THE UNIVERSITY  OF HONG KONG

Conference on Financial Modelling and Related Topics

January 16 – 17, 2009

Final Announcement

Invited Speakers

- Ping He (School of Economics and Management, Tsinghua University)
- Yingzi Zhu (School of Economics and Management, Tsinghua University)
- Zehao Chen (Bosera, China)
- Tze Leung Lai (Statistics, Stanford University & C.V. Starr Professor, HKU)
- Nicolas Privault (Mathematics, CityU of HK)
- Michael Wong (Statistics, CUHK)
- Lixin Wu (Mathematics, HKUST)
- Sam Wong (RiskMan Limited and Statistics, CUHK)
- Siu Pang Yung (Mathematics, HKU)
- Hua He (Nomura)
- Zhen Wei (Nomura)
- Robert Phelps (Asia Pacific Credit Risk Management, HSBC)
- Wai Keung Li (Statistics and Actuarial Science, HKU)
- Yat Fai Lam (CityU of HK)
- Jin Zhang (Business and Economics, HKU)
- Hailiang Yang (Statistics and Actuarial Science, HKU)
- Phillip Yam (Applied Maths, HK Poly U)

Organizing Committee:

Tze Leung Lai, Stanford U. & HKU,
Wai Keung Li, HKU, Siu Pang Yung, HKU

Conference on Financial Modelling and Related Topics

Financial Mathematics Program, Stanford,

Department of Statistics & Actuarial Science

and

Department of Mathematics and IMR

The University of Hong Kong

January 16-17, 2009

Organizing Committee:

T.L. Lai (Stanford), W.K. Li (HKU), S.P. Yung (HKU).

January 16 (Friday)
AM Sessions: Knowles 223
PM Sessions: MengWah 517

09:00 – 09:15 *Welcoming Address and Introductory Remarks*
N.M. Mok, Chair Professor and Director of the Institute of Mathematical Research, University of Hong Kong

Chair: **T.L. Lai,** Stanford University

09:15 – 09:55 **Ping He**, Tsinghua University
Mark-to-Market and Financial Modeling

09:55 – 10:35 **W.K. Li**, University of Hong Kong
On a Dynamic Mixture GARCH Model

10:35 – 10:55 *Coffee Break*

Chair: **W.K. Li**, University of Hong Kong

10:55 – 11:35 **Nicolas Privault,** City-University of Hong Kong
Sensitivity Analysis and Computation of Greeks by the Malliavin Calculus

11:35 – 12:15 **Phillip Yam**, Hong Kong PolyU, **and Wei Zhou**, University of Hong Kong
When is a Good Time to Sell a Stock?

12:15 – 14:15 *Lunch Break*

Chair: **Hailiang Yang**, University of Hong Kong

14:15 – 14:55 **Lixin Wu**, Hong Kong University of Science & Technology
Inflation Derivatives: HJM Framework and Market Models

14:55 – 15:35 **Michael Wong**, Chinese University of Hong Kong
Beating a Stochastic Target within a Finite Time: Exotics-Replicating Optimal Portfolio Strategies

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15:35 – 15:55 *Coffee Break*

Chair: **Phillip Yam**, Hong Kong Polytechnic University

15:55 – 16:35 **Hailiang Yang,** University of Hong Kong
On Optimal Dividend Strategy

16:35 – 17:15 **S.P.Yung and Junhua Zhou**, University of Hong Kong
Mean-Variance Portfolio Selection subject to a Benchmark Constraint

January 17 (Saturday)
All Sessions: MengWah T2

Chair: **Zhen Wei**, Nomura

09:00 – 09:40 **Hua He,** Nomura
Perspectives on Recent Events in the Financial Industry

09:40 – 10:20 **T.L. Lai and Paul Pong,** Stanford University
A Substantive-Empirical Approach to Parameter Estimation in Interest Rate Models

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10:20 – 10:40 *Coffee Break*

Chair: **Yingzi Zhu**, Tsinghua University.

