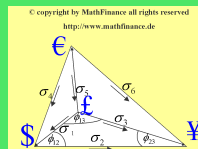


derivatives and risk
management in
theory and practice

Frankfurt MathFinance Workshop
14th - 15th April 2005
<http://workshop.mathfinance.de/>



1. Organising committee

- Uwe Wystup, HfB / MathFinance
- Tino Kluge, University of Oxford, OCIAM
- Susanne Griebisch, HfB - Business School of Finance and Management

The event takes place at HfB Audimax (Thursday) and in the conference room no 1, 7th floor, Commerzbank Tower (Friday). For further details refer to our web site or contact us at info@workshop.mathfinance.de.

2. Contents

The workshop is intended for practitioners of the areas of trading, quantitative or derivative research and risk management as well as for academics studying or researching in the field of financial mathematics or finance in general.

The talks during the two days of the workshop cover a broad range of current topics and are presented by internationally known academics and practitioners. This time we will focus on Portfolio Management, Calibration Techniques and Credit. There will be enough time for questions and discussions after each talk and additional breaks provide you the opportunity to build networks within the quantitative finance community.

The workshop will be held in English.

3. List of speakers

- Herman Brodie
- Dr Diana Diaz
- Dr Vitaly Dovgal
- Dr Hans-Peter Deutsch
- Dr Götz Giese
- Dr Werner Koch
- Prof Christoph Kühn
- Prof Ludger Overbeck
- Prof Eckhard Platen
- Dr Matthias Reimer
- Prof Wolfgang Schmidt
- Dr John Schoenmakers
- Milind Sharma
- Jurgen Tistaert
- Prof Robert G Tompkins
- Dr Thomas Weber

This event is supported by HfB and sponsored by

UnRisk2
When accurate derivatives
analytics counts

d-fine
we define consulting

:lpa
lucht · probst · associates

COMMERZBANK

Thursday, 14 April 2005: HfB Audimax

08:30 Registration

09:00 Prof Ludger Overbeck

Semi-analytics Techniques for CDO-modelling

Collateralized debt obligations (CDOs) constitute an important subclass of asset backed securities. The evaluation of CDOs relies on mathematical modeling and on simulation as well as analytic and semi-analytic approaches, depending on the underlying asset pool and the cash flow structure of the transaction. In this paper we will present a semi-analytic approach where the granularity of the underlying portfolio is maintained, but the time-dependency is modeled by the upper Fréchet-copula. In particular we investigate the accuracy of that approximation in concrete transactions.

09:50 Dr Diana Diaz

What drives Credit Risk in Emerging Markets? The Role of Country Fundamentals and Market Co-movements

This paper uses bond prices to investigate how the creditworthiness of Argentina, Brazil, Mexico and Venezuela is influenced by global, regional and country-specific factors. Each country's distance-to-default is estimated monthly for 1994 to 2001, by fitting the structural model of Cathcart and El Jahl (2003) with a Kalman filter to Brady bonds. A small set of variables is able to explain up to 80% of the variance of the estimated distance-to-default for each country. Surprisingly, country-specific variables account for only about 8% of the explained variance; the largest part of the variance (45%) is explained by regional factors, which relate to joint stock-market returns, volatility and market sentiment; global conditions, related mainly to US stock-market returns, explain another 25% of the variance. Of the 20% variance which remains unexplained, more than half is due to another common (but unidentified) factor. The conclusion is that the creditworthiness of these four emerging markets is driven mainly by a common set of factors, which are related closely to stock-markets in the region and the US. This is joint work with Gordon Gemmill (Warwick Business School).

10:40 tea break

11:00 Dr Götz Giese

Bridging the gap between CreditRisk+ and Merton-style credit portfolio models

We discuss similarities and differences between Merton-style credit portfolio models and default-rate based approaches such as CreditRisk+. In particular, we present a generalised CreditRisk+ model (the multivariate Vasicek model), which employs distribution assumptions similar to those of Merton-style models. Special

emphasis is put on the calculation of contributions to tail risk for individual obligors in this framework.

11:50 Prof Robert Tompkins

Volatile Days and Jumping Nights

Most empirical studies of financial market returns only consider prices when the markets are open. While considerable research has examined the return process when markets are closed, this has been restricted to comparisons of means and variances. Little research has considered the higher moments or the shape of the distributions of the returns.

