RiskLab® Switzerland

Center of Competence Finance in Zurich

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RISK DAY 2006

Mini-Conference on Risk Management in Finance and Insurance

organised by
RiskLab (www.risklab.ch) and Center of Competence Finance in Zurich (www.ccfz.ch)

Location
ETH Zürich, Main Building, Rämistrasse 101, 8092 Zürich
Lecture Theatre HG F3 (***new!***). Refreshments in the «Uhrenhalle» (main hall, F-floor)

Time
Friday, October 20, 2006, full day

Program

8.50–9.00 *Prof. Dr. Paul Embrechts* (Department of Mathematics, ETH Zürich)
Opening

9.00–9.45 *Prof. Dr. Dilip Madan* (Department of Finance,
Robert H. Smith School of Business, University of Maryland, USA)
Sato Processes and the Valuation of Structured Products

Abstract: We report on the adequacy of using Sato processes to value equity structured products. A pricing comparison of these processes with other standard models like Heston stochastic volatility, with and without jumps, VGSA, local volatility and local CGMY are also provided.

9.45–10.15 *Johannes Wissel* (Department of Mathematics, ETH Zürich)
Term structures of implied volatilities: Absence of arbitrage and existence results

Abstract: In this talk we study modelling and existence issues for market models of stochastic implied volatility in a continuous-time framework with one stock, one bank account and a family of European options for all maturities with a fixed payoff function h. We first characterize absence of arbitrage in terms of drift conditions for the forward implied volatilities corresponding to a general convex h. For the resulting infinite system of SDEs for the stock and all the forward implied volatilities, we then study the question of solvability and provide sufficient conditions for existence and uniqueness of a solution. We do this for two examples of h, namely calls with a fixed strike and a fixed power of the terminal stock price, and we give explicit examples of volatility coefficients satisfying the required assumptions.

10.15–10.45 **Coffee Break** (Main Hall, F-Floor, «Uhrenhalle»)

10.45–11.30 *Prof. Dr. Uwe Schmock* (Institute for Mathematical Methods in Economics,
Vienna University of Technology, Austria)
Modelling and Aggregation of Dependent Credit or Operational Risks

Abstract: The CreditRisk+ methodology allows for numerous useful extensions like dependent risk factors, stochastic losses given default, and risk groups with joint defaults and dependent losses, to name the most important ones. These extensions allow to capture correlations between defaults as well as between defaults and losses given default. Even with these extensions, the distribution of the portfolio loss can be calculated in an efficient and numerically stable way. In particular, Monte Carlo simulations and the corresponding stochastic errors are avoided. Using the credit portfolio loss distribution, value-at-risk, expected shortfall and other coherent risk measures can be calculated; a small variation allows to calculate risk contributions of individual obligors. The methodology has also been successfully applied to the aggregation of operational risks. (Joint work with Richard Warnung.)

11.30–12.00 *Andrea Macrina* (Department of Mathematics, King's College London, UK)
Infation-linked Securities in a Stochastic Monetary Economy

Abstract: We propose a class of continuous-time stochastic models for the pricing of infation-linked assets using a pricing kernel approach. The nominal and real pricing kernels, in terms of which the price index can be expressed, are modelled by introducing a bivariate utility function

depending on (a) the aggregate rate of consumption, and (b) the aggregate rate of real benefit conferred by the money supply. Consumption and money supply policies are chosen such that the expected joint utility obtained over a speci ed time horizon is maximised subject to a budget constraint that takes into account the "value" of the benefit of the money supply. For any choice of the bivariate utility function, the resulting model determines a relation between the rate of consumption, the price level, and the money supply. The model also produces explicit expressions for the real and nominal pricing kernels, and hence establishes a basis for the valuation of infation-linked securities. (Work carried out in collaboration with L. P. Hughston, King's College London.)

12.00-13.45 **Lunch Break**

13.45–14.30 *Prof. Dr. Christoph Schwab* (Seminar of Applied Mathematics, Department of Mathematics, ETH Zürich)
Computational Methods for Levy Models in Finance

Abstract: We report on our development of deterministic computational techniques for financial models with jumps. Such models emerged in the past decade as generalizations of the Black-Scholes models, starting with the work of Madan and Seneta in 1990. Our approach is based on Galerkin discretization of the process' infinitesimal generator resp. Dirichlet form in a multiscale basis. The methods allow to value single and multiperiod contracts, european, american or exotic, on single underlyings or baskets. Before illustrating the techniques by a number of case studies, among others for Levy copula dependence models, stochastic volatility models and continuous time GARCH models, we explain the computational techniques and hint at their mathematical background. Deterministic computation of certain optimal hedging strategies by these methods will also be addressed. Joint work of the CMQF group in the Seminar for Applied Mathematics, ETH.

14.30–15.00 *Prof. Dr. Alexander Shapiro* (School of Industrial and System Engineering, Georgia Tech, USA)
Risk Averse Approach to Multistage Stochastic Programming

Abstract: In this talk we discuss how coherent risk measures can be applied to risk averse formulations of stochastic programming problems in a dynamical setting. We derive the corresponding dynamic programming equations and study their basic properties. Finally, we discuss computational complexity of such models.

