HAUSDORFF
RESEARCH INSTITUTE
FOR MATHEMATICS

universitätbonn

Workshop

Finance, Stochastics and Insurance

25th - 29th February 2008, Bonn

Program

Hausdorff Research Institute for Mathematics (HIM)

Poppelsdorfer Allee 45, D-53115 Bonn

	Monday, 25.02.2008	Tuesday, 26.02.2008	Wednesday, 27.02.2008	Thursday, 28.02.2008	Friday, 29.02.2008
09:00 - 09:30		**Opening**	**Session C**		**Session G**
9:30 - 10:30		**Invited lecture 1** **R. Korn** Survey and New Results on Worst-Case Portfolio Optimization	**A. Chen** Approximate Solutions for Indifference Pricing under General Utility Functions **N. Branger** Pricing Two Trees When Trees and Investors are Heterogeneous	**Invited lecture 5** **M. Steffensen** What Finance has done for Life Insurance - and vice versa	**M. Ludkovski** Relative Hedging of Systematic Mortality Risk **N. Branger** Using Hedging Errors to Identify Option Pricing Models
10:30 - 11:00		Coffee break	Coffee break	Coffee break	Coffee break
11:00 - 12:30		**Session A** **Y. Dolinsky** Binomial Approximations of Shortfall Risk for Game Options **R. Poulsen / J. Siven** Auto-Static for the People: Risk-Minimizing Hedges of Barrier Options	**Session D** **F. Riedel** Optimal Stopping under Ambiguity **A. Chen** How Ambiguity Affects Regulator's Decision	**Session E** **A. Chen / A. Mahayni** Endowment Assurance Products - Effectiveness of Risk - Minimizing Strategies under Model Risk **C. Bernard** Optimal Insurance Policies - When Insurers Implement Risk Management Metrics	**Session H** **D. De Giovanni** Lapse Rate Modelling: A Rational Expectation Approach 11:45 - 12:00: Final remarks
12:30 - 14:00		Lunch break	Lunch break	Lunch break	
14:00 - 15:00		**Invited lecture 2** **F. E. Benth** Pricing of Electricity Futures	**Invited lecture 3** **I. Evstigneev** Evolutionary Finance: Discrete-Time Models **K.-R. Schenk-Hoppé** Empirical and Simulation Studies on Discrete-Time Models	**Invited lecture 6** **R. Zagst** Pricing and Risk Management of Credit Derivatives	
15:00 - 15:30		Coffee break	Coffee break (15:30-16:00)	Coffee break	
15:30 - 17:00		**Session B** **J. H. Jho** Asymptotic Super(Sub)additivity of Value-at-risk of Regularly Varying Dependent Variables **W. Sun** Determining and Forecasting High-Frequency Value at Risk by Using Levy Processes	**Invited lecture 4** **K.-R. Schenk-Hoppé** Evolutionary Finance: Continuous-Time Models	**Session F** **A. Herbertsson** Default Contagion in Large Homogeneous Portfolios **S.-A. Persson** Callable Risky Perpetual Debt: Options, Pricing and Bankruptcy Implications	
	Welcome Reception and Registration (18:00-20:00)	**Jazz Meeting (18:00-20:00)**	**Excursion (18:00-19:30)**	**Dinner (19:00-22:00)**	

Places

Monday,	25th February 2008:	18:00-20:00	*Welcome Reception and Registration Poppelsdorfer Allee 45*
Tuesday,	26th February 2008:	18:00-20:00	*Jazz Meeting, Poppelsdorfer Allee 45*
Wednesday,	27th February 2008:	18:00-19:30	*Excursion, Arithmeum, Lennéstr. 2*
Thursday,	28th February 2008:	19:00-22:00	*Dinner, Restaurant Em Höttche, Markt 4*

Program Committee

Holger Kraft	*University of Kaiserslautern, Germany*
Kristian R. Miltersen	*NHH, Bergen, Norway*
J. Aase Nielsen	*University of Aarhus, Denmark*
Klaus Sandmann	*University of Bonn, Germany*

Tuesday, 26th February 2008

9.30-10.30
Invited Lecture 1

SURVEY AND NEW RESULTS ON WORST-CASE PORTFOLIO OPTIMIZATION

Ralf Korn

ABSTRACT: We will present a new approach to optimal portfolios under the threat of a crash. This is based on having only upper bounds for both crash height and crash time. The considerations lead to a stochastic control problem that looks similar to problems of stochastic differential games. Applications in finance and insurance are given. We will propose two solution methods, one based on an indifference argument and another one based on an HJB-system of equations and inequalities. Both methods are illustrated by explicitly given optimal strategies.

