Risk Day 2003

Mini-Conference on
Risk Management in Finance and Insurance

Friday, October 17, 2003
ETH Zürich, Main Building, Lecture Theatre HG F5

Program

9.00 – 9.10	Prof. Dr. Paul Embrechts (Department of Mathematics, ETH Zürich) *Welcome and Introduction*
9.10 – 9.20	Eckart Jäger (NCCR FINRISK, Swiss Banking Institute, Univ. of Zürich) *Presentation of the Doctoral Program in Finance at the Univ. of Zürich*
9.20 – 10.00	Prof. Dr. Martin Schweizer (Department of Mathematics, ETH Zürich) *Pricing and Hedging Recursive Payoff Structures*
10.00 – 10.30	Dr. Hansjörg Furrer (RiskLab, ETH Zürich) *Quantifying Regulatory Capital for Operational Risk*
10.30 – 11.00	Coffee Break (Main Hall, F-Floor, Uhrenhalle)
11.00 – 11.40	PD Dr. Wolfgang Breymann (RiskLab, ETH Zürich) *An Intraday Analysis of Diversified World Stock Indices*
11.40 – 12.10	Jonathan Wendin (Department of Mathematics, ETH Zürich) *Generalized Linear Mixed Models in Portfolio Credit Risk Modelling*
12.10 – 13.50	Lunch Break
13.50 – 14.30	Dr. Juri Hinz (University of Tübingen) *On Valuation of Electricity Contracts*
14.30 – 15.00	Michael Kupper (Department of Mathematics, ETH Zürich) *Coherent and Convex Risk Measure for càdlàg Processes*
15.00 – 15.30	Prof. Dr. Philipp Schönbucher (Department of Mathematics, ETH Zürich) *Frailty Models, Contagion and Information Effects*
15.30 – 16.00	Coffee Break (Main Hall, F-Floor, Uhrenhalle)
16.00 – 16.30	Dr. Daniel Straumann (RiskLab, ETH Zürich) *Maximum Likelihood and Quasi Maximum Likelihood Estimation in Conditionally Heteroscedastic Time Series Models*
16.30 – 17.00	Filip Lindskog (RiskLab, ETH Zürich) *On Regular Variation for Stochastic Processes*

General Information

Participation is free and there is no official registration. Everyone is welcome, practitioners are especially encouraged to attend. There are no special arrangements for lunch since there are sufficient possibilities nearby, in particular at ETH and the University.

Local Organisers:
Prof. Dr. Uwe Schmock (Financial and Actuarial Math., Vienna University of Technology)
Prof. Dr. Philipp Schönbucher (Department of Mathematics, ETH Zürich)
Conference Secretary: Mrs Irma Drack, CLP D4 (IFOR), Phone +41-1-632 40 16
E-mail: drack@ifor.math.ethz.ch
Risk Day 2003 Web Page: http://www.math.ethz.ch/finance/Risk-Day-2003.html

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Abstracts

Prof. Dr. Martin Schweizer, **Pricing and Hedging Recursive Payoff Structures**

Abstract: We discuss some ideas in the context of pricing and hedging financial structures whose payoffs are defined in terms of their valuation—for instance defaultable bonds or certain insurance products. This leads to a recursive definition of the value process associated to such a structure, and we present a class of stochastic models where such products can be handled by using PDE methods. This is joint work with Dirk Becherer. Discretizing these models also leads to interesting new convergence problems, and we touch upon this issue as well.

Home page: `http://www.math.ethz.ch/~mschweiz/`
Email: `mschweiz@math.ethz.ch`

Dr. Hansjörg Furrer, **Quantifying Regulatory Capital for Operational Risk**

Abstract: The proposed New Basel Capital Accord (Basel II) established by the Basel Committee on Banking Supervision calls for an explicit treatment of operational risk. Banks are required to demonstrate their ability to capture severe tail loss events. Value-at-risk is a risk measure that could be used to derive the necessary regulatory capital. Yet operational loss data typically exhibit irregularities which complicate the mathematical modeling. It is shown that traditional modeling approaches, including extreme value theory, reach their limits as the structure of operational loss data is barely in line with the modeling assumptions.

Home page: `http://www.math.ethz.ch/~hjfurrer/`
Email: `hjfurrer@math.ethz.ch`

PD Dr. Wolfgang Breymann, **An Intraday Analysis of Diversified World Stock Indices**

Abstract: This talk proposes an approach to the intraday analysis of diversified world accumulation indices. The growth optimal portfolio (GOP) is used as reference unit or benchmark in a continuous financial market model. Diversified global portfolios, covering the world financial market, are constructed and shown to approximate the GOP. The normalized GOP is modeled as a time transformed square root process of dimension four. Its dynamics is empirically verified in a robust manner for several world stock indices. Furthermore, the long-term evolution of the transformed time is modeled via a constant net growth rate of the drift of the discounted GOP and a quickly evolving market activity. The latter is decomposed into a mean reverting stochastic market activity process and a deterministic seasonal market activity component. The empirical findings identify a simple and realistic model for a world stock index that reflects its historical evolution reasonably well by using only a few constant parameters. (This is joint work with Leah Kelly and Eckhard Platen.)

