

# HKU-HKUST-Stanford Conference in Quantitative Finance

## Sponsors:

*Centre for Financial Innovation and Risk Management (HKU),  
Department of Statistics and Actuarial Science (HKU),  
Institute of Mathematical Research (HKU),  
Department of Mathematics (HKUST),  
Financial Mathematics Program (Stanford)*

December 9, 2011 at HKUST (Lecture Theater G)

and

December 10, 2011 at HKU (Meng Wah T2)

---

*The primary goal of this conference is to bring researchers and practitioners working in quantitative finance and related fields together. Recent advances in both theoretical and practical issues will be reported and it will be a great occasion for researchers from academia and firms to share each other's views. Registration is free, students and young researchers are highly encouraged to participate.*

---

## **Organizing Committee:**

*Wai Keung Li, HKU, Jin Zhang, HKU, Siu Pang Yung, HKU,  
Tze Leung Lai, Stanford U & HKU, Yue Kuen Kwok, HKUST*

## Invited Speakers

- Ning Cai (HKUST)
- Ka Chun Cheung (HKU)
- Haksun Li (Numerical Methods)
- Hai Lin (U of Otago)
- Xianhua Peng (HKUST)
- Xuhu Wan (HKUST)
- Samuel Po Shing Wong (CASH)
- Fan Yang (HKU)
- Siu Pang Yung (HKU)
- Jin Zhang (HKU)
- Kathryn Zhao (JP Morgan)
- Wei Zhou (JP Morgan)
- Nan Chen (CUHK)
- Cho Hoi Hui (HK Monetary Authority)
- Xun Li (HKPolyU)
- Rhea Liu (UBS)
- Mike So (HKUST)
- Hoi Ying Wong (CUHK)
- Phillip Yam (CUHK)
- Hailiang Yang (HKU)
- Chu Zhang (HKUST)
- Qiang Zhang (CityU of HK)
- Xinghua Zheng (HKUST)
- Xunyu Zhou (CUHK)

# HKU-HKUST-Stanford Conference in Quantitative Finance

## Program at a glance

December 9, 2011 (Friday)

Venue: Lecture Theater G, Academic Concourse,  
Hong Kong University of Science and Technology

9:00am - 9:10am      Opening remark  
Professor Henry TYE, Director of Institute for  
Advanced Study, Hong Kong University of Science and  
Technology

Session chair      Yue Kuen KWOK (HKUST)

9:10am - 9:40am      Xunyu ZHOU (CUHK)

9:40am - 10:10am    Chu ZHANG (HKUST)

10:10am - 10:40am   Samuel WONG (CASH)

10:40am - 11:10am   coffee break

Session chair      Albert LO (HKUST)

11:10am - 11:40am   Ning CAI (HKUST)

11:40am - 12:10pm   Siu Pang YUNG (HKU)

12:10pm - 12:40pm   Haksun LI (Numerical Methods)

12:40pm - 2:00pm    lunch break

Session chair      Chu ZHANG (HKUST)

2:00pm - 2:30pm      Hoi Ying WONG (CUHK)

2:30pm - 3:00pm      Cho Hoi HUI (HKMA)

3:00pm - 3:30pm      Mike SO (HKUST)

3:30pm - 4:00pm      coffee break

Session chair      Ning CAI (HKUST)

4:00pm - 4:30pm      Philip YAM (CUHK)

4:30pm - 5:00pm      Xinghua ZHENG (HKUST)

5:00pm - 5:30pm      Wei ZHOU (JP Morgan)

December 10, 2011 (Saturday)

Venue: T2, Meng Wah Building, Hong Kong University

9:00am - 9:10am Opening remark

Professor Ngai Ming MOK, Director of Institute of  
Mathematical Research, Hong Kong University

Session chair Ngai Ming MOK (HKU)

9:10am - 9:40am Qiang ZHANG (CityU)

9:40am - 10:10am Jin ZHANG (HKU)

10:10am - 10:40am Hailiang YANG (HKU)

10:40am - 11:10am coffee break

Session chair Wai Keung LI (HKU)

11:10am - 11:40am Ka Chun CHEUNG (HKU)

11:40am - 12:10pm Xun LI (PolyU)

