Stieltjes/CentER/MRI

Winter school on Mathematical Finance

special topics: Portfolio Optimization and Risk Measures

January 19-21, 2009
CongresHotel De Werelt, Lunteren

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8th Winter School on Mathematical Finance

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Risk Measures

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In recent years, the mathematical theory associated with financial risk management and the pricing of contingent claims has been a highly active field of research. The area has established itself as one of the most vigorously growing branches of applied mathematics. Model-based analysis of contracts and portfolios has become a standard in the finance industry, and the number of academic institutions offering curricula in financial mathematics is increasing rapidly. In this context, the winter school on Mathematical Finance that will take place January 19–21, 2009 in Lunteren aims at providing a meeting place for participants both from industry and from academia. The program provides ample opportunity for discussion.

The special topics of the 8th winter school are *Portfolio Optimization* and *Risk Measures*. These are the subjects of minicourses that will be taught by two distinguished speakers: Professor Jérôme Detemple (Boston University) and Professor Georg Pflug (University of Vienna). Additionally there will be three one-hour lectures by Professors Piotr Karasinski (HSBC Bank), Damien Lamberton (Université Marne-la-Vallée) and Martin Schweizer (ETH Zürich). Thirty-minute lectures on recent research work in the Netherlands will be presented by Jiajia Cui (Tilburg University), Xinzheng Huang (TU Delft), Coen Leentvaar (TU Delft) and Denitsa Stefanova (Vrije Universiteit, Amsterdam).

Auspices and sponsoring

The winter school takes place under the auspices of three research schools, to wit:

- Center for Economic Research (CentER)

- Mathematics Research Institute (MRI)

- Thomas Stieltjes Institute for Mathematics.

CentER is the research school of the Faculty of Economics and Business Administration of Tilburg University. The mathematics departments of the universities of Groningen, Nijmegen, Twente, and Utrecht cooperate in MRI, while the Stieltjes Institute involves mathematics groups at the two universities in Amsterdam and at the universities in Delft, Eindhoven, Leiden, Rotterdam, and Tilburg. The winter school is supported financially by the three research schools, by the Netherlands Organization for Scientific Research (NWO) and by the research program AMaMeF (Advanced Mathematical Methods for Finance) of the European Science Foundation (ESF). Administrative assistance is provided by the Korteweg–De Vries Institute for Mathematics of the Universiteit van Amsterdam.

Organizers

The winter school is organized by:

Hans Schumacher (Department of Econometrics and Operations Research, Tilburg University; tel. 013-4662050, e-mail `jms@uvt.nl`)

Peter Spreij (Korteweg–De Vries Institute for Mathematics, Universiteit van Amsterdam; tel. 020-5256070, e-mail `p.j.c.spreij@uva.nl`).

Program outline

The program starts with registration and coffee on Monday, January 19, from 10:30 to 11:30, and ends on Wednesday, January 21, at 16:00. The following events are planned:

Minicourses

Jérôme Detemple
Dynamic asset allocation

Georg Pflug
Risk functionals for multi-period decision problems

Special invited lectures

Piotr Karasinski
Mindless fitting?

Damien Lamberton
Some option pricing problems in exponential Lévy models

Martin Schweizer
New insights into exponential utility indifference valuation

Short contributions

Jiajia Cui
Longevity risk pricing

Xinzheng Huang
Generalized beta regression models for random loss-given-default

Coen Leentvaar
Multi-asset option pricing using a parallel Fourier-based technique

Denitsa Stefanova
Dynamic correlation hedging in copula models for portfolio selection

Schedule of lectures

	Monday January 19	Tuesday January 20	Wednesday January 21
09:00 - 10:00		Pflug	Pflug
10:30 - 11:30		Pflug	Pflug
11:30 - 12:30	Pflug	Detemple	Detemple
14:00 - 15:00			Detemple
15:00 - 16:00	Detemple	Detemple	Schweizer
16:00 - 17:00	Karasinski	Lamberton	
17:30 - 18:00	Huang	Cui	
18:00 - 18:30	Leentvaar	Stefanova	

Web page

Please see `www.mathfin.nl` for the latest information about the winter school.

Venue

The winter school will take place at Congreshotel De Werelt, Westhofflaan 2, Lunteren, tel. 0318-484641, fax 0318-482924. Located in the heart of the Veluwe forest, De Werelt is one of the top accommodations in the Netherlands in terms of attractiveness of surroundings. Access by car or by public transportation is easy. By train, the village of Lunteren can be reached in twenty minutes from Amersfoort, and in ten minutes from Ede-Wageningen. It takes about fifteen minutes to walk from the railway station in Lunteren to the conference center (see directions below). If you come by car, ANWB signs in Lunteren will guide you to the venue. It is also possible to take a taxi from the taxi stand at railway station Ede-Wageningen. To get a taxi in Lunteren, call 0318-484555. For further details please see `www.congrescentrum.com/engels/index.htm`.

