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Editorial for special issue on advances in Actuarial Science and quantitative finance

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Abstract
This article provides an overview of all papers published on the special issue, Advances in Actuarial Science and Quantitative Finance. The special issue is intended to collect articles that reflect the latest development and emerging topics in these closely related two areas. Topics included in this special issue range from actuarial and risk theory, to optimal control for finance and insurance, to statistical inferences of financial and insurance models, to pricing, valuation and reserving.

Keywords Actuarial science · Quantitative finance · Editorial · Best paper prize · Probability modeling · Insurance

This special issue is created in conjunction with the 57th Actuarial Research Conference (ARC), which will take place at the University of Illinois at Urbana-Champaign from August 4 to 6, 2022. The Actuarial Research Conference series is one of the premier actuarial research conferences in the world. The ARC provides an annual opportunity for academics and practitioners to meet and discuss actuarial problems and their solutions. The conference is the central meeting point in North America for academics, researchers and practitioners from all over the continent and the world to gather and address all aspects of actuarial science. The ARC promotes all topics in education, research and industry engagements. The organizers hope to use this opportunity to reflect on the latest development in the field of actuarial science and quantitative finance during the COVID-19 pandemic and

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promote the interactions and collaborations between the applied probability and actuarial communities.

The purpose of this special issue to highlight the development of innovative probability models, methodologies and applications reflecting recent trends in finance and insurance. We are pleased with the large volumes of high-quality submissions to this special issue. There are a wide range of topics that have been submitted to this special issue, including epidemiological modeling, especially pertaining to the COVID-19 pandemic, risk theory and queuing theory, asset and liability management techniques, risk measures, solvency and financial instability, Monte Carlo simulations and other computational methods, as well as emerging risks modeling and technologies (cyber, climate, machine learning).

This special issue has a rich collection of 32 articles contributed by leading authors from all over the world. It is a testimony to the popularity of applied probability and statistical modeling and analysis in the literature of actuarial and financial mathematics. While it is impossible to provide a comprehensive review of all research work in a selected collection, we believe that this special issue offers a glimpse of the growing diversity of research interests in actuarial science and quantitative finance.

The papers in this collection can be roughly divided into four groups, each of which consists of multiple topics of active research in the literature.

1 Actuarial and Risk Theory

The mathematics of life and non-life insurance occupy a central place in actuarial science. The articles below show the variety of risk models studied (classical, renewal, diffusion approximation, epidemic type, …). They also highlight the many tools and methods useful for their analysis (ruin measurements, penalty function, stochastic orders, dependency modeling, …).

On the Discounted Penalty Function in a Perturbed Erlang Renewal Risk Model with Dependence

By F. Adékambi and E. Takouda.

On the Randomized Schmitter Problem

By H. Albrecher and J. C. Araujo-Acuna.

Ruin and Dividend Measures in the Renewal Dual Risk Model

By R. G. Alcoforado, A. I. Bergel, R. M. R. Cardoso, A. D. Elgídio dos Reis, and E. V. Rodriguez-Martinez.

"Some Expressions of a Generalized Version of the Expected Time in the Red and in the. Expected Area in the Red".

By J. Callant, J. Trufin and P. Zuyderhoff.

On the Risk of Ruin in a SIS Type Epidemic

By C. Lefèvre and M. Simon.

General Draw-Down Times for Refracted Spectrally Negative Lévy Processes

By X. Huang and J. Zhou.

"Polynomial Series Expansions and Moment Approximations for Conditional Mean Risk. Sharing of Insurance Losses".

By M. Denuit and C.-Y. Robert.

"A Tail Measure with Variable Risk Tolerance: Application in Dynamic Portfolio.
Insurance Strategy".
By W. Hu, C. Chen, Y. Shi and Z. Chen.
Bivariate Sarmanov Phase-Type Distributions for Joint Lifetimes Modeling
By K. Moutanabbir and H. Abdelrahman.
Fraction-Degree Reference Dependent Stochastic Dominance
By J. Yang, C. Zhao, W. Chen, D. Zhou and S. Han.

2 Optimization and Control in Finance and Insurance

Optimal control problems for life and non-life insurance are important research areas in actuarial mathematics. Optimal investment, reinsurance and dividend payment strategies under various objectives such as minimizing the probability of ruin, maximizing the utility of the terminal wealth and the expected total discounted dividends for the insurers are main topics in recent years. Also pension management and portfolio optimization in life insurance and finance play an important role in practice. The optimal stopping theory is another research area which has been applied in finance and insurance to find the optimal stopping strategies for various purposes. In recent years, deep learning as an efficient tool has attracted more attentions. The articles are evidence of recent progress in the above-mentioned research areas and contribute to interdisciplinary studies of insurance mathematics, finance and optimal control theory.

Bond Prices Under Information Asymmetry and a Short Rate with Instantaneous Feedback

By P. Chakraborty and K. Lee.

Portfolio Selection and Risk Control for the Insurer with Uncertain Time Horizon and Partial Information in an Anticipating Environment

By F. Chen, B. Li and X. Peng.

"Optimal Double-Stopping Problems for Maxima and Minima of Geometric.
Brownian Motion".
By P. Gapeev, P. Kort, M. Lavrutich and J. Yhijssen.
Deep Learning for Constrained Maximisation
By A. Davey and H. Zheng.