12:10pm - 12:40pm Xuhu WAN (HKUST)

12:40pm - 2:00pm lunch break

Session chair Jin ZHANG (HKU)

2:00pm - 2:30pm Kathryn ZHAO (JP Morgan)

2:30pm - 3:00pm Fan YANG (HKU)

3:00pm - 3:30pm Hai LIN (Univ Otago, New Zealand)

3:30pm - 4:00pm coffee break

Session chair Tze Leung LAI (Stanford University)

4:00pm - 4:30pm Rhea LIU (UBS)

4:30pm - 5:00pm Nan CHEN (CUHK)

5:00pm - 5:30pm Xianhua PENG (HKUST)

5:30pm - 5:35pm Closing remark

Professor Tze Leung LAI, Department of Statistics,  
Stanford University

# HKU-HKUST-Stanford Conference in Quantitative Finance

## Titles and abstracts of presentations

*December 9, 2011 (Friday)*

Venue: Lecture Theatre G, Academic Concourse, Hong Kong University of Science and Technology

9:00am – 9:10am            Opening remark  
Professor Henry TYE  
Director of Institute for Advanced Study, Hong Kong  
University of Science and Technology

9:10am – 9:40am            Xunyu ZHOU  
Department of Systems Engineering and Engineering  
Management, Chinese University of Hong Kong

*Title: Hope, Fear and Aspiration*

Abstract:

I will present a new portfolio choice model in continuous time featuring three key human emotions in decision-making: hope, fear and aspiration. The model is solved completely by applying the recently developed quantile formulation. Hope and fear indices are introduced to quantify the impact of these emotions on portfolio selection. This is a joint work with Xuedong He of Columbia University.

9:40am – 10:10am            Chu ZHANG  
Department of Finance, Hong Kong University of Science  
and Technology

*Title: On the Finite-Sample Performance of Nonparametric Jump Detection Tests*

Abstract:

In this study, we use simulation to examine the finite sample performance of four popular nonparametric jump detection tests in the recent literature. These tests are all based on large-sample properties which are impeded by microstructure issues. Our simulation is guided by the stylized facts of actual intraday returns with moderate sample sizes. The simulation results reveal the pros and cons of each test depend on various features of the jumps. When the four jump detection tests are applied to the intraday returns of 1000 stocks from January 1996 to December 2010 in the empirical analysis, they confirm the findings in the simulation. The simulation and empirical results in this paper provide guidance on how these tests should be used in practice. This is a joint work with Gang Li.

10:10am – 10:40am Samuel WONG  
Head of Research, CASH Dynamic Investment  
Opportunities Limited  
Adjunct Professor, Hong Kong University of Science and  
Technology

*Title: The Behavior of Liquidity Providers under an Enhanced Datafeed System*

Abstract:

Recently, Hong Kong Stock Exchange launched the new derivative datafeed system, namely, the PRS Plus (Price Reporting System Plus). On March 14, 2011, the rate of derivative price update was increased from every second to every 0.5 second. Such frequency was furthered enhanced to every 0.1 second on April 11, 2011. Under PRS Plus, supposedly the derivative market should be more efficient and the liquidity providers should be able to fulfill their obligations better. In this talk, a detailed statistical analysis on such belief will be delivered.

10:40am – 11:10am Coffee break

11:10am – 11:40am Ning CAI  
Department of Industrial Engineering and Logistics  
Management, Hong Kong University of Science and  
Technology

*Title: Exact Simulation of the SABR Model*

Abstract:

The SABR model has won great popularity in the financial industry due to its strong capability of capturing the volatility smiles. However, there exists no analytical solution for the SABR model that can be simulated directly. We propose a Monte Carlo method for the exact simulation of the forward price and the volatility under the SABR model, which can be used to generate unbiased estimators for derivative prices. Numerical experiments indicate that the method is efficient and simple to implement. This is joint work with Nan Chen from CUHK and Yingda Song from Hong Kong University of Science and Technology.

11:40am – 12:10pm Siu Pang YUNG  
Department of Mathematics, Hong Kong University

*Title: A Bang-Bang Control Perspective on Some Reinsurance Problems*

Abstract:

We shall describe the optimal solution of some reinsurance problems and find out that most of them are in a Bang-Bang control form.