Home page: `http://www.math.ethz.ch/~breymann/`
Email: `breymann@math.ethz.ch`

Jonathan Wendin, **Generalized Linear Mixed Models in Portfolio Credit Risk Modelling**

Abstract: A crucial point in portfolio credit risk modelling is that of dependence among default events. One way of handling this is given by Generalized Linear Mixed Models (GLMMs); a well-known concept in statistics for dealing with repeated measurements on different units. This talk gives a general introduction to GLMMs with problems relating to portfolio credit risk in mind. In this setting default probabilities or default intensities are viewed as a result of both fixed effects and random effects, where the latter are the key to dependence between counter-party defaults. By choosing the random effects suitably we

obtain dependence between defaults in a given year as well as dependence between defaults in consecutive years—two kinds of dependence that have been observed in empirical default data.

Home page: http://www.math.ethz.ch/~wendin/
Email: wendin@math.ethz.ch

Dr. Juri Hinz, **On Valuation of Electricity Contracts**

Abstract: Beginning in the nineties a number of electricity markets have been deregulated. The enforced competition in electricity production, retail, and trading raises various problems concerning optimal market design, price risk management, and strategy optimization. In this talk, we outline a special topic in this area elaborating on real assets. The idea here is that, since electricity is not storable, the true underlying will be the ability to produce power. Calculating equilibrium prices for production capacites, we obtain a valuation of contracts which is fair in the sense that arbitrage is excluded for capacity and claim trading.

Home page: http://zufall1.mathematik.uni-tuebingen.de/hinz.html
Email: juri.hinz@uni-tuebingen.de

Michael Kupper, **Coherent and Convex Risk Measure for càdlàg Processes**

Abstract: If the random future evolution of values (such as the market value of a firm's equity, the market value of a portfolio of financial securities or the surplus of an insurance company) is modelled in continuous time, then a risk measure can be seen as a functional on the space of stochastic processes. We extend the notions of coherent and convex risk measures to the space of bounded càdlàg adapted processes. We present representation results based on convex duality theory and show that under a weak continuity assumption (Fatou property) the representation holds in terms of σ-additive optional random measures. Furthermore, we discuss an extension to the space of unbounded processes. As an example, we calculate the risk of a classical Cramér–Lundberg process under a given coherent risk measure and compare it with classical results. (This is joint work with Patrick Cheridito and Freddy Delbaen.)

Home page: http://www.math.ethz.ch/~kupper/
Email: kupper@math.ethz.ch

Prof. Dr. Philipp Schönbucher **Frailty Models, Contagion and Information Effects**

Abstract: Most of the existing literature on default contagion assumes a direct causal relationships between two obligors' defaults. In contrast to this we show in this talk that default contagion can also arise from information effects if investors are imperfectly informed about some common factors affecting the true riskiness of the obligors. We model this effect in a simple extension of the intensity-based modelling framework using unobserved frailty variables. The default intensities in this model exhibit jumps at default events of other obligors. This entails much higher (and more realistic) levels of default dependence between the obligors than what purely diffusion-based intensity models were able to capture previously, without adding too much additional complexity. The parameters of the dependence can be implied directly from spread jumps observed in the market, thus enabling a full specification of the model under pricing probabilities without recourse to historical default correlations. We furthermore present two extensions of the model: The first extension shows that the size of the contagion effect can depend on the reason for the default and not just the identity of the defaulted obligor, the second extension exhibits stochastic default correlation.

Home page: http://www.math.ethz.ch/~schonbuc/
Email: p@schonbucher.de

Dr. Daniel Straumann, **Maximum Likelihood and Quasi Maximum Likelihood Estimation in Conditionally Heteroscedastic Time Series Models**

ABSTRACT: By exploiting the techniques of stochastic recurrence equations, we develop a general and unifying limit theory for the maximum likelihood estimator (MLE) and quasi maximum likelihood estimator (QMLE) in a certain parametric class of conditionally heteroscedastic processes, which contains widely used financial time series models: (asymmetric) GARCH(1,1) and EGARCH. Our approach generalizes and clarifies work of Lumsdaine (1996) and Berkes et al. (2003). We furthermore discuss the issue of misspecification in the MLE and the behavior of the QMLE in the presence of a heavy-tailed noise distribution. This complements work by Newey and Steigerwald (1997) and Hall and Yao (2003). (The talk is based on my Ph.D. thesis.)

Home page: `http://www.math.ethz.ch/~strauman/`
Email: `strauman@math.ethz.ch`

Filip Lindskog, **On Regular Variation for Stochastic Processes**

ABSTRACT: We study a formulation of regular variation on the space of $\mathbb{R}^d$-valued right-continuous functions on $[0,1]$ with left limits and provide necessary and sufficient conditions for a stochastic process with sample paths in this space to be regularly varying. A version of the Continuous Mapping Theorem is proved which enables the derivation of the tail behavior of rather general mappings of the regularly varying stochastic process. For a wide class of Markov processes with asymptotically independent increments we obtain simplified sufficient conditions for regular variation. For such processes we show that the possible regular variation limit measures concentrate on step functions with one step, from which we conclude that extremes for such processes are due to one big jump in $(0,1]$ or an extreme starting point. Finally, using the Continuous Mapping Theorem we derive the tail behavior of filtered regularly varying Markov processes with asymptotically independent increments. (This is joint work with Henrik Hult.)

Home page: `http://www.math.ethz.ch/~lindskog/`
Email: `lindskog@math.ethz.ch`