abstract not available at time of publication.

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MS21

Pricing Derivatives on Multiscale Diffusions: An Eigenfunction Expansion Approach

Using tools from spectral analysis, singular and regular perturbation theory, we develop a systematic method for analytically computing the approximate price of a derivative-asset. The payoff of the derivative-asset may be path-dependent. Additionally, the process underlying the derivative may exhibit killing (i.e. jump to default) as well as combined local/nonlocal stochastic volatility. The nonlocal component of volatility is multiscale, in the sense that it is driven by one fast-varying and one slow-varying factor. The flexibility of our modeling framework is contrasted by the simplicity of our method. We reduce the derivative pricing problem to that of solving a single eigenvalue equation. Once the eigenvalue equation is solved, the approximate price of a derivative can be calculated

formulaically. To illustrate our method, we calculate the approximate price of three derivative-assets: a vanilla option on a defaultable stock, a path-dependent option on a non-defaultable stock, and a bond in a short-rate model.

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MS21

Closed-form Expansions of Option Prices under Time-changed Dynamics

We consider a broad class of option pricing models and derive a simple closed-form expansion of option prices in these models in terms of Black-Scholes prices and higher-order Greeks. The expansion provides a transparent and informative decomposition of option prices. Moreover, it can be used for a large class of flexible models which allow for both stochastic volatility and jumps. Finally, it allows for fast model calibration.

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MS22

Optimal Portfolios under Worst Case Scenarios

Standard portfolio theories such as Expected Utility Theory, Yaari's Dual Theory, Cumulative Prospect Theory and Mean-Variance optimization all assume that investors only look at the distributional properties of strategies and do not care about the states of the world in which the cashflows are received. In a very interesting paper, Dybvig (1988a, 1988b) essentially showed that in these instances optimal portfolios are decreasing in the state-price density, also pointing indirectly to the important role of diversified portfolios. In this paper we first observe that the worst outcomes for optimal strategies exactly occur when the market declines (i.e. during a financial crisis), but this is at odds with the aspirations and requirements of many investors. Hence we depart from the traditional behavioral setting and study optimal strategies for investors who do not only care about the distribution of wealth but, additionally, also impose constraints on its interaction with the (stressed) financial market. Preferences become state-dependent and we are able to assess the impact of these on trading decisions. We construct optimal strategies explicitly and show how they outperform traditional diversification strategies under worst-case scenarios.

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MS22

Myopic Loss Aversion, Reference Point, and Money Illusion

We use the portfolio selection model presented in He and Zhou (2011, *Management Science*, Volume 57, Issue 2, pages 315–331) and the NYSE equity and U.S. treasury bond returns for the period 1926-1990 to provide a rigorous treatment of Benartzi and Thaler's myopic loss aversion theory. We find that in addition to the agent's loss aversion and evaluation period, his reference point also has a significant effect on optimal asset allocation. We demonstrate that the agent's optimal allocation to equities is consistent with the market observation when he has reasonable values of degree of loss aversion, evaluation period, and reference point. We also find that the optimal allocation to equities is sensitive to these parameters. We then examine the implications of money illusion for asset allocation and pricing. Finally, we extend the model to a dynamic setting.

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MS22

Consumption-based Behavioral Portfolio Selection in Continuous Time

We study the optimal consumption-investment problem in a continuous-time financial market with behavioural criteria featured by S-shaped utility function and probability distortions. Different formulations of the problem are studied. When optimal solutions exist, we get explicit forms based on some algebraic equations.

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MS22

Utility Maximization with Addictive Consumption Habit Formation in Incomplete Markets

We study the utility maximization problem of consumption with addictive habit formation in the general incomplete semimartingale market. By introducing the auxiliary state and dual processes and defining the value function both on initial wealth and initial habit, we embed our original path dependent problem into an abstract time separable optimization problem with the shadow random endowment. We establish existence and uniqueness of the optimal solution using convex duality approach on L^0_+ spaces.

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MS23

The Log Optimal Portfolio under Transaction Costs and the Shadow Price: The Geometric Ornstein-Uhlenbeck Process and a Counterexam-

ple

As in (Gerhold/Muhle-Karbe/Schachermayer 2011) we find the growth optimal portfolio for the geometric Ornstein-Uhlenbeck process under proportional transaction costs by constructing a shadow price. This is a price process, such that the optimization problem without frictions for that price has the same solution as the one under transaction costs. This technique allows us to explicitly compute fractional Taylor expansions of arbitrary order for all quantities of interest. Similar results have (to the best of our knowledge) so far only been obtained for the Black Scholes model. Moreover, we present a counterexample that shadow prices may not exist in general even in discrete time and for "well-behaved' markets.

