2024年度
苏州大学与西交利物浦大学
金融数学和保险精算学术交流研讨会

会议手册

苏州大学金融工程研究中心　承办

2024 年 5 月 10 日

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2024 年 5 月 10 日　报到			
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上午	09:00-09:30	**开幕式致辞：**王过京、温从华 **会议合影：**　　中心楼前	**主 持 人：**岳兴业
	09:30-10:15	**大会报告：**杨海亮	**主 持 人：**王过京
	茶歇：10:15-10:30		
	10:30-11:00	**邀请报告：**许昕	**主 持 人：**刘佳骏
	11:00-11:30	**邀请报告：**李博晗	**主 持 人：**刘佳骏
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下午	13:30-14:00	**邀请报告：**秦聪	**主 持 人：**蒋萍萍
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	14:30-15:00	**邀请报告：**徐耀飞	**主 持 人：**蒋萍萍
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	15:45-16:15	**邀请报告：**姚经	**主 持 人：**李博晗
	16:15-16:45	**邀请报告：**张喆昊	**主 持 人：**姚经
	16:45-18:00	**研究生科研成果汇报**	**主 持 人：**姚经
晚餐：18:00-20:00			

大会报告

报告题目： Insurance Fraud Detection with Unsupervised Deep Learning

报告人： 杨海亮　　香港大学、西交利物浦大学

报告时间： 2024 年 5 月 10 日 9:30-10:15

报告地点： 苏州大学本部览秀楼报告厅 105

摘要： In this talk, I will present a deep learning methodology to gain pragmatic insights into the behavior of an insured person using unsupervised variable importance. Starting with a preliminary investigation of the limitations of the existing fraud detection models, we propose a variable importance methodology incorporated with two prominent unsupervised deep learning models, namely, the autoencoder and the variational autoencoder. Both qualitative and quantitative performance evaluations are conducted. Real data sets are used to illustrate the idea and methodology. I will mention some related recent work at the end of the talk.

报告人简介： Hailiang Yang, PhD., ASA, HonFIA, received his PhD degree from University of Alberta and Master in Actuarial Science from University of Waterloo. He joined the University of Hong Kong in 1996 and is currently a Professor in the Department of Statistics and Actuarial Science.HailiangYang's research is on actuarial science and mathematical finance.He has worked with many leading figures in the field. He has supervised more than 20 research students, his graduate students are, in many cases, now well-known researchers in their own right. He is an editor of Insurance: Mathematics and Economics and associate editor of five other journals. He is an Associate of Society of Actuaries,and he was elected as an Honorary Fellow of the Institute and Faculty of Actuaries and a Corresponding Member of the Swiss Association of Actuaries in 2014. He is an elected member of the International Statistical Institute. He received an Outstanding Researcher Award from The University of Hong Kong in 2013-2014.

邀请报告

报告题目：The optimal time to liquidate a portfolio of insurance products in the presence of bankruptcy

报告人： 许昕 西交利物浦大学

报告时间：2024 年 5 月 10 日 10:30-11:00

报告地点：苏州大学本部览秀楼报告厅 105

摘要：We consider an optimal stopping problem driven by a Cramér-Lundberg process with Omega killing, which can be understood as the so-called bankruptcy event for an insurance company. The problem is essentially about choosing the optimal time to liquidate the portfolio, that is, to transfer all insurance policies to another company or otherwise terminate all policies. The payoff function has a constant penalty p for negative values and is not continuous at zero, which makes the problem harder to apply the change of measure formula and to follow the classic verification steps of solving optimal stopping problems. We show that under some mild conditions, the solutions are fully characterised where the optimal up-crossing thresholds are explicitly defined. Numerical examples are presented to illustrate the results, including the cases where explicit solutions are not available at the current stage.