In this research, we decompose returns estimated on the usual close-to-close basis into the returns from the close to the open and the open to the close. We consider a wide range of stock markets in this study and examine the distributional properties of the alternative returns periods.

We find that for all markets, overnight returns are higher, the variance is lower and display significant non-zero skewness and excess kurtosis. During the trading day, returns are consistent with stochastic volatility with Gaussian increments. Extensive statistical testing confirms that for most markets, the average return is statistically significantly higher overnight and that the variance is significantly lower. Hypothesis tests of higher moments confirm that these also are statistically significantly different between overnight and trading periods.

The implications of these results are considered with the most likely reason for this effect is that trading day returns are driven by stochastic volatility and overnight returns by jumps. Given that returns are higher overnight suggests that risk premia are more likely associated with jumps than stochastic volatility.

12:40 lunch

14:00 Prof Wolfgang Schmidt

Interest Rate Convexity and the Volatility Smile

Pricing the convexity effect in irregular interest rate derivatives such as e.g. Libor-in-arrears or CMS one often ignores the volatility smile which is quite pronounced in the interest rate options market. This note solves the problem of convexity by replicating the irregular interest flow or option with liquidly traded options with different strikes thereby taking into account the volatility smile. This idea is known among practitioners for pricing CMS caps. We approach the problem on a more general scale and apply the result to various examples.

14:50 Dr John Schoenmakers

Iterative construction of the optimal Bermudan stopping time

We present a new iterative procedure for solving the discrete optimal stopping problem. The method produces monotonically increasing approximations of the Snell envelope from below, which

coincide with the Snell envelope after finitely many steps. Then, by duality, the method induces a convergent sequence of upper bounds as well. Contrary to backward dynamic programming, the presented iterative procedure allows to calculate approximative solutions with only a few nestings of conditionals expectations and is, therefore, tailor-made for a plain Monte-Carlo implementation. The power of the procedure is demonstrated for high dimensional Bermudan products, in particular, for Bermudan swaptions in a full factor Libor market model.

15:40 tea break

16:00 Dr Hans-Peter Deutsch

Portfolio Theory with a Drift

In this talk we introduce the Deutsch Ratio which is the correct market price of risk when drift effects are taken into account. This ratio (not the Sharpe Ratio) emerges naturally when excess returns (instead of returns) are considered throughout. We show by explicit construction that the Market Portfolio defining this capital market line is the same as in traditional Markowitz theory. Therefore,

even when drift effects are taken into account there still exists the Market Portfolio everybody should invest (part of his/her money) in. Portfolio optimization is as stable and parameter-independent (w.r.t. holding period and confidence level) when maximizing the Deutsch Ratio as it is when maximizing the Sharpe Ratio, as long as holding period and confidence are chosen in a sensible way. Although the Market Portfolio is the same as the Markowitz Market Portfolio and therefore independent of holding period and confidence, any individual portfolio within the optimal strategy for a specific risk preference is different from the Markovitz portfolio.

16:50 Dr Matthias Reimer

What is the recipe for a successful derivative product?

We analyze a variety of financial instruments which we have observed in the markets during the past years, and draw the connection between derivative modelling and the management of derivative products. We then examine various business models to explain why some products succeed and others dont.

Friday, 15 April 2005: Commerzbank Tower, Kaiserplatz

08:30 Registration

09:00 Prof Eckhard Platen

On the Role of the Growth Optimal Portfolio in Finance

The paper discusses various roles that the growth optimal portfolio (GOP) plays in finance. For the case of a continuous market we show how the GOP can be interpreted as a fundamental building block in financial market modeling, portfolio optimization, contingent claim pricing and risk measurement. On the basis of a portfolio selection theorem, optimal portfolios are derived. These allocate funds into the GOP and the savings account. A risk aversion coefficient is introduced, controlling the amount invested in the savings account, which allows to characterize portfolio strategies that maximize expected utilities. Natural conditions are formulated under which the GOP appears as the market portfolio. A derivation of the intertemporal capital asset pricing model is given without relying on Markovianity, equilibrium arguments or utility functions. Fair contingent claim pricing, with the GOP as numeraire portfolio, is shown to generalize risk neutral and actuarial pricing. Finally, the GOP is described in various ways as the best performing portfolio.