12:10pm – 12:40pm Haksun LI  
Numerical Methods

*Title: The Role of Technology in Quantitative Trading Research*

Abstract:

There needs a technology to streamline the quantitative trading research process. Typically, quants/traders, from idea generation to strategy deployment, may take weeks if not months. This means not only loss of trading opportunity, but also a lengthy, tedious, erroneous process marred with ad-hoc decisions and primitive tools. From the organization's perspective, comparing the paper performances of different traders is like comparing apples to oranges. The success of the firm relies on hiring the right geniuses. Our solution is a technological process that standardizes and automates most of the mechanical steps in quantitative trading research. Creating a new trading strategy should be as easy and fun as playing Legos by assembling together simpler ideas. Consequently, traders can focus their attention on what they are supposed to be best at - imagining new trading ideas/strategies.

12:40pm – 2:00pm            Lunch break

2:00pm – 2:30pm            Hoi Ying WONG

Department of Statistics, Chinese University of Hong Kong

*Title: Dynamic Cointegrated Pairs Trading: Mean-Variance Time-Consistent Strategies*

Abstract:

Cointegration is a useful econometric tool for identifying assets which share a common equilibrium. Cointegrated pairs trading is a trading strategy which attempts to take a profit when cointegrated assets depart from their equilibrium. This paper investigates the optimal dynamic trading of cointegrated assets using the classical mean-variance portfolio selection criterion. To ensure rational economic decisions, the optimal strategy is obtained over the set of time-consistent policies from which the optimization problem is enforced to obey the dynamic programming principle. We solve the optimal dynamic trading strategy in a closed-form explicit solution. This analytical tractability enables us to prove rigorously that cointegration ensures the existence of statistical arbitrage using a dynamic time-consistent meanvariance strategy. This provides the theoretical grounds for the market belief in cointegrated pairs trading. Comparison between time-consistent and precommitment trading strategies for cointegrated assets shows the former to be a persistent approach, whereas the latter makes it possible to generate infinite leverage once a cointegrating factor of the assets has a high mean reversion rate. This is a joint work with M.C. Chiu.

2:30pm – 3:00pm            Cho Hoi HUI

Research Department, Hong Kong Monetary Authority

*Title: How Sovereign CDS Affect Other Market Prices? – Implications for Risk Management and Regulatory Policy*

Abstract:

Sovereign CDS spread has become an important yardstick of a country's sovereign risk. However, as the market has been dominated by 'naked CDS', some have argued that this speculative activity has played a significant destabilising role in the financial crisis. We show evidence of one-way information flow from the sovereign CDS market to the

currency option market from September 2009 to August 2011 when concerns about sovereign credit risks in the developed economies were triggered. The impact of the sovereign credit risk on the risk reversals which imply crash risk of currencies is a separable risk factor in driving the market expectation of the exchange rates after controlling other macro-financial variables. We shall discuss the interpretation of the empirical results and their implications for risk management and regulatory policy.

3:00pm – 3:30pm

Mike SO

Department of Information Systems, Business Statistics  
and Operations Management, Hong Kong University of  
Science and Technology

*Title: Conditional Quantile Estimation in Heteroskedastic Time Series Models*

Abstract:

This paper studies the statistical properties of a conditional quantile estimator under heteroskedastic time series models with the error distribution unspecified. The asymptotic distribution of the quasi-maximum likelihood estimators and the filtered empirical percentiles is derived. Three applications of the asymptotic result are considered. First, we construct interval estimator of the conditional quantile without any distributional assumption. Second, we develop a specification test for the error distribution. Finally, using the specification test, we propose methods to estimate the tail index of the error distribution, from which we can also construct a new conditional high quantile estimator. The asymptotic results and the applications are illustrated by simulations and real data analysis where we adopt our methods in analyzing daily and intraday financial return series.