报告题目：Inter-temporal DC Pension Management

报告人： 李博晗 苏州大学

报告时间：2024 年 5 月 10 日 11:00-11:30

报告地点：苏州大学本部览秀楼报告厅 105

摘要： The continuing shift from defined benefit (DB) pension plans to defined contribution (DC) plans in many countries has brought into great emphasis the optimal investment problem in DC plans, among the risk management of occupational retirement plans. However, the fund managers mostly handle their funds via an ad hoc approach or, more quantitatively, by considering the terminal-only optimization problem. Research on the existing literature largely neglects the impacts of inter-temporal reward for the manager. There are numerous reasons for this rareness, including the mathematical complexity of having a continuum number of constraints on the optimization problem. For instance, the natural inter-temporal optimal investment problem from the perspective of the fund manager is one of this kind; here the manager earns management fees proportional to assets under management (AUM, for short, a golden rule in the industrial practice) both during the interim period and at the maturity date, which maintain his or her unfailing incentive for making prudent investment decisions. The objective of this article is to completely resolve this mathematically challenging investment problem, namely, the pension management with constant contribution from fund holders in the perspective of the manager who aims to maximize the expectation of generic running and terminal utilities of the management fees collected. With the aim of the Dynamic Programming Principle, the problem is associated with a singular, fully non-linear HJB equation. One of our contributions is to develop a direct mathematical primal analysis to establish the unique existence of its classical solution by transforming the problem into a non-canonical variational

inequality problem and then solving it in a trailer Sobolev space. In addition, an efficient numerical scheme has been introduced to compute the optimal trading strategy and the value function numerically. Simulation studies also point out that the policy of charging a substantial terminal-only management fee can now be replaced by another scheme of charging a negligible amount of management fee over the interim period, without lowering the manager's satisfaction yet with a significant reduction of the total management fee paid by the clients; this interesting observation echoes the magic of the alchemy finance. Last but not least, numerical experiments also show that there are no significant advantages for one to manage the pension fund by him/herself, compared with when the fund is invested by the manager.

报告题目：Optimal Switching with Realization Utility

报告人： 秦聪 苏州大学

报告时间：2024 年 5 月 10 日 13:30-14:00

报告地点：苏州大学本部览秀楼报告厅 105

摘要： We develop a dynamic trading model where a realization-utility investor (Barberis and Xiong, 2012; Ingersoll and Jin, 2013; Dai, Qin, and Wang, 2024) has two-layered mental accounts at both the trading-account and the individual-asset levels. At the trading-account level, the investor focuses on a riskless bond and a risky stock but is subject to under-diversification by allocating her wealth to only one asset in each investing episode. At the individual-asset level, the investor derives a utility burst at the end of each investing episode from a realized gain/loss whose reference point is the counterfactual investment in the other asset. Consistent with the empirical findings, we find that the investor will optimally choose a switching policy between the stock and the bond, and is reluctant to repurchase the stock that has risen in price after a prior sale. Finally, jump risks can further lead to non-monotonic propensities to buy and sell the stock.

报告题目：Goodness-of-Fit for Conditional Distributions: An Approach Using Principal Component Analysis and Component Selection

报告人： 李愚昊 西交利物浦大学

报告时间：2024 年 5 月 10 日 14:00-14:30

报告地点：苏州大学本部览秀楼报告厅 105

摘要： This paper introduces a novel goodness-of-fit test technique for parametric conditional distributions. The proposed tests are based on a residual marked empirical process, for which we develop a conditional Principal Component Analysis. The obtained components provide a basis for various types of new tests in addition to the omnibus one. Component tests that based on each component serve as experts in detecting certain directions. Smooth tests that assemble a few components are also of great use in practice. To further improve testing efficiency, we introduce a component selection approach, aiming to identify the most contributory components. The finite sample performance of the proposed tests is illustrated through Monte Carlo experiments.

报告题目：Cross-Sectional Variation of Risk-targeting Option Portfolios

报告人： 许耀飞 西交利物浦大学

报告时间：2024 年 5 月 10 日 14:30-15:00

报告地点：苏州大学本部览秀楼报告厅 105

摘要： In the U.S., several options exchanges list option contracts on thousands of stocks, and the number of option contracts on each underlying stock differs greatly both over time and across different names. The option behavior varies not only across the different underlying names, but also across the different moneyness and maturities of the option contracts, confounding the comparative analysis. Based on a decentralized return attribution analysis, this paper constructs risk-targeting option portfolios for a given underlying stock that each targets a unit level of risk to a particular risk dimension while hedging away exposures to other risk dimensions. The paper estimates the market pricing of each risk source for each underlying stock and examines the cross-sectional variation of both the market pricing estimates and the ex post realized excess returns on each risk-target option portfolio across the large stock universe. The cross-sectional variation of the market pricing estimates strongly predicts the variation of the portfolio's future excess return in accordance with the expectation hypothesis.