09:50 Jurgen Tistaert

A Perfect Calibration! Now What?

We show that several advanced equity option models incorporating stochastic volatility can be calibrated very nicely to a realistic option surface. More specifically, we focus on the Heston stochastic volatility model (with and without jumps in the stock price process), the Barndorff-Nielsen-Shepard model and Levy models with stochastic time. All these models are capable of accurately describing the marginal distribution of stock prices and indices and hence lead to almost identical European vanilla option prices. As such, we can hardly discriminate between the different processes on the basis of their smile-conform pricing characteristics. We therefore are tempted applying them to a range of exotics. However, due to the different structure in path-behavior between these models, the resulting exotics prices can vary significantly. It motivates a further study on how to model the fine stochastic behavior of assets over time. This is joint work with Wim Schoutens (K.U. Leuven, Belgium), Erwin Simons (ING SWE Brussels).

10:40 tea break

11:00 Dr Thomas Weber

Efficient Calibration for Libor Market Models - Alternative strategies and implementation issues

During the talk we compare and test alternative methods for calibrating LIBOR Market Models and give arguments for choices we made while developing a calibration applications.

11:50 Prof Christoph Kühn

Convertible bonds in jump-diffusion models

A convertible (callable) bond is a security that the holder can convert into a specified number of underlying shares. In addition, the issuer can recall the bond, paying some compensation, or force the holder to convert it immediately. We give explicit solutions to the corresponding stopping game in the context of a perpetual reduced form model with a Brownian motion part and exponentially distributed jumps. It turns out that the occurrence of jumps leads to quite interesting optimal stopping strategies whose structure differs from the results for continuous models. Finally, we discuss a semiexplicit approximation of nonperpetual optimal stopping problems which is based on the randomization of the maturity date.

12:40 lunch

14:00 Dr Vitaly Dvagal

Efficient computations for the local volatility model and consistent pricing of multiunderlying derivatives

After years of intensive development of derivative markets around the world, the local volatility approach turned out to be one of the most widely used pricing models despite of some serious arguments against it. In this talk the author would like to dispute again theoretical and practical issues around the local volatility approach and propose some original computational solutions providing efficient calibrating of the model for particular derivative markets. Within these solutions he will consider a new approach for pricing of such widespread multiunderlying derivatives as basket options or options on min/max of N assets, where N is not necessarily small. This approach allows to keep prices and risks of these options consistent with the individual assets volatility structures. As well it improves the speed and precision of calculations as a result of reducing the Monte-Carlo part significantly if not sometimes completely.

14:50 Dr Werner Koch

Consistent Return Estimates in the Asset Allocation Process - The Black-Litterman Approach

In asset management, the forecast of asset returns is essential within the investment process. In this context, the Black-Litterman approach (1992) yields consistent asset return forecasts as a weighted combination of (strategic) market equilibrium returns and (tactical) subjective forecasts ("views"). The Black-Litterman formalism allows to implement both absolute views (return levels) and relative views (outperforming vs. underperforming assets) for selected assets investigated under "core competence". For any particular view, individual confidence levels for the return estimates have to be specified. The formalism spreads this information consistently across all assets in the portfolio. The BL-revised returns then serve as a consistent input for mean-variance portfolio opti-

mization procedures, thus allowing for the implementation of additional constraints. It turns out that the BL-optimized portfolios overcome some well-known Markowitz insufficiencies as unrealistic sensitivity to input factors or extreme portfolio weights. The BL process will be introduced both from its theoretical background and its implementation in practice.

15:40 tea break

16:00 Milind Sharma

Alternative Risk-Adjusted Performance Measures for Alternative Investments

We highlight the inadequacies of traditional RAPMs (Risk-Adjusted Performance Measures) when applied to hedge funds. It surveys risk and risk-adjusted measures currently in use and discusses their pros and cons. Their inability to deal with higher moment risks and asymmetric distributions is noted along with evidence of non-normality in individual as well hedge fund index data. This issue is particularly germane because attractive mean-variance profiles are often coupled with undesirable exposure to skewness and kurtosis. Hence the necessity for a measure which incorporates investor preferences qua risk aversion and adjusts for iceberg risks lurking in the higher moments.

