

Editorial

Computational Issues in Insurance and Finance

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Comparison and cultural exchange always enrich and produce innovative and interesting results. This concept is valid in particular in the field of scientific culture and production. The awareness of how much good can come from the interaction between contiguous scientific fields such as mathematics applied to finance and insurance and statistics was the seed from which the biennial initiative materialized in the MAF—Mathematical and Statistical Methods for Actuarial Sciences and Finance Conference—and many related initiatives, such as this Special Issue entitled “Computational Issues in Insurance and Finance”.

The first six editions of the conference were held in Italy, specifically in 2004 and 2006 in Salerno, in 2008 in Venice, in 2010 in Ravello (Salerno), in 2012 again in Venice, and in 2014 in Vietri sul Mare (Salerno). The international dimension of the conference has grown over time, attracting a wider and wider audience, and acquiring an increasingly international significance. Thus, in 2016 the MAF was held in Paris, and in 2018, it was held in Madrid. The 2020 conference, which was organized to take place in Geneva, suffered difficulties due to the COVID-19 pandemic, and as a consequence, it was run by the University of Venice Cà Foscari. The tenth conference, in 2022, returned to the University of Salerno.

This Special Issue focuses on mathematics and computational statistics in various fields of actuarial sciences and finance, with a special emphasis on interdisciplinary interactions as a source of new knowledge. It is this last aspect that is the core of our MAF-related activities: mathematicians and statisticians, united by a common interest in finance and actuarial sciences, can facilitate the exchange of ideas, methods, and approaches, in a common platform, in order to enrich knowledge, improve skills, and complete and refine the scientific product.

The aspect that this Special Issue wishes to highlight is the computational aspect of this interaction, which represents one of the indispensable new frontiers with which the quantitative disciplines dedicated to finance and actuarial science must measure themselves. The approach to a complex world, in which many variables merge through connections that are very often difficult to model, poses dilemmas that computational procedures are better equipped to address and solve than others.

It is from this perspective that this Special Issue aims to offer a contribution to the scientific community, in the awareness that computational tools, especially in their most advanced and innovative version, constitute an indispensable instrument in the quest for knowledge of phenomena related to quantitative sciences of social impact.

This Special Issue contains eight papers, which present new and interesting results, both methodologically and in terms of application, with a strong computational connotation.

In the following section, the eight papers will be briefly introduced and discussed as they appear in the Special Issue.

The paper entitled *Credit Spreads, Leverage and Volatility: A Cointegration Approach* by Federico Maglione [1] proposes a new structural model in which a firm’s equity is priced as a compound call option. The reference firm is assumed to default only at discrete times that are known and coincide with the reimbursement dates of the bonds outstanding. The paper presents relevant elements not only from a theoretical point of view, particularly in



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the specification of the model, but also from a technical point of view, in the estimation technique for those variables which structural models of default predict to be the drivers for the spreads. In particular, a method is proposed to estimate two unobservable quantities such as a firm's assets and a firm's book value volatility. The results were tested by assessing the ability of the obtained estimates for asset volatility and market leverage to predict the one-period ahead CDS spreads and show a strong improvement in reducing pricing errors. Moreover, and significantly, the author sets a cointegration equation among credit spreads, "financial leverage" and "volatility of the firm's equity", showing the existence of a long-run equilibrium. The proposed methodology was validated in a large panel of US firms, thus also showing the model's ability to capture the systematic aspects of risk.

In the paper entitled *On Barrier Binary Options in the Telegraph-like Financial Market Model* by Nikita Ratanov [2], the study's aim was to overcome some limits concerning Wiener–Levy processes when applied to the pricing of binary barrier options. The proposed mathematical methodology is based on the theory of first-passage time probabilities, studying the market model by means of a jump-telegraph process. In this context, it is assumed that the jumps occur when a change in the pattern of the risky assets' price occurs. The author prices a "Cash-(At Hit)-or-Nothing Barrier Binary Option", characterized by the pay-off available when the barrier is infringed. Two interesting applications are offered in which, starting with different assumptions about constant alternating velocities and jumps, the author arrives at option pricing by assigning different values to interest rates. In addition, the author provides a methodology for choosing an appropriate martingale measure both in the case where the jump risk is not priced and in the case where the jump risk is insured.

The issue of the main factor that influences the market of housing regarding the aspects of supply and demand is studied in the paper entitled *Factors Affecting Demand and Supply in the Housing Market: A Study on Three Major Cities in Turkey* by Sheikh Abdul Kader, Nurul Mohammad Zayed, Md. Faisal-E-Alam, Muhammad Salah Uddin, Vitalii Nitsenko, and Yuliia Klius [3]. The effects of macroeconomic variables affecting this market are analyzed by means of a cointegration analysis and the vector error correction model with regard to three of the main cities in Turkey, i.e., Ankara, Istanbul, and Izmir. The authors highlight the effects of house prices, income levels, interest rates, and inflation on housing demand and the effect of building costs, house prices, and real interest rates on housing supply. Moreover, they present some meaningful considerations, from which a clear description of the housing market in these three cities emerges. As the authors consider monthly data ranging from January 2010 to December 2020, the analysis also provides insights into the effects of the COVID-19 pandemic on the housing market in Turkey.