10:40 – 11:20 **Zhen Wei**, Nomura.
Asset Swap Options: Valuation, Risks and Trading Strategies

11:20 – 12:00 **Zehao Chen**, Bosera, China
Static Hedging of Complex Portfolios

12:00 – 13:30 *Lunch Break*

Chair: **Alan Wong**, Hong Kong Baptist University

13:30 – 14:10 **Jin Zhang,** University of Hong Kong
The Market for Volatility Trading

14:10 – 14:50 **Yingzi Zhu**, Tsinghua University
Technical Analysis: An Asset Allocation Perspective on the Use of Moving Averages

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14:50 – 15:10 *Coffee Break*

Chair: **S.P. Yung**, University of Hong Kong

15:10 – 15:50 **Y.F. Lam,** City-University of Hong Kong and HKMA
Incremental Risk Charge for Basel II Market Risk Framework

15:50 – 16:30 **Robert Phelps**, HSBC
Retail Risk Models: Changing Environments and Evolving Directions

16:30 – 17:10 **Samuel Wong**, Chinese University of Hong Kong and RiskMan Limited
Credit Risk Modeling via Empirical Bayes Markov Chain Models

17:10 – 17:20 ***Closing***

Abstracts

Zehao Chen (Bosera, China)

Static Hedging of Complex Portfolios

Static hedging is a general technique of replicating certain exposures of complex derivative securities with simpler instruments within a predefined range of market environment. Different from dynamic hedging which needs constant rehedging, static hedging does not require any adjustment of hedging portfolio since the hedging instruments will closely track the target derivative exposures as long as the market stays inside the range. This technique is very useful for derivative traders, especially market makers. It helps them simplify hedging and risk management process by avoid constant rebalancing. In practice, it's often desirable to find the minimum set of hedging instruments that statically replicate the target portfolio. We show that LARS (Least Angle Regression) can be a useful tool in achieving this goal. A real life example of hedging Bermudan Swaptions is also illustrated.

Hua He (Nomura)

Perspectives on Recent Events in the Financial Industry

Ping He (School of Economics and Management, Tsinghua University)

Mark-to-Market and Financial Modeling

Many financial model attempts to incorporate market conditions into asset pricing, and one of the important role played by financial model is to identify the "fair" value of the assets using market information. Delegated traders payoffs are marked to market or marked to models, which also indirectly marked to market due to the inputs of market condition in models. However, this mark-to-market compensation structure, intertwined with the moral hazard problem, could cause market failure with price not reflecting the fundamental value of assets.

Tze Leung Lai (Statistics, Stanford University & C.V. Starr Professor, HKU)

A Substantive-Empirical Approach to Parameter Estimation in Interest Rate Models

After a brief overview of interest rate markets and models and of the methods commonly used in the financial industry to calibrate these models, we describe a new approach that is based on empirical fitting of the discrepancy between model-based and market prices. The substantive component of our approach consists of fitting commonly adopted models for widely traded instruments, whereas the empirical component involves principal components and regression. An illustrative example is used to show that functional data analysis is a natural statistical counterpart of the infinite-dimensional stochastic analysis approach to term structure modeling, and that it provides a powerful tool to analyze

historical, and predict future, term structure of interest rates.
This is joint work with Haipeng Xing (SUNY at Stony Brook) and Paul Pong (Stanford University).

Yat Fai Lam (City-University of Hong Kong and HKMA)

Incremental Risk Charge for Basel II Market Risk Framework

Under the new Basel II framework, banks using internal model to report their specific risk charge for market risk are required to model and hold capital against default risk at one-year horizon, 99.9% confidence level that is incremental to the market risk captured in the banks' existing ten-day 99% value-at-risk (VaR) model. Although the requirement was set out as early as in 2005, the first consultative paper on modelling default risk was issued by the Basel Committee in October 2007. In light of the recent credit market turmoil where a number of major financial institutions experienced large losses, most of which were not arisen from actual defaults but rather from credit migrations combined with widening of credit spreads and the loss of liquidity, the Basel Committee further proposed in July 2008 to extend the requirement to cover default risk, credit migration risk, credit spread risk and equity price risk (collectively called incremental risk) at one-year horizon, 99.9% confidence level. Due to the arguments from banking industry, the latest proposal reduced modelling to include the default risk and credit migration risk for non-securitized exposures only and supplemented the securitization exposures with static specific risk capital charges.
In this session, Mr. Yat-fai LAM, Senior Teaching Fellow, Department of Economics and Finance, City University of Hong Kong, will explain the Basel Committee's initiative for incremental risk charges, the evolution of the proposals and the responses from the banking industry.

Wai Keung Li (Statistics and Actuarial Science, HKU)

On a Dynamic Mixture GARCH Model

This paper proposes a new mixture GARCH model with a dynamic mixture proportion. The mixture Gaussian distribution of the error can vary from time to time. The Bayesian Information Criterion and the EM algorithm are used to estimate the number of parameters as well as the model parameters and their standard errors. The new model is applied to the S&P500 Index and Hang Seng Index and compared with GARCH models with Gaussian error and Student's t error. The result shows that the IGARCH effect in these index returns could be the result of the mixture of one stationary volatility component with another non-stationary volatility component. The VaR based on the new model performs better than traditional GARCH-based VaRs, especially in unstable stock markets.