报告题目：On Government Bond Yields in China: From Dynamic Term Structure Modelling to Economic Scenario Generation

报告人： 洪毅 西交利物浦大学

报告时间：2024 年 5 月 10 日 15:15-15:45

报告地点：苏州大学本部览秀楼报告厅 105

摘要： This study proposes a new algorithm framework to integrate the dynamic modelling of term structure of bond yields in China and the generation of market-consistent economic scenarios. Equipped with statistical inference, the incorporation of the unscented Kalman filter (UKF) as the learning instrument from historical data of bond yields under the multi-factor models can effectively tackle the modelling of term structure of bond yields and further enhance the performance of the in-sample model fitting and the out-of-sample predictability in bond yields. Moreover, the market views on the term structure of bond yields among investors, expressed in terms of the expected mean and variance of the distribution of bond yields, are further incorporated in this framework, which generally provides prospects of macro-economics. As such, the simulation-based economic scearnios are driven mainly by the dynamics of term structure of bond yields and aggregate market sentiments among investors about future economic growths. This algorithm-driven framework provides a new instrument for effective interest rate risk mangament.

报告题目：Time-consistent reinsurance-investment games for multiple mean-variance insurers with mispricing and default risks

报告人： 姚经 苏州大学

报告时间：2024 年 5 月 10 日 16:15-16:45

报告地点：苏州大学本部览秀楼报告厅 105

摘要： This paper studies a non-zero-sum stochastic differential game for multiple mean-variance insurers. Insurers can purchase proportional reinsurance and invest in a risk-free asset, a market index, a defaultable bond and multiple pairs of mispriced stocks. The dynamics of the mispriced stocks satisfy a "cointegrated system" where the expected returns follow the mean reverting processes, and the bond is defaultable with a recovering proportional value at default. In particular, we assume that the investment opportunities in mispriced stocks are only available for a few insurers, which is more realistic and in line with the superiority of information in the competitive market. Each insurer's objective is maximizing a function of her terminal wealth and competitors' relative wealth under the mean-variance criterion. Using techniques in stochastic control theory, we establish the extended Hamilton-Jacobi-Bellman equations and obtain the equilibrium strategies. Note that the derived solutions are analytical and time-consistent, and we verify the competitive advantages gained from investment opportunities in mispriced stocks. We represent our results in terms of the M-matrices, which help us prove the existence and uniqueness of the solutions and further explicitly analyze how the crucial arguments in the model affect the equilibrium strategies. Numerical examples with detailed sensitivity analyses are presented to support our conclusions.

报告题目：Stochastic mortality model with respect to mixed fractional Poisson process: calibration and empirical analysis of long-range dependence in actuarial valuation

报告人： 张喆昊 西交利物浦大学

报告时间：2024 年 5 月 10 日 15:45-16:15

报告地点：苏州大学本部览秀楼报告厅 105

摘要： Recently, many studies have adopted the fractional stochastic mortality process in characterising the long-range dependence (LRD) feature of mortality dynamics, while there is still fewer appropriate non-Gaussian fractional model to describe it. We propose a stochastic mortality process driven by a mixture of Brownian motion and modified fractional Poisson process to capture the LRD of mortality rates. The survival probability under this new stochastic mortality model keeps flexibility and consistency with existing affine-form mortality models, which makes the model convenient in evaluating mortality-linked products under the market-consistent method. The formula of survival probability also considers the historical information from survival data, which enables the model to capture past health records of lives. The LRD feature is reflected by our proposed model in the empirical analysis, which includes calibration and prediction of the survival curve based on recent generation data in Japan. Finally, the consequent empirical analysis of annuity pricing illustrates the difference of whether this feature is involved in actuarial valuation.

研究生科研成果汇报

汇报时间：2024 年 5 月 10 日 16:45-18:00

题目：Equilibrium indifference price of defaultable claims under mean-field and n-agent games（汇报人：谢阿遇）

摘要：This paper studies an equilibrium indifference pricing problem within the framework of an n-agent game and the corresponding mean field game. Our focus lies in examining portfolio optimization problems under relative performance criteria for investors possessing CDSs and the underlying defaultable bonds. Based on the constant Nash equilibrium result of the portfolio games, we derive the explicit formulas of indifference prices of defaultable bonds and CDSs and we investigate the impact of risk aversion and competitive attitude on the indifference prices. Finally, in a bond market without CDS, we provide insights into the establishment of market equilibrium prices for defaultable bonds through the application of the indifference pricing approach alongside the market-clearing condition.