11.00-12.30
Session A

BINOMIAL APPROXIMATIONS OF SHORTFALL RISK FOR GAME OPTIONS

Yan Dolinsky

ABSTRACT: We show that the shortfall risk of binomial approximations of game (Israeli) options converges to the shortfall risk in the corresponding Black–Scholes market considering Lipschitz continuous path dependent payoffs for both discrete and continuous time cases. These results are new also for usual American style options. The paper continues and extends the study of [8] where estimates for binomial approximations of prices of game options were obtained. Our arguments rely, in particular, on strong invariance principle type approximations via the Skorokhod embedding, estimates from [8] and the existence of optimal shortfall hedging in the discrete time established in [4].

[4] Yan Dolinsky and Yuri Kifer, Hedging with risk for game options in discrete time, Stochastics 79 (2007), 169-195.
[8] Yuri Kifer, Error estimates for binomial approximations of game options, Annals Applied Probability 16 (2006), 984-1033.

AUTO-STATIC FOR THE PEOPLE: RISK MINIMIZING HEDGES OF BARRIER OPTIONS

Johannes Sivén / Rolf Poulsen

ABSTRACT: We present a straightforward method for computing risk-minimizing static hedge strategies under general asset dynamics. Experimental investigations for barrier options show that in a stochastic volatility model with jumps the resulting hedges have superior performance to previous suggestions in the literature. We also illustrate that the risk-minimizing static hedges work in an infinite intensity. Levy-driven models and that the performance of the hedges are robust with respect to model risk.

14.00-15.00
Invited Lecture 2

PRICING OF ELECTRICITY FUTURES

Fred Espen Benth

ABSTRACT: We discuss different approaches to electricity futures pricing. A standard approach is to derive the futures price from the spot using the "market price of risk". As an alternative, we look at a certainty equivalence principle for deriving prices, which in simple models can explain the changing sign of the risk premium frequently observed in the electricity markets. Finally, we consider an approach which includes forward information in the derivation of futures prices. Here we encounter theory based on "enlargement of filtrations" in stochastic analysis. The talk is based on joint work with A. Cartea (Birkbeck), R. Kiesel (Ulm) and T. Meyer-Brandis (CMA).

15.30-17.00
Session B

ASYMPTOTIC SUPER-(SUB)ADDITIVITY OF VALUE-AT-RISK OF REGULARLY VARYING DEPENDENT VARIABLES

Jae Hoon Jho

ABSTRACT: Assuming the existence of diversification of risks in practice, we have taken it for granted that the subadditivity of value-at-risk holds. However, if risks are extremely heavy-tailed, it is essential to find the lower bound of risks for a given risk measure in order to determine the minimum capital charge required by regulators. Using value-at-risk as a risk measure in this paper, we examine the asymptotic super-/subadditivity of value-at-risk when the losses are regularly varying but not necessarily independent.

DETERMINING AND FORECASTING HIGH-FREQUENCY VALUE AT RISK BY USING LEVY PROCESSES

Wie Sun

ABSTRACT: A new approach for using Lévy processes to compute value at risk (VaR) using high-frequency data is presented in this paper. The approach is a parametric model using an ARMA(1,1)-GARCH(1,1) model where the tail events are modelled using fractional Lévy stable noise and Lévy stable distribution. Using high-frequency data for the German DAX Index, the VaR estimates from this approach are compared to those of a standard nonparametric estimation method that captures the empirical distribution function, and with models where tail events are modelled using Gaussian distribution and fractional Gaussian noise. The results suggest that the proposed parametric approach yields superior predictive performance.