"Optimal DC Pension Management Under Inflation Risk with Jump Diffusion Price Index and Cost of Living Process".

By X. Zhang.
Robust Optimal Investment Problem with Delay under Heston's Model
By Y. Zhao, H. Mi and L. Xu.
"Hitting Time Problems of Sticky Brownian Motion and Their Applications in Optimal.
Stopping and Bond Pricing".
By H. Zhang and Y. Tian.
"Optimal Mean-Variance Investment-Reinsurance Strategy for a Dependent Risk Model.
With Ornstein-Uhlenbeck Process".
By Y. Tian, Z. Sun and J. Guo.

Portfolio Optimization with a Guaranteed Minimum Maturity Benefit and Risk-Adjusted Fees

By A. MacKay and A. Ocejo.

3 Statistical Inferences for Financial and Insurance Models

There are two broad classes of financial models: discrete- and continuous-time models. Financial time series models such as GARCH have played central roles in much of the financial literature, and estimation and forecasting are primary tasks in the successful implementation of these models in practice. At the same time, continuous-time models are embedded in the theory of arbitrage-free pricing theory, which produced the advent of financial mathematics. While the complexity of the models grew significantly in the two decades after the seminal work of Black and Scholes, the statistical tools to apply them were lacking for many years. This changed substantially at the beginning of the 21st century with the advent of high-frequency financial data. Since then, statistical inference of continuous-time stochastic models based on high-frequency data has been an active research area. The articles below are prime examples of the richness and beauty of the broad area of statistical methods for financial and insurance models.

Statistical Inference for Partially Observed Markov-Modulated Diffusion Risk Model
By F. Baltazar-Larios and L. J. R. Esparza.
"Bounds on Multivariate Kendall's Tau and Spearman's Rho for Zero-Inflated.
Continuous Variables and their Application to Insurance".
By M. Mesfioui and J. Trufin.
"Estimation of Tempered Stable Lévy Models of Infinite Variation".
By J. E. Figueroa-López, R. Gong and Y. Han.
Inference for the Lee-Carter Model with an AR(2) Process
By D. Li, C. Ling, Q. Liu and L. Peng.
"Second Order Asymptotics for Infinite-Time Ruin Probability in a Compound Renewal.
Risk Model".
By Y. Yang, X. Wang and S. Chen.
On Accelerating Monte Carlo Integration Using Orthogonal Projections
By H.-W. Teng and M.-H. Kang.

4 Pricing, Valuation and Reserving

Pricing and valuation of financial derivatives on exchanges and embedded options in insurance products remain a very active area of research in actuarial science and quantitative finance. Unique characteristic of derivatives and insurance pose more complexities with the increasing diversity and sophistication of product designs. In this special issue, some adopt no arbitrage pricing framework while others take game theoretical approaches. Given the long-term nature of insurance products, reserving and liability management are also essential for insurance and pension products. These issues are also well-studied by papers in this category.

"Perpetual American Double Lookback Options on Drawdowns and Drawups with.
Floating Strikes".
By P. Gapeev.

A Numerical Method for Hedging Bermudan Options under Model Uncertainty
By J. Imai.
Valuation of Annuity Guarantees Under a Self-Exciting Switching Jump Model
By C. G. N. Leunga and D. Hainaut.
On a Markovian Game Model for Competitive Insurance Pricing
By C. Mouminoux, C. Dutang, S. Loisel and H. Albrecher.
Manage Pension Deficit with Heterogeneous Insurance
By D.-L. Sheng, L. Shi, Y. Zhao and D. Li.
Analysis of IBNR Liabilities with Interevent Times Depending on Claim Counts
By D. J. Geiger and A. Adekpedjou.
Dynamic Bivariate Mortality Modelling
By Y. Jiao, Y. Salhi and S. Wang.

Each article in this special issue collection represents a step towards the future of the discipline that we have tried to articulate in this editorial. As our community moves beyond the COVID-19 pandemic, we hope to encourage this community to continue to produce innovative work in response to the changing landscape of applied probability.

In honor of the late Professor Joseph L. Doob, an internationally renowned probabilist, the Doob Best Paper Prize has been created for this special issue. All papers submitted to this special issue have been considered for this prize. We are very pleased to announce that the paper *portfolio optimization with a guaranteed minimum maturity benefit and risk adjusted fees* by A. MacKay and A. Ocejo has won the best paper prize. The runners-up for this prize include *deep learning for constrained utility maximisation* by A. Davey and H. Zheng, *fraction-degree reference dependent stochastic dominance* by J. Yang, C. Zhao, W. Chen, D. Zhou and S. Han, and *dynamic bivariate mortality modeling* by Y. Jiao, Y. Salhi and S. Wang. Congratulations to the authors for their excellent research work!

Last but not the least, we would like to thank Professor Joseph Glaz, the editor-in-chief of the Methodology and Computing in Applied Probability, for his generous guidance and support of this special issue. Many thanks to all the contributing authors for their originality and ingenuity. Special thanks should also go to over 100 reviewers who have offered honest, meticulous, and thoughtful reviews over the course of production for this special issue, which would have not been possible without their strong dedication and tireless services.

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