Robert Phelps (Asia Pacific Credit Risk Management, HSBC)

Retail risk models: Changing environments and evolving directions

This talk will provide an overview of challenges in retail risk modelling, especially in the light of recent (and previous) financial crises, and discusses some emerging modelling approaches that may help both

to identify potential risks and to manage their effects if realized. A number of current developments and issues will be used to illustrate the problems and challenges faced in this area of risk modelling.

Nicolas Privault (Mathematics, CityU of HK)

Sensitivity analysis and computation of Greeks by the Malliavin calculus

In this talk we will review recent progress in variance reduction methods for the Monte Carlo computation of Greeks in option hedging. The methods to be presented rely on integration by parts techniques on probability spaces (Malliavin calculus), which result in faster and more accurate numerical algorithms in the case of non-smooth payoff functions. We plan to cover continuous and jump diffusion models and some stochastic volatility models, with application to European and exotic options.

Zhen Wei (Nomura)

Asset Swap Options: Valuation, Risks and Trading Strategies

An asset swap combines a fixed-rate bond/note and an interest rate swap by taking the interest rate risk and credit risk of the bond/note issuer synthetically. An asset swap option gives the buyer the right to enter into a long or short position into a forward asset swap. It allows the investors to take views on the forward par asset swap spread in the market as well as to hedge the callable/cancellable risk usually embedded in the underlying bond of an asset swap. We explain the determinants of a forward par asset swap spread and use a two factor lattice model to price the asset swap options. Based on the valuation results, we introduce several trading strategies using asset swap options.

Michael Wong (Statistics, CUHK)

Beating a Stochastic Target within a Finite Time: Exotics-Replicating Optimal Portfolio Strategies

We investigate a general class of portfolio selection problems of target return funds, which includes the following three situations as its special cases: (i) maximization of the probability of beating the target on or before the terminal time, (ii) maximization of the expected reward for beating the target on or before the terminal time, and (iii) minimization of the expected time for beating the target. Consider a bankruptcy-prohibited optimal portfolio strategy for a continuous-time incomplete market with time-varying deterministic coefficients, in which a hitting time is involved in the wealth process. Note that the market incompleteness comes from the stochastic target which is unspanned by stocks. Adopting a general martingale approach, we show that the hitting time on the wealth process can be transformed into another hitting time on a specific martingale measure. Thus, a general class of portfolio selection problems in beating a stochastic target within a finite time can be completely solved. It is interesting that the optimal trading strategies replicate different exotic path-dependent options for different problems mentioned above. Our finding also adds a new insight into how a portfolio selection problem with a hitting time can be solved by a martingale approach.
This is a joint work with Chiu, Mei Choi (Department of Math., HKUST) and Li, Duan (Department

of Systems Engineering and Engineering Management, CUHK).

Sam Wong (RiskMan Limited and Statistics, CUHK)

Credit Risk Modeling via Empirical Bayes Markov Chain Models

The Basel II Accord aims at developing a systematic approach to evaluate and control credit risks. The common obstacle for any robust financial institution to attain the Basel II internal ratings based standard is the lack of default data in prime credit class. In this talk, we address such issue by a Markov chain model via the empirical Bayes methodology. We will also introduce a beta mixed model for the loss given default prediction. This is a joint work with Professor Tze Leung Lai of the Department of Statistics at Stanford University.

Lixin Wu (Mathematics, HKUST)

Inflation Derivatives: HJM Framework and Market Models

In this paper, we abandon the "foreign currency analogy" and establish a Heath-Jarrow-Morton (HJM) type framework that governs the co-evolution of the term structures of both nominal and inflation rates. Pricing of inflation derivatives under this framework can be carried out similarly to that of nominal interest-rate derivatives under the classic HJM model. Based on new HJM framework for inflation rates, we further develop a market model with simple forward inflation rates using displaced diffusion processes, which results in closed-form pricing for inflation caplets as well as inflation swaptions. The price formulae carry hedging strategies and allow efficient calibration of the model. Examples of pricing and calibration are provided.

Phillip Yam (Applied Maths, HK Poly U) and Wei Zhou (Mathematics, HKU)

When is a good time to sell a stock?