Wednesday, 27th February 2008

9.00-10.30
Session C

APPROXIMATE SOLUTIONS FOR INDIFFERENCE PRICING UNDER GENERAL UTILITY FUNCTIONS

An Chen

ABSTRACT: With the aid of Taylor-based approximations, this paper presents results for pricing insurance contracts by using indifference pricing under general utility functions. We discuss the connection between the resulting "theoretical" indifference prices and the pricing rule-of-thumb that practitioners use: Best Estimate plus a "Market Value Margin". Furthermore, we compare our approximations with known analytical results for exponential and power utility.

PRICING TWO TREES WHEN TREES AND INVESTORS ARE HETEROGENEOUS

Nicole Branger

ABSTRACT: We consider an exchange economy with two heterogeneous stocks and two groups of investors. Dividends follow diffusion processes, with a constant expected growth rate for one stock and a stochastic drift for the other. 'Rational investors' can either observe this stochastic drift without error or are at least able to use a noisy signal about it, while 'irrational investors' base their inference only on dividend observations. In an economy with homogeneous investors, uncertainty about the drift increases the volatilities of both stocks and the expected return of the smaller stock. Differences between the two types of stocks are mainly caused by learning, which increases both the volatility and the expected return of the stock with the stochastic drift. When both groups of investor are present, differences in portfolio holdings and thus trading mainly depend on differences in beliefs. In the long run, the irrational investors will be driven out of the market, and for realistic parameter scenarios, they can loose on average half of their wealth within twenty years.

11.00-12.30
Session D

OPTIMAL STOPPING UNDER AMBIGUITY

Frank Riedel

ABSTRACT: We consider optimal stopping problems for ambiguity averse decision makers with multiple priors. In general, backward induction fails. If, however, the class of priors is time–consistent, we establish a generalization of the classical theory of optimal stopping. To this end, we develop first steps of a martingale theory for multiple priors. We define minimax (super)martingales, provide a Doob–Meyer decomposition, and characterize minimax martingales. This allows us to extend the standard backward induction procedure to ambiguous, time–consistent preferences. The value function is the smallest process that is a minimax supermartingale and dominates the payoff process. It is optimal to stop when the current payoff is equal to the value function. Moving on, we study the infinite horizon case. We show that the value process satisfies the same backward recursion (Bellman equation) as in the finite horizon case. The finite horizon solutions converge to the infinite horizon solution. Finally, we characterize completely the set of time–consistent multiple priors in the binomial tree. We solve two classes of examples: the so–called independent and indistinguishable case (the parking problem) and the case of American Options (Cox–Ross–Rubinstein model).

HOW AMBIGUITY AFFECTS REGULATOR'S DECISION

An Chen

ABSTRACT: In contrast to insurance companies, regulatory authorities or regulators hold limited information about the companies' future value. The present paper characterizes this imperfect information as Knightian (1921) uncertainty or ambiguity. Firstly, in order to stress the analytical effects of ambiguity on the regulation decisions, we carry out our analysis deliberately in an over-simplified default and liquidation model setup, i.e. an immediate bankruptcy regulation. By releasing unrealistic assumptions of the first part of analysis and adding some new perspectives, the ambition of the second part is to design a more realistic default and liquidation model setup under ambiguity. Moreover, based on this new model setup, we examine several risk measures which play a relevant role in the insurance regulation.

14.00-15.30
Invited Lecture 3

EVOLUTIONARY FINANCE: DISCRETE-TIME MODELS

Igor Evstigneev

EVOLUTIONARY FINANCE: EMPIRICAL AND SIMULATION STUDIES ON DISCRETE-TIME MODELS

Klaus Reiner Schenk-Hoppé

ABSTRACT: The idea of this direction of research is to apply evolutionary dynamics (mutation and selection) to the analysis of the long-run performance of financial trading strategies. A stock market is understood as a heterogeneous population of frequently interacting investment strategies (portfolio rules) in competition for market capital. The general objective of the work is to build a "Darwinian theory" of portfolio selection. The framework for this study is a new stochastic dynamic model of market equilibrium, departing in a number of respects from the classical Arrow-Debreu paradigm. The model revives in a new, financial, context Marshallian ideas of temporary economic equilibrium. The main results aim at the identification of evolutionary stable (surviving) portfolio rules. Mathematically, the model is based on the theory of random dynamical systems, a key role being played by issues of stochastic stability. The talk will give an introduction into the theme and review central results in the field, focusing on the discrete-time case.