15.00–15.30 *Dr. Ulrich Müller* (Financial and Risk Modeling, Converium Ltd.)
Bootstrapping the Economy - Generating Consistent Scenarios for Risk Management

Abstract: The fortune and the risk of almost every business venture depends on the future course of the economy. There is a strong demand for economic forecasts and scenarios that can be applied to planning and risk modeling. A method to simulate the future of the world economy is given. The economy is represented by key variables such as interest rates (yield curves), inflation, GDP and equity indices, all of these for several currency zones, plus the foreign exchange rates between the currencies. The goal is to generate a set of consistent stochastic scenarios that represent the space of likely future developments. While there is an ongoing debate on modeling economic scenarios, the bootstrapping approach has several advantages. As a non-parametric method, it resamples past market behaviors rather than using debatable assumptions on models and parameters. Empirical distributions (with heavy tails) and dependencies between economic variables are automatically captured. Historical innovation vectors (= deviations of actual variable values from their prior market expectations) are sampled and used for simulated scenarios. Some variable transformations vouchsafe the arbitrage-free consistency of the generated scenarios, which is a demanding task for interest rates and their term structure. While usual yield curves are based on interest rates for different maturity periods, the bootstrapping method deals with forward interest rates for a series of regular time intervals in the future. Another transformation makes sure that simulated forward interest rates stay non-negative and accounts for the asymmetry of interest rate risks. Several straightforward extensions of the method help to overcome some limitations of the original bootstrapping method. The limited historical data used for resampling may not contain extreme innovations, but a well-defined modification makes sure that a small number of simulated scenarios will behave extremely, leading to a realistic modeling of risks due to shocks. While the original method disrupts serial dependencies, an additional GARCH filter re-establishes clusters of volatility. Long-term trends and long-term mean reversion effects such as purchasing power partity are introduced as small correction terms in the market expections. Thus the method is suitable for

long-term simulations over many years, as tests and applications have shown. In the main application, the economic scenario generator produces simulated values for asset classes such as equities, bonds, mortgage-backed securities, hedge funds and real estate, for six currency zones: US Dollar, Euro, Yen, Sterling, Swiss Franc and Australian Dollar. More economic variables and currency zones can be added due to the modularity and flexibility of the method.

15.30–16.00 **Coffee Break** (Main Hall, F-Floor, «Uhrenhalle»)

16.00–16.45 *Andrew Gallacher and Andrew Smith* (Deloitte Switzerland respectively Deloitte UK)
Risk Geographies

Abstract: Financial firms are exposed to many risks, including asset price movements, credit exposures, changing actuarial assumptions, policyholder behaviour and operational failures. Leading banks, insurers, universities and consulting firms have invested in tools for fast and accurate numerical computation of risk information, clear communication of threats and evaluation of mitigating strategies. Risk Geographies is a versatile graphical and analytical toolkit for highlighting the risks facing an organisation and exploring those combined risk events which are most likely and painful.

16.45–17.15 *Philippe Ehlers* (Department of Mathematics, ETH Zürich)
Dynamic Credit Portfolio Derivatives Pricing

Abstract: In this paper we present a modelling framework for portfolio credit risk which incorporates the dependence between risk-free interest-rates and the default loss process. The innovation in this approach is that -- besides the traditional diffusion-based covariation between loss intensities and interest-rates -- a direct dependence between interest-rates and the loss process is allowed, in particular default-free interest-rates can also depend on the loss history of the credit portfolio. Amongst other things this enables us to capture the effect that economy-wide default events are likely to have on government bond markets and/or central banks' interest-rate policies. Similar to Schönbucher (2005), the model is set up using a set of loss-contingent forward interest-rates $f_n(t,T)$ and loss-contingent forward credit protection rates $F_n(t,T)$ to parameterize the market prices of default-free bonds and credit-sensitive assets such as CDOs. We show that (up to weak regularity conditions), existence of such a parameterization is necessary and sufficient for the absence of static arbitrage opportunities in the underlying assets. We also give necessary and sufficient conditions on the dynamics of the parameterization which ensure absence of \emph{dynamic} arbitrage opportunities in the model. Similar to the HJM drift restrictions for default-free interest-rates, these conditions take the form of restrictions on the drifts of $f_n(t,T)$ and $F_n(t,T)$, together with a set of regularity conditions.

17.15–18.00 **Apero** (Main Hall, F-Floor, «Uhrenhalle»)

General Information

Participation is free, and there is no official registration. Everyone is welcome, practitioners are especially encouraged to attend. We have not made any special arrangements for lunch since there are sufficient possibilities nearby, in particular at ETH and the University. There is also the Dozentenfoyer.

For hotel accommodation, please check the Zürich Tourism home page (www.zuerich.com).

Organizers:

PD Dr. Walter Farkas (Managing Director CCFZ; ISB, Uni Zürich and ETHZ)
Prof. Dr. Philipp Schönbucher (Department of Mathematics, ETH Zürich)

Conference Secretary:

Ms. Galit Shoham, HG G21.3 (IFOR)
Phone 044 632 40 16
sekretariat@ifor.math.ethz.ch