Directions from the railway station: leaving the station, turn right across the pebble-covered parking lot. Turn left into the forest (Boslaan). At the crossroads, turn right into Molenweg. The first turn left is Westhofflaan.

Abstracts

Minicourse on Portfolio Optimization

Jérôme Detemple (Boston University)

Dynamic asset allocation

Dynamic asset allocation models have attracted intense interest from academics and practitioners in recent years. These lectures will focus on recent developments in the field. A classic portfolio formula, based on Malliavin calculus, will be reviewed and implementation aspects discussed. An alternative decomposition formula, emphasizing the role of long term bonds, will also be presented. Various applications of the formulas will be examined. Aspects pertaining to the structure of optimal portfolios and the role of dynamic hedging terms will be clarified.

Minicourse on Risk Measures

Georg Pflug (University of Vienna)

Risk functionals for multi-period decision problems

We introduce the setting for (time-discrete) multi-period convex risk functionals (definitions, properties such as time-consistency, dual representations, characterizations) as generalizations of single-period functionals. Unlike as in the one-period situation, the functionals are defined on pairs of stochastic processes and filtrations, to which the processes are adapted. We give a new notion of version-independence (law-invariance) and a concept of equivalence.

The pairs consisting of filtrations and processes can be endowed with a (weak) metric and continuity as well as Lipschitz properties of risk functionals may be studied. This allows the quantification of the approximation error when a sophisticated model is replaced by a simpler one.

Applications include examples from longer term financial optimization problems such as those arising in pension fund management and electricity portfolio planning.

Special invited lectures

Piotr Karasinski (HSBC Bank)

Mindless fitting?

We are required to mark-to-market non-plain, exotic, products consistently with the market-observed prices of liquid vanilla products.

Thus for each exotic we must have a one-to-one mapping between vanilla prices and the exotic's price. Such mapping is called the mark-to-market model as it produces mark-to-market price and risk exposure. Risk management policies (risk limits, desire to minimise volatility of the mark-to-market P&L) typically compel traders to hedge exotics with vanillas such that the combined risk exposure, measured by the mark-to-market model, is close to zero.

In the traditional approach we set the price of an exotic equal to its value given by a traditional derivatives valuation model that assumes a certain stochastic evolution

of the relevant risk factors. To fit vanilla prices practitioners often use (are forced to use?) over-parametrised models in which risk factor dynamics can be counter-intuitive. Does this produce a good model, i.e., does hedging to such model's risk exposure result in realised replication costs that are close to the initial exotic's price the model produces? How can we find an answer to this question?

What are the alternatives? Can we start with a price of an exotic produced by a standard derivatives valuation model, with risk factors' dynamics that makes sense (who is to judge?), and somehow, externally, adjust the price to reflect the difference between market and model prices of relevant vanilla options? Would the resulting mapping produce a hedging model that is better than the one based on the traditional approach?

Damien Lamberton (Université Marne-la-Vallée)

Some option pricing problems in exponential Lévy models

In this lecture, we will discuss two types of path-dependent options within exponential Lévy models: American options, and lookback options.

In the first part, we will highlight the connection between variational inequalities and optimal stopping problems, and derive some regularity properties of American option prices. The second part of the lecture will be devoted to discretization issues for the maximum of a Lévy process and potential applications to lookback options.

The results which will be presented are based on joint work with M. Mikou for the first part and with E.H.A. Dia for the second part.

Martin Schweizer (ETH Zürich)

New insights into exponential utility indifference valuation

One popular approach to the problem of valuing contingent claims in incomplete markets is to use exponential utility indifference valuation. This has the combined advantages of being economically well-founded and yet mathematically fairly tractable in quite general settings. Especially for executive stock option valuation, this approach is quite popular in the literature. In a Markovian setting with one traded and one nontraded asset driven by two correlated Brownian motions, several authors have used PDE techniques to obtain an almost explicit valuation formula. This involves a reduction of the nonlinear PDE resulting from the HJB equation to a linear one by a well-chosen power transformation, where the distortion power is given explicitly in terms of the correlation which is assumed constant. But it turns out that this kind of formula can be extended to much more general models, going over Ito processes with stochastic correlation to completely general semimartingales. In addition, going up to that level of generality gives a much better understanding of why such a formula holds. We shall explain the above ideas and results in detail. This talk is based on joint work with Christoph Frei (ETH Zürich).

Short contributions

Jiajia Cui (Tilburg University)

Longevity risk pricing

Longevity risks, i.e. unexpected improvements in life expectancies, may lead to severe solvency issues for annuity providers. Longevity-linked securities provide the desirable hedging instruments to annuity providers, and in the meanwhile, diversification benefits to their counterparties. But longevity-linked securities are not traded in financial markets due to the pricing difficulty. This paper proposes a new method to price the longevity risk premia in order to tackle the pricing obstacle. Based on the equivalent utility pricing principle, our method obtains the minimum risk premium required by the longevity insurance seller and the maximum acceptable risk premium by the longevity insurance buyer. The proposed methodology satisfies four important requirements for applications in practice: i) suitable for incomplete market pricing, ii) consistent with other financial market risk premia and iii) flexible in handling different payoff structures, basis risk and natural hedging possibilities. The method is applied in pricing various longevity-linked securities (bonds, swaps, caps and floors). We show that the size of the risk premium depends on the payoff structure of the security due to the market incompleteness. Furthermore, we show that the financial strength of the longevity insurance seller and buyer, the availability of the natural hedges and the presence of basis risk may significantly affect the size of longevity risk premium.