3:30pm – 4:00pm

Coffee break

4:00pm – 4:30pm

Philip YAM

Department of Statistics, Chinese University of Hong Kong

*Title: Linear Quadratic Mean Field Games (LQMFGs)*

Abstract:

The theory of Mean Field Games has grown rapidly after the pioneering work by Lasry and Lions (2007). For the recent development and its applications, one can refer to, for example, the survey by Gueant et al. (2011) and the references therein. In this talk, I shall introduce a class of Mean Field Games, LQMFGs, in which both the pay-off function and cost functional are quadratic in state variable, control variable together with the mean field term; besides, the controlled dynamics is linear and also consists of a mean field term. We shall also briefly discuss about the existence and uniqueness of both the optimal control and value function of each LQMFG; indeed, we can establish the result by applying a hybrid method that combines adjoint equation approach and the theory of forward-backward stochastic differential equations. This is a joint work with A. Bensoussan, J. K. C. Sung, and S. P. Yung.



4:30pm – 5:00pm

Xinghua ZHENG

Department of Information Systems, Business Statistics and  
Operations Management, Hong Kong University of Science  
and Technology

*Title: On the Estimation of Integrated Covariance Matrices of High Dimensional Diffusion Processes*

Abstract:

We consider the estimation of integrated covariance (ICV) matrices of high dimensional diffusion processes based on high frequency observations. We start by studying the most commonly used estimator, the realized covariance (RCV) matrix. We show that in the high dimensional case when the dimension  $p$  and the observation frequency  $n$  grow in the same rate, the limiting spectral distribution (LSD) of RCV depends on the covolatility process not only through the targeting ICV, but also on how the covolatility process varies in time. We establish a Marcenko-Pastur type theorem for weighted sample covariance matrices, based on which we obtain a Marcenko-Pastur type theorem for RCV for a class  $C$  of diffusion processes. The results explicitly demonstrate how the time variability of the covolatility process affects the LSD of RCV. We further propose an alternative estimator, the time-variation adjusted realized covariance (TVARCV) matrix. We show that for processes in class  $C$ , the TVARCV possesses the desirable property that its LSD depends solely on that of the targeting ICV through the Marcenko-Pastur equation, and hence, in particular, the TVARCV can be used to recover the empirical spectral distribution of the ICV by using existing algorithms. This is a joint work with Yingying Li.

5:00pm – 5:30pm

Wei ZHOU

J.P. Morgan

*Title: Backward Induction Algorithms for Singular Stochastic Control Problems in Finance Associated with Transaction Costs*

Abstract:

Up till now, numerical solution of option hedging and optimal investment problems in the presence of proportional transaction costs has been based on discrete-time dynamic programming applied to a Markov chain approximation of the singular stochastic control problem, or on finite-difference methods for the Hamilton-Jacobi-Bellman partial differential equation. Here, we introduce a new and computationally much simpler approach based on backward induction to compute the boundaries between buying or selling stock and doing nothing. Beginning with a class of singular stochastic control problems that can be transformed to optimal stopping problems, we use this equivalence to develop an efficient backward induction algorithm. We then modify it by using coupled backward induction algorithms for applications that cannot be reduced to optimal stopping. Numerical results and convergence properties are presented for these algorithms. This is joint work with Tze Leung Lai of Stanford University and Tiong-Wee Lim of National University of Singapore.

***December 10, 2011 (Saturday)***

Venue: T2, Meng Wah campus, Hong Kong University

9:00am – 9:10am            Opening remark  
Professor Ngai Ming MOK  
Director of Institute of Mathematical Research, Hong Kong University

9:10am – 9:40am            Qiang ZHANG  
Department of Mathematics, City University of Hong Kong

*Title: An Investment Strategy for both Bull and Bear Markets*

Abstract:

The well-known Merton strategy maximizes the expected utility at the end of investment horizon. Although this strategy performs better than several other strategies, the strategy is optimal only in the sense of ensemble averaging. However, in reality, only one random path will be realized and the value of the portfolio at the end of the investment horizon could be dramatically lower than its historical high. This is evident in the recent financial crisis. We will present a new investment strategy to overcome this problem. This new strategy performs well in both good and bad economic times

9:40am – 10:10am        Jin ZHANG  
School of Economics and Finance, Hong Kong University

*Title: Is Warrant Really a Derivative? Evidence from the Chinese Warrant Market.*

Abstract:

This paper first studies the Chinese warrant market that has been developing since August 2005. Empirical evidence shows that the market prices of warrants are much higher systematically than the Black-Scholes prices with historical volatility. The prices of a warrant and its underlying asset do not support the monotonicity, perfect correlation and option redundancy properties. The cumulated delta-hedged gains for almost all expired warrants are negative. The negative gains are mainly driven by the volatility risk, and the trading values of the warrants for puts and the market risk for calls. The investors are trading some other risks in addition to the underlying risk. This is a joint work with Eric C. Chang and Lei Shi.