16.00-17.00
Invited Lecture 4

EVOLUTIONARY FINANCE: CONTINUOUS-TIME MODELS

Klaus Reiner Schenk-Hoppé

ABSTRACT: This paper studies the wealth dynamics of investors holding self-financing portfolios in a continuous-time model of a financial market. Asset prices are determined through the market interaction of heterogeneous investors. Individual trades have a price impact through their effect on the short-term market-clearing price. We derive results on the asymptotic dynamics of the wealth distribution and asset prices for time-invariant investment strategies. This study is the first step towards a theory of continuous-time asset pricing that combines concepts from mathematical finance and economics by drawing on dynamic and evolutionary principles.

Thursday, 28th February 2008

9.00-10.30
Invited Lecture 5

WHAT FINANCE HAS DONE FOR LIFE INSURANCE - AND VICE VERSA!

Mogens Steffensen

ABSTRACT: We present standardized methods for modelling and valuation of life insurance payment streams. These are based on assumptions about simple dependence structures and simple modelling of capital gains. We discuss how the mathematics of finance has influenced the view on these assumptions and how this influence has moved the industry concerning design and management. But the enlightenment is not one-way: We also provide an example of what life insurance can offer finance. The talk is based on the article 'life insurance' to appear in Encyclopedia of Quantitative Finance.

11.00-12.30
Session E

ENDOWMENT ASSURANCE PRODUCTS - EFFECTIVENESS OF RISK - MINIMIZING STRATEGIES UNDER MODEL RISK

Antje Mahayni

ABSTRACT: This paper analyzes and discusses the effects of model misspecification associated with both interest rate and mortality risk on the hedging decisions of insurance companies. We consider hedging strategies in different instruments (zero bonds) which are risk{(variance{)minimizing with respect to an assumed model. In this case, the associated expected costs and the variance of the costs are the same for all strategies. While the introduction of model risk, i.e. a deviation of assumed and true models, has the same effect on the expected costs, this is not true with respect to the variance. It turns out that the choice of hedging instruments has a crucial impact on the robustness of the strategies. In addition, the results of the paper can be used to emphasize the necessity to use a combined hedging model. In terms of robust hedging, a separate specification of interest rate model and mortality model is not convenient, even in the case that interest rate and mortality are assumed to be independent.

OPTIMAL INSURANCE POLICIES - WHEN INSURERS IMPLEMENT RISK MANAGEMENT METRICS

Carole Bernard

ABSTRACT: In recent years, the insurance market has been subject to significant changes. In Europe, the regulation system (with the project Solvency II) is about to change. The project Solvency II is likely to involve the Value-at-Risk and extends the ideas of Basel II to the insurance market. Changing regulations can have a significant impact on the decisions and the risk management of insurance companies. Our aim is to develop a theoretical model to understand the possible implications of implementing Value-at-Risk requirements on the insurance and reinsurance markets. To achieve this goal, we study the optimal risk sharing and explain how it is modified in the presence of regulators. We show that economic efficiency is improved in the presence of an implemented risk management program of the insurer. Risk management requirements are imposed by regulators to reduce the insurers' insolvency risk, as well as to improve the insurance market stability. We extend the classical analysis on optimal insurance design to the case when the insurer implements regulatory requirements (Value-at-Risk). Optimal designs for both the insurer and the insured are derived explicitly. Our analysis reveals that insured are better protected in the event of greater loss irrespective of the optimal design from either the insured or the insurer perspective. Therefore the overall insurance market becomes more stable.

14.00-15.00
Invited Lecture 6

PRICING AND RISK MANAGEMENT FOR CREDIT DERIVATIVES

Rudi Zagst

Abstract: We show how to price credit derivatives based on the extended Schmid and Zagst defaultable term structure model which is an extension of the model of Schmid and Zagst (2000). The model is mainly driven by Treasury yields and credit spreads. It is assumed that the levels of interest rates and credit spreads jointly depend on a general market factor. By doing so we relate interest rates and credit spreads to the business cycle and allow for correlated defaults. We derive the pricing functions and present a consistent, scenario-based asset allocation framework for analyzing traditional financial instruments and credit instruments in a portfolio context. To determine optimal portfolios we use a mean-variance and a conditional value at risk optimization. Performing a case study for the US market, we find that the mean-variance optimization overestimates the benefits of low-rated credit instruments and that optimal portfolios always contain a considerable proportion of credit instruments.