The Expected Utility framework of Von NeumannMorgenstern is introduced as the foundation for the proposed RAPM. AIRAP (Alternative Investments Risk Adjusted Performance) is the implied equivalent return that the risk-averse investor desires with certainty in exchange for the uncertain return from holding risky assets. Key benefits to the hedge fund community of using AIRAP is that it captures the full distribution, penalizes appropriately for volatility and leverage, is customizable by risk aversion, works with negative mean returns and eschews convergence requirements of series expansions. The general solution is based on non-parametric fits in addition to a closed form special case. A modified Sharpe Ratio formulation is also provided. AIRAP is contrasted with Sharpe, Treynor and Jensen rankings of the HFR universe of hedge funds to show significant divergence. A framework for generating peer percentile rankings by incorporating stressed scenarios or regime-

switching models is proposed.

The results have implications for manager selection to the extent that better RAPMs facilitate better discernment. In terms of the portfolio construction of fund of hedge funds, transcending the mean-variance framework should help mitigate the bias in optimal style weights towards illiquidity and short volatility. Finally, AIRAP can also shed light on the degree of leverage optimal for a given track record and level of risk-aversion.

A.I.R.A.P. - Alternative Views on Alternative Investments We investigate issues of risk-adjusted performance, value added and leverage for hedge funds. It applies AIRAP (Alternative Investments Risk Adjusted Performance), which is the power utility implied certain return that a risk-averse investor would trade off for holding risky assets, to hedge fund indices and individual hedge fund data. Inferences are made about the value added by hedge funds and the difference between directional and non-directional strategies. Evidence of non-normality, higher moment risks and the trade-off between mean-variance profile vis--vis skewness and kurtosis is noted across style categories. Further, survivorship bias is estimated across style categories in the first four moments.

16:50 Herman Brodie

Behavioral Finance: How to Model Investor Adaptation to Changing Levels of Wealth/Performance

Happiness researchers know that despite improving conditions (lottery winners) or worsening conditions (accident victims) people tend to revert to baseline happiness levels after a certain time; they get used to it. Could adaptation explain why investors are able to hold onto stocks as they lose 95

17:30 End of Conference

5. Personal descriptions

Herman Brodie, Cognitrend

Herman Brodie is the founder and managing partner of Cognitrend, a consultancy that specialises in Behavioural Finance.

Dr Diana Diaz, Dresdner Bank

Diana Diaz currently works for the Risk Methodology Trading team at Dresdner Bank. She has worked previously for Barclays Capital, Nacional Financiera (one of the largest development banks in Latino America) and the Central Bank of Mexico. She holds a doctorate on Credit Risk Modelling and has presented her research at several international finance conferences. Her academic career includes teaching and lecturing Finance, Statistics and Mathematics at Cass Business School of City University, the London Business School and at the National Autonomous University of Mexico.

Dr Vitaly Dovgal,

Capital Markets Trading GmbH, Frankfurt

Few years ago Dr. Dovgal came to the financial industry from the Associate Professor position at the Department of Statistical Modelling, St.Petersburg State University, Russia, where he received his Ph.D degree in Applied Mathematics in 1990. He worked at BNP/Paribas - Deutschland and Capital Markets Trading GmbH in Frankfurt, Germany, as a front office financial engineer, having been involved in intensive development and implementation of mathematical models for market making and proprietary trading on the major derivative markets. Deep practical experience which he received for these years and sufficient theoretical knowledge resulted in his own engineering developments, which have been substantially tested in real market environment. The main guideline in his work he sees in investigation of practical efficiency and usability of various proposed theoretical models.

Dr Hans-Peter Deutsch, d-fine

Dr Hans-Peter Deutsch is Managing Director of d-fine GmbH, a leading financial services consulting firm in Germany. Before founding this firm he was Partner at Arthur Andersen and head of Andersen's Financial and Commodity Risk Consulting (FCRC) in Germany, which he founded in 1997 and developed from scratch to the over hundred people strong consulting practice which is the d-fine GmbH today. He has worked with clients in several IT-based and quantitative trading and risk management projects, including software selection and development, pricing and risk management for derivatives. Dr Deutsch is a regular speaker at major conferences and author of many publications in this area including the book "Derivatives and Internal Models", now in its 3rd Edition. He is also Guest Lecturer and Member of the Advisory Board of the Mathematical Finance Programme at the University of Oxford, UK, and Director of the German Chapter of GARP, the Global Association of Risk Professionals. In addition, he is Chairman of the Advisory Board of the Frankfurt MathFinance Institute at

Johann-Wolfgang-Goethe Universität in Frankfurt, Germany. Before joining Andersen, he headed trading system development at a major German Bank and served as a consultant with Andersen Consulting (now Accenture). He holds a "summa cum laude"-PhD in theoretical physics and is also author of about 20 international scientific publications in this field, mainly on Monte Carlo simulations of stochastic processes.