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MS23
Market Depth and Trading Volume Dynamics

We derive the process followed by trading volume, in a market with finite depth and constant investment opportunities. A representative investor, with a long horizon and constant relative risk aversion, trades a safe and a risky asset with a liquidity cost proportional to trading speed. An ordinary differential equation identifies the trading policy and welfare. In the high-liquidity limit, trading volume follows approximately an Ornstein-Uhlenbeck process, and increases with liquidity, volatility, and risk aversion.

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MS23
Long-run Investment under Drawdown Constraints: optimal portfolios and numeraire property

We consider long-run investment problems under drawdown constraints: the current wealth can not fall below a given function of its past maximum. We work in a general semimartingale setting. First, we show that this problem is equivalent to an unconstrained problem but with a modified utility function: both the value and the optimal portfolio are given explicitly in terms of their unconstrained counterparts (joint work with Vladimir Cherny). Second, we analyse in more detail the growth optimal portoflio under linear drawdowns. We show it enjoys the numeraire property along specific sequences of stopping times and asymptotically but not for all times. A turnpike theorem shows it is a limit of numeraire strategies on finite horizons (joint work with Constantinos Kardaras and Eckhard Platen).

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MS23
Wealth vs Risk in a Continuous Time Model

We discuss a continuous time optimization problem which combines two conflicting objectives of maximizing the portfolio wealth up to a level and minimizing the conditional value-at-risk of the portfolio wealth loss. The associated utility function is not differentiable nor strictly concave and does not satisfy Inada's condition. We use the dual control method to show that there is a classical solution to the HJB equation and that the optimal value function is smooth if the optimal control satisfies an exponential moment condition. We find the closed-form optimal feedback control and optimal value function for a wealth maximization problem.

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MS24
Stress Tests: From Arts to Science (Overview)

Expectations on stress tests are high in the financial industry: they should measure the resilience of individual financial institutions and of the whole banking system as part of an economy. Additionally, they should act as a calmative for nervous markets. It is time to assess the expectations about what information can realistically be obtained from stress tests. How should we choose scenarios which are at the same time plausible and informative of potential weaknesses? How can we assess the validity of our models and the potential consequences where our models break down? How can we adequately discriminate adverse external shocks and dangerous endogenous effects?

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MS24
Finding Stress Scenarios That Get the Job Done, with Credit Risk Applications

We introduce new methods to generate finite representative collections of plausible yet severe scenarios. We apply these methods to generate credit risk scenarios and demonstrate, via numerical experiments, that with respect to certain performance measures, our method is better able to discover (ex ante) scenarios close to those that occurred (as determined ex post), than previously described methods. Moreover, our methods discover these scenarios at substantially lower computational cost.

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MS24
Stress Testing Model Risk

Abstract not available at time of publication.

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MS24
Must Stress Tests be Credible?

Abstract not available at time of publication.

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MS25
Utility Indifference Pricing in Energy Markets

Abstract not available at time of publication.

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MS25
Probabilistic Approach to Mean Field Games and the Control of McKean Vlasov Dynamics

Abstract not available at time of publication.

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MS25
Levy Semistationary Processes with Applications to Electricity Markets

So called Levy semistationary processes (LSS processes) constitute a rather general class of continuous time moving average processes. Our motivation is employing these processes to model electricity and commodity forwards and spots. We discuss and analyze numerical simulation procedures for LSS processes and energy forward random fields, by means of stochastic partial differential equations, Fourier methods and finite dimensional approximations.

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MS25
Forward-Backward SDE Games and Stochastic Control under Model with Uncertainty

Abstract not available at time of publication.

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MS26
Forward Equations and Mimicking Theorems for Discontinuous Semimartingales

We derive a forward partial integro-differential equation for prices of call options in a model where the dynamics of the underlying asset under the pricing measure is described by a -possibly discontinuous- semimartingale. A uniqueness theorem is given for the solutions of this equation. We relate this result to the construction of a Markovian projection - a Markov process which mimics the marginals distributions of the semimartingale. This result generalizes Dupire's forward equation to a large class of non-Markovian models with jumps.

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MS26
Functional Ito Calculus and the Pricing and Hedging of Path-dependent Derivatives

We provide a brief overview of the Functional Ito Calculus [Dupire 2009; Cont & Fournié 2010], which provides a convenient mathematical framework for analyzing path-dependent functionals of Ito processes, and show that it may be used to derive a 'universal' pricing equation which holds for a wide class of path-dependent options on an underlying asset whose price follows an Ito process. This universal pricing equation is a functional analog of the backward Kolmogorov equation: we present a uniqueness result for solutions of this equation and show that it verifies a comparison principle. Finally, we provide a unified approach to the computation of hedging strategies for path-dependent options.