Rüdiger Frey and Verena Köck in their paper entitled *Deep Neural Network Algorithms for Parabolic PIDEs and Applications in Insurance and Finance* [4] address the problem of solving linear and semi-linear parabolic partial integro-differential equations with boundary conditions in high-dimension and propose the use of algorithms based on deep neural networks. In this context, the proposed approach has the advantage of requiring the training of a single neural network per time step since it approximates only the solution of one equation. In the semi-linear case, the authors also develop a linearization procedure that ended up demonstrating good performance, which was evaluated in comparison to alternative procedures. Of particular interest is the second part of the paper, in which the purely theoretical aspects are applied to case studies in financial and actuarial mathematics, specifically to the reinsurance counterparty credit risk and to the optimization of credit portfolios with transaction costs. This aspect makes the paper particularly applicable to the purposes of this Special Issue.

The focus of the paper entitled *Some Remarks on Malicious and Negligent Data Breach Distribution Estimates* by Maria Francesca Carfora and Albina Orlando [5] is a cyber risk assessment. The topic is relevant in the insurance framework to the aim of adequately pricing the coverage of these events. In particular, the authors explore the updated version of the Privacy Rights Clearinghouse dataset since it provides information about the data

breaches causing the largest losses. The study aims to provide the distribution of the frequency and severity of data breaches, analyzing two categories of data separately: the malicious and the negligent ones. They quantify the cyber value at risk for both categories, identifying the extreme events as characterized by low probabilities of occurrence and strong financial consequences. The authors estimate cyber risk through the use of the VaR applied, in this context, not to assess the financial impact of the breach events but rather to assess their severity.

The paper entitled *Nonparametric Estimation of Range Value at Risk* by Suparna Biswas and Rituparna Sen [6] focuses on the range value at risk, a quantile-based risk measure that includes, as special cases, the value at risk and the expected shortfall. This risk measure is particularly attractive in financial real-world valuations and in risk management in general because it simultaneously incorporates the robustness characteristic of the value at risk and the sensitivity of the expected shortfall. The authors carefully analyze some non-parametric RVaR estimators and compare their performance in finite samples through Monte Carlo simulation. In addition, by means of backtesting analysis, they concluded that the RVaR risk measure was accurately calculated using the filtered historical method. This technique was applied to historical data by using an appropriate econometric model in order to filter out stylized aspects such as leverage, heavy tails, and volatility clustering, frequently observed in real financial time series.

The topic of non-performing loans is focused on in the paper entitled *Measuring the Recovery Performance of a Portfolio of NPLs* by Alessandra Carleo, Roberto Rocci, and Maria Sole Staffa [7]. In particular, the authors propose an interesting new method to measure the recovery performance of a portfolio of non-performing loans, considering the recovery rate and the time to liquidate simultaneously. This method is based on the estimation of a curve representing the recovery rates over time. The implemented technique is in line with algorithms usually used in survival analysis. Non-parametric statistical learning techniques, based on splines, are used to smooth the obtained curves. The performance of the proposed method was evaluated in a simulation experiment in which it was methodically compared with alternative methods. Finally, the method was applied to an interesting case concerning real financial data on existing Italian portfolios of unsecured NPLs.

Marcella Corduas and Domenico Piccolo present a paper entitled *Modelling Qualitative Data from Repeated Surveys* [8] in which they propose an innovative dynamic model, precisely the CUB one, for the probability distributions of ordered categorical variables observed over time. The authors identify the main components governing the respondent evaluation process. The proposed dynamic model provides a parsimonious parametric representation, useful for the identification of changes in the opinions expressed by the respondents and the evaluation of external economic shocks. Furthermore, by analyzing the pattern of the time-varying parameters, the authors manage to achieve significant results in order to detect similarities among the opinions of the respondents belonging to different groups on a given item. By using consumer opinion surveys, the model is applied to the consumers' perceptions and expectations of inflation in Italy. In particular, the authors examine a current and interesting issue concerning the effect of the COVID-19 pandemic on inflation sentiment and the impact of income level on the respondents' expectations.

Overall, the papers included in this Special Issue illustrate how computational approaches can be used at different levels in the fields of insurance and finance and how they can contribute to the strengthening of research in these areas.

In conclusion, we would like to thank all of the authors for submitting their valuable works to this Special Issue and we are very grateful to all of the reviewers for their critical remarks and suggestions, which helped to improve the quality of the published papers.

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