10:10am – 10:40am        Hailiang YANG  
Department of Statistics and Actuarial Science, Hong Kong University

*Title: Valuing T-year Contingent Options*

Abstract:

We consider the problem of valuing Guaranteed Minimum Death Benefits (GMDB) in various variable annuity and equity-indexed annuity contracts. We assume that the life contingent options will expire at a fixed time  $T$ . By using a discounted density function approach, we provide closed for expressions for the values of the contingent options. In

particular we show that the results in Ulm (2008) can be obtained easily using our approach. This talk is based on a joint paper with Hans Gerber and Elias Shiu.

10:40am – 11:10am      Coffee break

11:10am – 11:40am      Ka Chun CHEUNG  
Department of Statistics and Actuarial Science, Hong Kong  
University

*Title: On Partial Hedging and Counter-monotonic Sums*

Abstract:

In this article, we show, in the context of partial hedging, that some important relationships about comonotonicity and convex order cannot be translated to counter-monotonicity in general because of the possibility of over-hedging. We propose a new notion called proper hedge that can effectively avoid over-hedging. Different characterizations of a proper hedge are given, and we show that this notion is useful in translating relationship between comonotonicity and convex order to the case of counter-comonotonicity. As an application in an insurance context, we apply our results to identify desirable structural properties of insurance indemnities that make an insurance contract appealing to both the policyholder and the insurer.

11:40am – 12:10pm      Xun LI  
Department of Applied Mathematics, Hong Kong  
Polytechnic University

*Title: Optimal Multiperiod Mean-Variance Policy under No-shorting Constraint*

Abstract:

We consider in this talk the mean-variance formulation in multiperiod portfolio selection under no-shorting constraint. Recognizing the structure of a piecewise quadratic value function, we prove that the optimal portfolio policy is piecewise linear with respect to the current wealth level, and derive the semi-analytical expression of the piecewise quadratic value function. One prominent feature of our findings is the identification of a deterministic time-varying threshold for the wealth process and its implications for market settings. We also generalize our results in the mean-variance formulation to utility maximization under no-shorting constraint. This is a joint work with Xiangyu CUI, Jianjun GAO, Xun LI and Duan LI.

12:10pm – 12:40pm      Xuhu WAN  
Department of Information Systems, Business Statistics  
and Operations Management, Hong Kong University of  
Science and Technology

*Title: Dynamic Agency, Costly Project Search and Repeated Private Shocks*

Abstract:

I explore a new continuous-time principal-agent problem for a firm whose projects are found sequentially by a manager who exerts costly effort. Each project brings output to

the firm, subject to the manager's private shocks. These serial shocks are i.i.d and independent of the arrival time of new projects and the manager's efforts. The shocks and efforts constitute the manager's private information. During the employment period, the manager's reporting history concerning shocks drives the manager's continuation value until it reaches a minimum value, at which point she gets fired, or a maximum value, at which point the principal transfers firm ownership to her. In a pure repeated adverse-selection model with a binary-valued shock, the manager and firm's continuation values remain unchanged until a new project arrives. In the mixed model under moral hazard and adverse selection, we identify three regions of continuation value: the probation, interior and transfer domains. On these different domains, the patterns of incentive provision are completely different.

12:40pm – 2:00pm      Lunch break

2:00pm – 2:30pm      Kathryn ZHAO  
J.P. Morgan

*Title: Introduction to Algorithmic Trading*

Abstract:

Algorithmic trading started in the late 80's and early 90's as a utility tool for sell-side traders. The growth of Direct Market Access (DMA) and the shrinking of the trading floor due to the commission squeeze led to an explosion in the early 2000's. The most popular trading strategies include Volume Weighted Average Price (VWAP), Time Weighted Average Price (TWAP) and Percent of Volume (POV). The most critical part of any algorithmic trading strategies is its limit order placement model. Recent years have seen an explosion of new trading venues creating a fragmentation of the available liquidity. To obtain good executions, strategies need to be able to access all available liquidity. Smart Order Routers were created to address this problem.