题目：高维半线性抛物型偏微分方程的深度学习算法 (汇报人：郑晓韬)

摘要：高维半线性抛物型偏微分方程是一个广泛应用于自然科学和工程领域的数学模型。而由于“维数灾难”的问题，传统的数值解法在面对高维情况下无法求解。因此，基于随机过程的深度学习方法成为近几年重点发展的解决方案。其中，E 等提出的深度 BSDE 方法大受欢迎。同时，基于正倒向的 Feynman-Kac 公式，我们也可以将 PDEs 的解转化为两种条件期望的形式。结合正向的 Feynman-Kac 公式与深度学习，我们提出了深度 Feynman-Kac 算法；结合倒向的 Feynman-Kac 公式与深度学习，我们提出了整体训练和分时训练的倒向深度 Feynman-Kac 算法。本报告将会基于若干算例，从计算效率、计算精度和鲁棒性角度综合考量这四种算法，证明整体训练下的倒向深度 Feynman-Kac 算法具备更好的计算性能。

题目：The Maximum and Minimum of Multivariate Poisson Distribution with Dependence (汇报人：时斐凡)

摘要： In this paper, we studied the cumulative distribution functions of the maximum and minimum of three multivariate Poisson distributions. Specifically, we examine the common shock and comonotonic shock multivariate Poisson distributions, and introduce a novel distribution named thinning-dependence multivariate Poisson distributions, which is based on the thinning-dependence structure. Moreover, we conducted asymptotic analyses and validated the accuracy of all derived results through numerical examples.

题目：Pricing basket spread option pricing under skew Brownian motions: an analytical approximation approach (汇报人：仲启凤)

摘要： In this paper, we study the pricing problem of basket options and basket spread options under the skew Brownian motion model. We extend effective approximate methods from Gaussian models to skew Brownian motion. For basket options, we adopt the partial exact method to decompose prices into two components; one part can be calculated precisely, and the other requires approximation. Subsequently, we apply moment-matching and convex bounds methods to approximate the latter component. Notably, we propose a novel moment-matching random variable tailored for skew Brownian motion. Regarding basket spread options, we employ two different adjustment-based approximation methods. One entails adjusting only the exercise strategy, while the other involves modifications to the approximate exercise strategy and the terminal payoff. We utilize specific techniques to guarantee that the approximate prices are positive and sharpen pricing precision.

参会人员名单

序 号	姓 名	单 位
1	温从华	西交利物浦大学
2	杨海亮	香港大学、西交利物浦大学
3	刘佳骏	西交利物浦大学
4	徐冉	西交利物浦大学
5	许昕	西交利物浦大学
6	李愚昊	西交利物浦大学
7	徐耀飞	西交利物浦大学
8	洪毅	西交利物浦大学
9	张喆昊	西交利物浦大学
10	董迎辉	苏州科技大学
11	梁雪	苏州科技大学
12	郭洁	苏州科技大学
13	裴梓婷	苏州科技大学
14	王过京	苏州大学
15	岳兴业	苏州大学
16	钱晓松	苏州大学
17	姚经	苏州大学
18	徐玉红	苏州大学
19	秦聪	苏州大学
20	穆蕊	苏州大学
21	蒋萍萍	苏州大学
22	张婷婷	苏州大学
23	李博晗	苏州大学
24	饶楠	苏州大学
25	汪四水	苏州大学
26	余王辉	苏州大学
27	李丹丹	苏州大学
28	陈瑜	苏州大学

29	周艳荣	苏州大学
30	郝宇菲	苏州大学
31	王频	苏州大学
32	穆婉蓉	苏州大学
33	谢阿遇	苏州大学
34	杨阳	苏州大学
35	赵欣瑶	苏州大学
36	钱家瑗	苏州大学
37	仲启凤	苏州大学
38	程梦红	苏州大学
39	刘　铮	苏州大学
40	郑晓韬	苏州大学
41	霍小雨	苏州大学
42	陆智超	苏州大学
43	佘丹怡	苏州大学
44	丁　一	苏州大学
45	彭梓宸	苏州大学
46	朱乾熙	苏州大学
47	胡馨月	苏州大学
48	李颖	苏州大学
49	张天阳	苏州大学
50	李淑静	苏州大学
51	张温馨	苏州大学
52	钟立杭	苏州大学
53	时斐凡	苏州大学
54	武佳希	苏州大学
55	刘亮	苏州大学
56	吴紫涵	苏州大学
57	叶天	苏州大学
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