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MS26
Local Vs Non-Local Forward Equations for Option Pricing

When the underlying asset is a continuous martingale, call option prices solve the Dupire equation, a forward parabolic PDE in the maturity and strike variables. By contrast, when the underlying asset is described by a discontinuous semimartingale, call price solve a partial integro-differential equation (PIDE), containing a non-local integral term. We show that the two classes of equations share no common solution: a given set of option prices is either generated from a continuous martingale ("diffusion") model or from a model with jumps, but not both. In particular, our result shows that Dupires inversion formula for reconstructing local volatility from option prices does not apply to option prices generated from models with jumps.

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MS26

Degenerate Parabolic PDEs, Martingale Problems and a Mimicking Theorem for Itô Processes

We prove existence, uniqueness and regularity of solutions in weighted Hölder spaces for a certain class of degenerate parabolic partial differential equations with unbounded coefficients on the half space. We show that the martingale problem associate with the differential operator is well-posed, which implies existence and uniqueness of weak solutions to the corresponding stochastic differential equations. The weak solutions match the one-dimensional probability distributions of a certain class of Itô processes.

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MS27

Credit Risk Concentration under Stress

We present a general approach to implementing stress scenarios in multi-factor credit portfolio models, which is based on the truncation of risk factors. We derive analytic formulae for credit correlations under stress and analyze their asymptotic behavior in normal variance mixture (NVM) models. It turns out that correlations in heavy-tailed NVM models are less sensitive to stress than in medium- or light-tailed models.

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MS27

Risk Assessment Modelling of Systemic Institutions

The Bank of England has developed a top-down stress testing and systemic risk model (RAMSI). The model contains a network of banks, with each bank modelled in considerable detail. RAMSI allows the banks to be shocked by (deterministic or stochastic) macroeconomic scenarios to determine the resilience of the system under stress. The banks can themselves propagate stress around the system through second round effects. We present the model and an illustration of its use.

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MS27

A Systematic Approach to Multi-period Stress Testing of Portfolio Credit Risk

We propose a new method for analysing multiperiod stress scenarios for portfolio credit risk more systematically than in current macro stress tests. The plausibility of a scenario is quantified by its distance from an average scenario. For a given level of plausibility, we search systematically for the most adverse scenario. We show how this method can be applied to some models already in use by practitioners.

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MS27

Lessons and Limits of Stress Tests as a Macroprudential Supervisory Tool

Abstract not available at time of publication.

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MS28

Derivatives on Non-Storable Renewable Resources: Fish Futures and Options, Not So Fishy after All.

We study forward prices and prices of European call options, which are written on a non-storable renewable resource. An example for such derivatives is provided by futures and options on fresh salmon traded in large volumes at Fish Pool (Norway) since 2008. The introduction of similar exchanges in the United States and other countries is currently discussed. The pricing formulas are derived from first principles, starting of by modeling the dynamics of the resource reserves, and assuming that resource extraction is managed as open access. We derive closed form solutions for the forward price of the renewable resource and study its dynamics. In contrast to Black (1976) we show that forward prices do not evolve according to a geometric Brownian motion, but follow a more complex process. For the case of an option we show that the Black (1976) formula needs to be adapted in such a way, that the normal distribution is replaced by a reciprocal Γ-distribution, to get at least a very good approximation of the true option price. We include numerical evidence to underline this statement. Finally, we derive pricing formulas for options written on forward contracts, and show how forward contracts can be hedged under the assumption that there is a spanning asset. The full paper is available at SSRN: http://ssrn.com/abstract=1469135 The presentation will also include material from a second working paper, which includes more empirical analysis.

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MS28

Adaptations of Least-squares Methods to Convex Control Problems

Abstract not available at time of publication.

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MS28
Dark Pools and Hidden Markets

Abstract not available at time of publication.

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MS28
A Feedback Model for the Financialization of Commodity Prices

Abstract not available at time of publication.

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MS29
A Flexible Matrix Libor Model with Smiles

We present a flexible approach for the valuation of interest rate derivatives based on Affine Processes. We extend the methodology proposed in Keller-Ressel et al. (2009) by changing the choice of the state space. We provide semi-closed-form solutions for the pricing of caps and floors. We then show that it is possible to price swaptions in a multi-factor setting with a good degree of analytical tractability. This is done via the Edgeworth expansion approach developed in Collin-Dufresne and Goldstein (2002). A numerical exercise illustrates the flexibility of the Wishart Libor model in describing the movements of the implied volatility surface.