2:30pm – 3:00pm      Fan YANG

School of Economics and Finance, Hong Kong University

*Title: On the Relative Pricing of Long Maturity Index Options and Collateralized Debt Obligations*

Abstract:

We investigate a structural model of market and firm-level dynamics in order to jointly price long-dated S&P 500 index options and CDO tranches of corporate debt. We identify market dynamics from index option prices, and idiosyncratic dynamics from the term structure of credit spreads. We find that all tranches can be well priced out-of-sample before the crisis. During the crisis, however, our model can capture senior tranche prices only if we allow for the possibility of a catastrophic jump. Thus, senior tranches are non-redundant assets that provide a unique window into the pricing of catastrophic risk.

3:00pm – 3:30pm

Hai LIN

Department of Accountancy, University of Otago, New Zealand

*Title: Predictability of Corporate Bond Returns*

Abstract:

This paper studies the predictability of corporate bond returns based on a comprehensive data sample for the period from January 1973 to December 2010. We find that corporate bond returns are more predictable than stock returns and investment-grade bond returns are more predictable than speculative-grade bond returns. Most strikingly, the Cochrane-Piazzesi (2005) interest rate factor captures substantial variations in expected returns of corporate bonds across ratings and maturities at both short and long horizons. Furthermore, there is strong evidence that expected corporate bond returns contain a time-varying liquidity premium related to aggregate liquidity conditions. The aggregate liquidity level predicts corporate bond excess returns largely at short horizons. This is a joint work with Junbo Wang, and Chunchi Wu.

3:30pm – 4:00pm

Coffee break

4:00pm – 4:30pm

Rhea LIU

UBS

*Title: Hedging Risks via Derivatives: A Changing Landscape*

Abstract:

After a review of the use of derivatives to hedge risks, we discuss its implications to companies and the changes of market practice before and after the financial crisis.

4:30pm – 5:00pm

Nan CHEN

Department of Systems Engineering and Engineering Management, Chinese University of Hong Kong

*Title: Computing Functions of Conditional Expectation via Multilevel Nested Simulation*

Abstract:

In this paper we investigate efficient Monte Carlo simulation to compute function values of conditional expectations. This problem finds wide applications in finance, statistics and decision sciences. However, its nested structure incurs substantial computational cost and poses a great challenge on how to allocate time budget efficiently. We present a multilevel nested simulation scheme to resolve the tradeoff between the bias and variance of the estimator: in the initial levels, most of computational time is used to reduce the variance; in the later levels, the computation focus is shifted to bias reduction and the variance is still under control with the help of knowledge built up in the previous levels. The complexity of our method is significantly less than the alternative methods in the existing literature. This is a joint work with Yanchu Liu.

5:00pm – 5:30pm

Xianhua PENG

Department of Mathematics, Hong Kong University of  
Science and Technology

*Title: Location, Location, Location! Asset Pricing Models with Spatial Interaction*

Abstract:

It is common knowledge that spatial interaction is important in modeling real estate assets, as housing prices are significantly affected by the prices of neighbors. Although there have recently been some results applying spatial statistics to empirical studies of housing markets, to the best of our knowledge, there is little theoretical work connecting classical asset pricing models such as the Capital Asset Pricing Model and the Arbitrage Pricing Theory with spatial statistics. In this paper, we propose the Spatial Capital Asset Pricing Model and the Spatial Arbitrage Pricing Theory that extend the classical asset pricing models by incorporating spatial interaction among asset returns. In addition, we derive estimators and test statistics needed to implement the proposed asset pricing models. An empirical test using the S&P/Case-Shiller Home Price Indices futures is also given, which suggests a new housing factor based on a mean-variance efficient portfolio. This is a joint work with Steven Kou and Haowen Zhong.

5:30pm – 5:35pm

Closing remark

Professor Tze Leung LAI, Department of Statistics, Stanford University