Dr Götz Giese, Commerzbank

Götz Giese is Head of Quantitative Credit Risk at Commerzbank, Frankfurt. He holds a PhD in theoretical physics and has worked over the last seven years in Commerzbank in different areas such as derivative pricing, market and credit risk methodology. In his current role he is responsible for credit portfolio modelling and statistical parameter estimation.

Dr Werner Koch, ComInvest

Dr Werner Koch is a senior quantitative analyst at Cominvest, the asset management division of Commerzbank, Frankfurt. Within the investment process, his main responsibilities include asset allocation, portfolio construction (model-portfolios), strategies and special client-related projects in these fields as well as asset-liability modeling and in general new approaches of quant modeling in finance. For a couple of years, he worked on the bond trading floor on relative value models and the analysis of spread products. Furthermore, he holds seminars and presentations (national and international). Werner holds a PhD in theoretical physics.

Prof Christoph Kühn,

Frankfurt MathFinance Institute (Goethe University)

Christoph Kühn is Juniorprofessor at the Frankfurt MathFinance Institute. He holds a diploma in mathematical economics from the University of Marburg and a PhD in mathematics from Munich University of Technology. His main research interests are pricing and hedging of derivatives in incomplete markets and the microstructure of financial markets.

Prof Ludger Overbeck,

Giessen University / Hypovereinsbank

Ludger Overbeck is professor of mathematics at the University of Giessen. Previously he headed the Research and Development team in the Risk Analytics and Instrument department of Deutsche Bank's credit risk management function. His main responsibilities were the credit portfolio model for the group-wide RAROC process, the risk assessment of credit derivatives, ABS, and other securitization products, and operational risk modeling. Before joining Deutsche Bank in 1997, he worked with the Deutsche Bundesbank in the supervision department, examining internal market risk models. He earned a Ph.D. in Probability Theory from the University of Bonn. After two post-doctoral years in Paris and

Berkeley, from 1995 to 1996, he finished his Habilitation in Applied Mathematics during his affiliation with the Bundesbank. In Frankfurt he received a Habilitation in Business and Economics in 2001. He has published papers in several forums, from mathematical and statistical journals, journals in finance and economics, including RISK magazine and practitioners handbooks. In 2003, the book *An Introduction to Credit Risk Modeling* appeared, jointly authored by Christian Bluhm, Ludger Overbeck and Christoph Wagner.

Prof Eckhard Platen,

Sydney University of Technology

Eckhard Platen is a Professor of Quantitative Finance at the University of Technology, Sydney. Prior to this appointment he was Head of the Centre of Financial Mathematics in the Institute of Advanced Studies at the Australian National University. He has a PhD in Mathematics from the Technical University in Dresden and obtained his Dr.sc. from the Academy of Sciences in Berlin. He is co-author of two books on numerical methods for stochastic differential equations and has authored more than hundred papers in applied mathematics and finance. He serves on the editorial boards of four international journals in finance and mathematics, including *Mathematical Finance*. For over twenty five years he has worked on stochastic numerical methods and has applied these methods successfully to many problems in mathematical finance. His current research interests cover areas ranging from financial market modeling, quantitative methods in derivative pricing and risk analysis to the statistics of stochastic processes in finance.

Dr Matthias Reimer, Postbank

Matthias Reimer is currently a Senior Specialist for Asset-Liability-Management at Deutsche Postbank Treasury (since 01/2004). He develops quantitative analyses for ALM. From 1999 to 2003 he was with WestLB Equity Derivatives Trading as a Senior Financial Engineer, developing structured products for retail and institutional clients (i.e. multi-asset derivative products), derivative solutions for major German corporates and trading applications. Before this, from 1997 to 1999, he was Senior Risk Controller at Dresdner Bank, validating derivative models and auditing derivative trading books. Matthias holds a PhD in Economics from University of Bonn (Prof. Sondermann). His research focused on numerical option pricing models, exotic options, and volatility smile models. He co-authored the renowned LEISEN-REIMER binomial tree approach.