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MS29
The Explicit Laplace Transform for the Wishart Process

We derive the explicit formula for the joint Laplace transform of the Wishart process and its time integral which extends the original approach of [Bru, M. F. (1991): Wishart processes. Journal of Theoretical Probability, 4:725751]. We compare our methodology with the alternative results given by the variation of constants method, the linearization of the Matrix Riccati ODEs and the Runge-Kutta algorithm. The new formula turns out to be fast, accurate and very useful for applications when dealing with stochastic volatility and stochastic correlation modelling.

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MS29
Generalized Affine Transform Formulae and Exact Simulation of the WMSV Model

The aim of this talk is to introduce transform formulae for linear functionals of affine processes and their bridges whose state space is a set of positive semidefinite matrices. Particularly, we investigate the relationship between such transforms and certain integral equations. We are, then, able to derive analytic expressions for Laplace transforms of some functionals of Wishart bridges. As an application, we suggest an exact simulation method of Wishart multi-dimensional stochastic volatility model.

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MS29
Calibration of Multivariate Affine Stochastic Volatility Models

We provide a new calibration algorithm for multivariate affine stochastic covariance models using both option and timeseries data. The option data is used to recover the parameters determining the drift of the covariance process, while the timeseries allows us to identify the volatility of the covariance process and its correlation to the price processes. The procedure relies only on the knowledge of the first moments of log-prices and an estimation of volatility using Fourier series.

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MS30
Calibrating Volatility Surfaces for Commodity Derivatives

Commodities and their derivatives have become key players in the portfolios of many corporations, especially for those working in the energy sector. In this talk we shall discuss the calibration of local volatility surfaces for commodity derivatives. In order to obtain stable and robust results we shall make use of regularization techniques to handle the inverse problem. In particular we shall present some results with Brent oil (WTI) and Natural Gas (HH) data.

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MS30

Volatility Surface Calibration and Relative-Entropy Minimization

In this talk we will survey the research developed jointly with a number of collaborators during the past few years in connection with the calibration of Black-Scholes models under stochastic volatility. We shall start with the relation between uncertain volatility models, Hamilton-Jacobi equations, and the Kullback-Leibler distance. Then, we shall discuss calibration and entropy. Finally we will discuss weighted Monte Carlo methods and applications.

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MS30

Calibrating Self-exciting Marked Point Processes for Algorithmic Trading

Recently, marked point processes have been used to model the dynamics of assets at ultra-high frequencies. Cartea, Jaimungal and Ricci (2011) develop a multi-factor self-exciting model accounting for the arrival of market orders that influence activity, trigger one- and two-sided clustering of trades, and induce temporary changes in the shape of the LOB. The classification of trades as influential versus non-influential induces hidden state variables and makes online calibration a necessity in high frequency trading a challenging endeavor. Here, we develop quasi-maximum-likelihood parameter estimators and a Sequential Monte Carlo estimator of the activity path for use in algorithmic trading strategies.

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MS30

An Overview of Calibration Methods of Local Volatility Surfaces

Local volatility models are extensively used and well recognized for hedging and pricing in financial markets. They are frequently used, for instance, in the evaluation of exotic options so as to avoid arbitrage opportunities with respect to other instruments. Yet, the ill-posed character of local volatility surface calibration from market prices requires the use of regularization techniques either implicitly or explicitly. Such regularization techniques have been widely studied for a while and are still a topic of intense research. In this talk we shall review different attempts that have been made in order to tackle the local volatility calibration problem. In particular, we shall discuss convex regularization tools and recent inverse problem advances to deal with the calibration problem.

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PP1

Adjoint Monte-Carlo Technique for Calibration of Financial Market Models

We present a Monte-Carlo based adjoint technique for solving calibration problems of financial market models like the Heston model with time-dependent parameters. Any efficient optimization method for calibration requires at least gradient information. The major advantage of the adjoint technique lies in the fact that the calculation time required for a gradient computation stays nearly constant, independent of the number of parameters. Our numerical results confirm this improved speed-up.

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PP1

On Efficient Option Pricing Under Jump Diffusion

Merton's jump-diffusion model leads to partial-integro differential equations (PIDE), which can be solved in order to price options. Discretization of the integral in the PIDE leads to non-local terms and dense matrices. The presentation will discuss ways to solve the PIDE, avoiding dense matrices. This is applied to European-style options.

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PP1

The Impact of Constraints on the Views of the Black-Litterman Model

The Black-Litterman model is a Bayesian portfolio optimization model that allows investors to impose prior views on the expected returns of assets in the portfolio. Constraints can be considered as prior views on the optimal portfolio weights. Constraints distort the views expressed by the investor, resulting in sub-optimal portfolio weights. Our research shows that a mild relaxation of the long-only constraint results in Black-Litterman views that are more efficiently represented in the portfolio weights.

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