15.30-17.00
Session F

DEFAULT CONTAGION IN LARGE HOMOGENEOUS PORTFOLIOS

Alexander Herbertsson

ABSTRACT: We study default contagion in large homogeneous credit portfolios. Using data from the iTraxx Europe series, two synthetic CDO portfolios are calibrated against their tranche spreads, index CDS spreads and average CDS spreads, all with five year maturity. After the calibrations, which render perfect fits, we investigate the implied expected ordered defaults times, implied default correlations, and implied multivariate default and survival distributions, both for ordered and unordered default times. Many of the numerical results differ substantially from the corresponding quantities in a smaller inhomogeneous CDS portfolio. Furthermore, the studies indicate that market CDO spreads imply extreme default clustering in upper tranches. The default contagion is introduced by letting individual intensities jump when other defaults occur, but be constant between defaults. The model is translated into a Markov jump process. Expressions for the investigated quantities are derived by using matrix-analytic methods.

CALLABLE RISKY PERPETUAL DEBT: OPTIONS, PRICING AND BANKRUPTCY IMPLICATIONS

Svein-Arne Persson

ABSTRACT: Issuances in the USD 260 Bn global market of perpetual risky debt are often motivated by capital requirements for financial institutions. However, observed market practices indicate that actual maturity equals first possible call date. We develop a valuation model for callable risky perpetual debt including an initial protection period before the debt may be called. The total market value of debt including the call option is expressed as a portfolio of perpetual debt and barrier options with a time dependent barrier. We analyze how an issuer's optimal bankruptcy decision is affected by the existence of the call option using closed-form approximations. In accordance with intuition, our model quantifies the increased coupon and the decreased initial bankruptcy level caused by the embedded option. Examples indicate that our closed form model produces reasonably precise coupon rates compared to more exact numerical solutions. The credit-spread produced by our model is in a realistic order of magnitude compared to market data.

Friday, 29th February 2008

9.00-10.30
Session G

RELATIVE HEDGING OF SYSTEMATIC MORTALITY RISK

Michael Ludkovski

ABSTRACT: We study indifference pricing mechanisms for mortality contingent claims under stochastic mortality age structures. Our focus is on capturing the internal cross-hedge between components of an insurer's portfolio, especially between life annuities and life insurance. We carry out an exhaustive analysis of the dynamic exponential premium principle which is the representative nonlinear pricing rule in our framework. Along the way we also derive and compare a variety of linear pricing rules which value claims under various martingale measures. We illustrate our examples with realistic numerical examples that show the relative importance of model parameters.

USING HEDGING ERRORS TO IDENTIFY OPTION PRICING MODELS

Nicole Branger

ABSTRACT: In this paper we investigate two main issues. First, when two competing option pricing models cannot be distinguished by their pricing performance, how large is the hedging error due to model misspecification? We find that model misspecification has a significant impact on hedging errors. The impact of model risk is largest for delta-vega and smallest for minimum variance hedges. Second, can hedging errors for plain vanilla options help in distinguishing between models? Due to the fact that the differences between realized and expected hedging performance under the null of correct model specification are substantial, hedging errors can provide useful support in model identification.

11.00-12.30
Session H

LAPSE RATE MODELLING: A RATIONAL EXPECTATION APPROACH

Domenico De Giovanni

ABSTRACT: The surrender option embedded in many life insurance products is a clause that allows policyholders to terminate the contract early. Pricing techniques based on the American Contingent Claim (ACC) theory are often used, though the actual policyholders' behaviour is far from optimal. Inspired by many prepayment models for mortgage backed securities, this paper builds a Rational Expectation (RE) model describing the policyholders' behaviour in lapsing the contract. A market model with stochastic interest rates is considered, and the pricing is carried out through numerical approximation of the corresponding two-dimensional parabolic partial differential equation. Extensive numerical experiments show the differences in terms of pricing and interest rate elasticity between the ACC and RE approaches as well as the sensitivity of the contract price with respect to changes in the policyholders' behaviour.