Prof Wolfgang Schmidt,

HfB - Business School of Finance and Management

Wolfgang M. Schmidt is currently Professor for Quantitative Methods at HfB - Business School of Finance and Management in Frankfurt. From 1992 to 2002 he was Director and Head of Research and Analytics at Deutsche Bank AG in Frankfurt. Prior to joining Deutsche Bank he held teaching and research positions at the University of Jena, Berlin, Moscow and Tbilisi. He graduated in Mathematics from Dresden University of Technology and holds

a PhD and Habilitation in the field of probability theory from the University of Jena. Prof. Schmidt is the author of research papers in the fields of probability theory, stochastic processes and mathematical finance as well as co-author (with S. Assing) of the book "Continuous Strong Markov Processes in Dimension One - A Stochastic Calculus Approach", Springer Verlag. His current research interests include mathematical finance, risk management, credit default modelling, term structure modelling.

Dr John Schoenmakers,

Weierstrass Institute, Berlin

Dr. John Schoenmakers is deputy head of the research group Stochastic Algorithms and Nonparametric Statistics, and director of the financial mathematics research at the Weierstrass Institute Berlin. One of his main topics is (LIBOR) interest rate modeling and pricing of derivative products, in particular, Bermudan callable structures.

Milind Sharma, Deutsche Bank, New York

Milind Sharma is Director and Senior Proprietary Trader at Deutsche Bank. He was Vice President and co-founder of Risk & Performance at Merrill Lynch Investment Managers, where his investment role spanned a dozen quantitatively managed funds, including the ML Large Cap Series. Prior to MLIM, he was Manager of the Risk Analytics & Research Group at Ernst & Young LLP. He holds dual MS degrees in Computational Finance and Applied Mathematics from Carnegie Mellon University, where he was also a doctoral student. He graduated Summa Cum Laude from Vassar College and completed the Honors Moderation curriculum at Oxford University en-route.

Jurgen Tistaert, ING SWE Brussels

Jurgen Tistaert joined ING Brussels Credit Risk Management Department end 1996 where he later on became responsible for the credit risk modeling team. The main topics included the development of a range of default risk and classification models, the measurement of financial markets counterparty exposure and its credit risk pricing.

He joined Financial Markets end 2001, where the Brussels team develops pricing models for (structures of) equity, interest rate and credit derivatives. He holds a Master in Management Science from Leuven University, where he was a research assistant at the Quantitative Methods group, specialising in statistics and large scale optimisation problems.

He is appointed as a Fellow of the Hogheheuvel College for 2003-2006 (Leuven University)

Prof Robert G Tompkins,

HfB - Business School of Finance and Management

Dr. Robert G. Tompkins was born in Oklahoma, USA and he received his A.B. (1980), his A.M. (1980) and his MBA (honors) (1986) from the University of Chicago. He moved to England in 1986 and subsequently became a British citizen. He earned a Ph.D. (1998) from the University of Warwick and his Habilitation (2000) from the University of Technology, Vienna, where Dr. Tompkins lived from 1998 to 2003.

Dr Thomas Weber, Weber und Partner

Thomas Weber started in 1997 his own consultancy company focusing on quantitative methods in finance. Since two years his company closely works together with SciComp, an US based software company which provides a platform for financial derivatives modeling and pricing.

Prof Uwe Wystup,

HfB - Business School of Finance and Management

Uwe Wystup is Professor of Quantitative Finance at HfB - Business School of Finance and Management, Frankfurt. Before that

he worked for Deutsche Bank, Citibank, UBS and Sal. Oppenheim jr. & Cie and as financial engineer and structurer in the FX Options trading team of Commerzbank. He is managing director of MathFinance.de and editor of the MathFinance newsletter and the Financial Engineering Review. Uwe has a PhD in mathematical finance from Carnegie Mellon University. He also lectures on mathematical finance for Goethe University Frankfurt, organizes the Frankfurt MathFinance Colloquium and is founding director of the Frankfurt MathFinance Institute. His area of specialization are the quantitative aspects of foreign exchange markets, international treasury management and structured products. He recently published a book on Foreign Exchange Risk.