With no doubt, we are always keen to sell a stock at the highest price over a time horizon $[0, T]$; however our dream can never come true as nobody can anticipate the future. Nevertheless, it remains sensible to ask if one can sell a stock, on the average, as close as possible to its highest price in proportion. In mathematical terms, for illustration, we suppose that the stock price dynamics S_t follows the Black-Scholes model:

$$dS_t = S_t(\mu dt + \sigma d\mathbb{B}_t) \ .$$

In this talk, I shall introduce what the optimal time τ^* to sell the stock is in such a way that

$$\mathbb{E}\Big(\frac{S_{\tau^*}}{M_T}\Big) = \sup_{0\leq\tau\leq T} \mathbb{E}\Big(\frac{S_\tau}{M_T}\Big) \ ,$$

where $M_T \triangleq \max_{0\leq\tau\leq T} S_t$. Moreover, a new simple index for classifying the worthiness of a stock will also be indicated. Finally, we shall also include a brief account of recent progress in optimal selling of stocks subject to various objectives.

This is joint work with S.P. Yung (Department of Mathematics, The University of Hong Kong).

Hailiang Yang (Statistics and Actuarial Science, HKU)

On Optimal Dividend Strategy

There is considerable renewed interest in studying insurance risk models with dividend strategies in the recent years. In this talk, I will first give a brief review of the literature, then present a dividends-penalty identity in a general class of risk models. Using this dividends-penalty identity, an optimal dividend strategy framework which maximizes the difference between the expected present value of all dividends until ruin and the expected discounted value of a penalty at ruin will be presented. Some results on two classical insurance risk models, including some numerical examples, will be used to illustrate the ideas. The last part of the presentation is on the optimal dividend strategy in a regime switching insurance risk model.
(This talk is based on some joint papers with my co-authors).

Siu Pang Yung and Junhua Zhou (Mathematics, HKU)

Mean-Variance Portfolio Selection subject to a Benchmark Constraint

In this paper, we consider the continuous time mean-variance portfolio selection problem subjected to a nonconvex benchmark probabilistic constraint. Under the conventional assumption in mean-variance portfolio theory, we construct a unique optimal portfolio strategy. As an immediate implication, an efficient frontier is also derived and a few numerical illustrations for comparing efficient frontiers under the constraint with the one without the constraint will also be provided.
This is joint work with S.C.P. Yam.

Jin Zhang (Business and Economics, HKU)

The Market for Volatility Trading

Volatility/variance has become an asset class in its own right. In late 1990s, Wall Street firms started trading variance swaps, forward contracts written on the realized variance. These swaps are now the preferred route for many hedge fund managers and proprietary traders to make bets on market volatility. The exchange-listed volatility products started with the Chicago Board Options Exchange (CBOE) volatility index (VIX) futures on 26 March 2004, followed by the S&P 500 three-month variance futures on 18 May 2004 and VIX option on 24 February 2006. Currently, there are six kinds of volatility futures and three kinds of volatility options traded on the CBOE. There are three kinds of volatility futures traded on the Eurex. They are derivative contracts written on either the volatility index or realized variance.
To establish an intuition on the market size, we looked at the data provided by the CBOE. For example, on 11 December 2008, The CBOE volatility index, VIX level was 55.78. The open interest of VIX futures was 27,287 contracts, which corrsponds to a market value of 1.5 billion US dollars.

The open interest of VIX option was 18,720,920 contracts, which corresponds to a market value of 5.9 billion US dollars. The S&P 500 three-month variance futures is much less liquid. Its trading volume was only 78 contracts.

In this paper, I will present the historical development of the market for volatility trading, and review classical literature on pricing variance swap, such as Carr and Madan (1998), and Demeterfi, Derman, Kamal and Zou (1999). I will also discuss the recent development on studying CBOE-listed volatility derivatives such as VIX futures and options, and the S&P 500 variance futures, including Zhang and Zhu (2006), Brenner, Shu and Zhang (2006), Zhu and Zhang (2007), Lin (2007), Sepp (2008ab), and Zhang and Huang (2009).

Yingzi Zhu (School of Economics and Management, Tsinghua University)

Technical Analysis: An Asset Allocation Perspective on the Use of Moving Averages

In this paper, we analyze the usefulness of technical analysis, specifically the widely used moving average trading rule from an asset allocation perspective. We show that when stock returns are predictable, technical analysis adds value to commonly used allocation rules that invest fixed proportions of wealth in stocks. When there is uncertainty about predictability which is likely in practice, the fixed allocation rules combined with technical analysis can outperform the prior-dependent optimal learning rule when the prior is not too informative. Moreover, the technical trading rules are robust to model specification, and they tend to substantially outperform the model-based optimal trading strategies when there is uncertainty about the model governing the stock price.