Xinzheng Huang (TU Delft)

Generalized beta regression models for random loss-given-default

We propose a new framework for modeling systematic risk in Loss-Given-Default (LGD) in the context of credit portfolio losses. The class of models is very flexible and accommodates well skewness and heteroscedastic errors. The quantities in the models have simple economic interpretation. Inference of models in this framework can be unified. Moreover, it allows efficient numerical procedures, such as the normal approximation and the saddlepoint approximation, to calculate the portfolio loss distribution, Value at Risk (VaR) and Expected Shortfall (ES).

Coen Leentvaar (TU Delft)

Multi-asset option pricing using a parallel Fourier-based technique

We present and evaluate a Fourier-based sparse grid method for pricing multi-asset options. This involves computing multi-dimensional integrals efficiently and we accomplish it using the fast Fourier transform. We also propose and evaluate ways to deal with the curse of dimensionality by means of parallel partitioning of the Fourier transform and by incorporating a parallel sparse grid method. The benefit of the Fourier-based method is the absence of the time-integration for European options in contrast to the standard Black-Scholes multi-dimensional PDE. We test the presented Fourier-based method by solving pricing equations for options that are dependent on up to seven underlying assets and we compare the results to results obtained from multi-dimensional PDE methods.

Denitsa Stefanova (Vrije Universiteit)

Dynamic correlation hedging in copula models for portfolio selection

In this paper we address the problem of solving for optimal portfolio allocation in a dynamic setting, where conditional asset return correlations are modeled using observable factors, which allows us to isolate the demand for hedging correlation risk. We are able to analyse separately the impact of tail dependence through the unconditional distribution of the process for asset prices and that of the conditional correlation on portfolio holdings. With those distinct ways of modeling dependence we aim at replicating the stylised fact of increased dependence during extreme market downturns, rising market-wide volatility, or worsening macroeconomic conditions. We find that both correlation hedging demands and intertemporal hedges due to increased tail dependence have distinct portfolio implications and cannot act as substitutes to each other. As well, there are substantial economic costs for disregarding both the dynamics of conditional correlation and the dependence in the extremes.

Registration

To register for the winter school, please use the electronic registration form that is available at the web page of the winter school (see `www.mathfin.nl` or `www.science.uva.nl/~spreij/stieltjes/winterschool.html`). Alternatively, you may complete the registration form on the last page and return it to ms. E. Wallet, Korteweg–De Vries Institute for Mathematics, Plantage Muidergracht 24, 1018 TV Amsterdam.

The registration fee includes accommodation (single room) for the nights of January 19 and 20, all meals starting with lunch on Monday up to and including lunch on Wednesday, and tea and coffee during breaks. Payment can be made by transferral to account 7388994 of Winter School Amsterdam, Secretariaat Korteweg–De Vries Instituut, Amsterdam. For international money transfers please use the bank codes IBAN: NL76 PSTB 0007 388994 and BIC: PSTBNL21. The fee schedule is as follows:

	early registration (before December 1)	late registration (after December 1)
standard	1500 euro	1800 euro
full-time university staff	300 euro	350 euro

Inquiries concerning fees for partial attendance may be directed to ms. Wallet at the address given below. Registration will be valid after full payment has been received. Refunds can be given only for cancellations received before January 1, 2009.

Accommodation at the venue is limited. Therefore, reservations will be treated on a first-come-first-served basis with priority for full arrangements. Participants who cannot be lodged at the venue will be accommodated in a hotel nearby. Transportation from the hotel to the venue and vice versa will be taken care of by the organization.

Further information

For further information regarding the scientific program, please contact one of the members of the organizing committee. For information concerning registration please contact:

> ms. E. Wallet
> Korteweg–De Vries Institute for Mathematics
> Universiteit van Amsterdam
> Plantage Muidergracht 24
> 1018 TV Amsterdam
> e-mail: e.wallet@uva.nl
> tel.: 020-5255217
> fax: 020-5255101

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Registration Form

Surname: _____

Title and initials: _____

Name on badge: _____

Affiliation: _____

Address: _____

_____

_____

_____

Telephone: _____

Fax: _____

Email address: _____

Date: _____

Signature: _____

Please return the completed form *before January 1, 2009* to:

    ms. E. Wallet
    KdV Institute for Mathematics
    Universiteit van Amsterdam
    Plantage Muidergracht 24
    1018 TV Amsterdam
    fax: 020-5255101

Registration is valid only after full payment has been received following the fee schedule.