List of Participants

Sven Balder	*University of Bonn, Germany*
Fred Espen Benth	*University of Oslo, Norway*
Carole Bernard	*University of Waterloo, Canada*
Monika Bier	*University of Bielefeld , Germany*
Nicole Branger	*University of Münster, Germany*
Marcello Cadena	*University of Bonn, Germany*
An Chen	*University of Amsterdam, Netherlands*
Götz Cypra	*ERGO Versicherungsgruppe AG, Düsseldorf, Germany*
Domenico De Giovanni	*University of Aarhus, Denmark*
Inga Deimen	*University of Bonn, Germany*
Yan Dolinsky	*Hebrew University, Israel*
Sebastian Ebert	*University of Bonn, Germany*
Igor Evstigneev	*University of Manchester, United Kingdom*
Delphine Feral	*Visitor, Hausdorff Center for Mathematics*
Flavius Guias	*Visitor, Hausdorff Center for Mathematics*
Alexander Herbertsson	*Göteborg University. Sweden*
Anja Hesse	*University of Bonn, Germany*
Werner Hildenbrand	*University of Bonn, Germany*
Markus Holtz	*University of Bonn, Germany*
Haishi Huang	*University of Bonn, Germany*
Orest Iftime	*Visitor, Hausdorff Center for Mathematics*
Jan Indorf	*Visitor, Hausdorff Center for Mathematics*
Piotr Jaworski	*Visitor, Hausdorff Center for Mathematics*
Jae Hoon Jho	*Sir John Cass Business School, City University, United Kingdom*
Liza Jones	*Visitor, Hausdorff Center for Mathematics*
Oleksandr Khomenko	*ERGO Versicherungsgruppe AG, Düsseldorf, Germany*
Birgit Koos	*University of Bonn, Germany*
Ralf Korn	*University of Kaiserslautern, Germany*
Holger Kraft	*University of Kaiserslautern, Germany*
Ilka Krüger	*ERGO Versicherungsgruppe AG, Düsseldorf, Germany*
Susanne Kruse	*Hochschule der Sparkassen-Finanzgruppe - University of Applied Sciences - Bonn GmbH, Germany*
Mikhail Langovoy	*Visitor, Hausdorff Center for Mathematics*
Jing Li	*University of Bonn, Germany*
Michael Ludkovski	*University of Michigan, USA*
Eva Lütkebohmert-Holz	*University of Bonn, Germany*
Antje Mahayni	*University of Duisburg-Essen, Germany*
Kristian Miltersen	*Norwegian School of Economics and Business Administration, Bergen, Norway*
Svein-Arne Persson	*Norwegian School of Economics and Business Administration, Bergen, Norway*

Jörg Philipps	*Visitor, Hausdorff Center for Mathematics*
Rolf Poulsen	*University of Copenhagen, Denmark*
Frank Riedel	*University of Bielefeld, Germany*
Barbara Rüdiger	*Visitor, Hausdorff Center for Mathematics*
Klaus Sandmann	*University of Bonn, Germany*
Jörn Sass	*Austrian Academy of Sciences, Austria*
Klaus-Reiner Schenk-Hoppé	*University of Leeds, United Kingdom*
Klaas Schulz	*University of Bonn, Germany*
Klaus Schürger	*University of Bonn, Germany*
Jinghai Shao	*Visitor, Hausdorff Center for Mathematics*
Johannes Siven	*Lund University, Sweden*
Max Skipper	*Visitor, Hausdorff Center for Mathematics*
Dieter Sondermann	*University of Bonn, Germany*
Mogens Steffensen	*University of Copenhagen, Denmark*
Wolfgang Stummer	*University of Erlangen-Nuernberg, Germany*
Wie Sun	*University of Kaiserslautern, Germany*
Anja Voß-Böhme	*Visitor, Hausdorff Center for Mathematics*
Ying Wang	*Visitor, Hausdorff Center for Mathematics*
Manuel Wittke	*University of Bonn, Germany*
Lihu Xu	*Visitor, Hausdorff Center for Mathematics*
Rudi Zagst	*University of Münich, Germany*

Orientation

Adresse: **Poppelsdorfer Allee 45, D-53113 Bonn,**
Visitor's Secretary: **Dagmar Heine-Beyer**
visitors-secretary@him.uni-bonn.de
Tel.: +49 (0)228 73-4830