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EDITORIAL

Multi-objective optimization models in finance and investments

Michalis Doumpos[1] · Constantin Zopounidis[1,2]

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Since the pioneering work of Harry Markowitz on the mean–variance portfolio selection model that was introduced in the 1950s, optimization models have played a key role in financial decision making. The field of finance as well as the related area of insurance, pose several challenges for developing and applying sophisticated optimization approaches. Among others, one can note the deep uncertainties and the dynamic environment that characterize financial problems, the various actors involved (e.g., investors, managers, regulators), the interconnectedness of the global financial markets and their complex interactions, as well as the diversity of financial products and the big data that are now available to financial decision makers.

In this context, optimization models with multiple objectives are particularly relevant, because a single decision factor can hardly describe in a satisfactory manner the complexity of financial decisions. For instance, in the well-known problem of portfolio selection, typically return and risk are the two decision criteria. This bi-objective framework has been extensively considered in the literature and is widely used in practice. However, risk is a multi-faceted concept with different sources, including systematic, unsystematic, and systemic components. This fact has led to the introduction of various risk measures, beyond the variance of returns. Moreover, the individual policies of organizations and investors (e.g., liquidity, diversification, etc.), as well as emerging issues such as social responsibility and regulatory requirements, nowadays play a key role in financial decision making. The multi-faceted nature of these conflicting dimensions raises many methodological and practical challenges, which have attracted much interest among researchers in operations research and management science.

The goal of this special issue is to present the recent advances regarding the development and application of multi-objective optimization approaches in financial decision making. After a rigorous review process, five papers have been selected to be published in this special issue. Four of the accepted papers involve portfolio optimization. The special issue

✉ Michalis Doumpos
mdoumpos@dpem.tuc.gr

Constantin Zopounidis
kostas@dpem.tuc.gr

1 Financial Engineering Laboratory, School of Production Engineering and Management, Technical University of Crete, University Campus, 73100 Chania, Greece

2 Institute of Finance, Audencia Business School, 8 route de la Jonelière, B.P. 31222, 44312 Nantes Cedex 3, France

starts with the paper by Cesarone, Scozzari, and Tardella. The authors extend the traditional mean–variance portfolio selection framework through the introduction of a novel risk diversification approach. The proposed model constructs portfolios that are best diversified on a subset of assets and are globally optimal with an appropriate performance measure. This diversification-optimization framework is modeled as a nonlinear mixed integer problem, which is solved through an efficient and accurate heuristic. Empirical results demonstrate the superior performance of the proposed approach compared to standard techniques.

In the second paper, Caçador, Dias, and Godinho present new mean–variance optimization models using techniques from the area of robust optimization theory. Relative-robust and absolute-robust portfolios are constructed without estimating expected returns. Extensive computational testing on data from European stocks show that the new models outperform other established benchmarks.

The third paper by Ruiz, Saborido, Bermúdez, Luque, and Vercher, presents a portfolio selection model in which the uncertainty of the returns is modeled through fuzzy variables. The model is formulated in a tri-criterion setting with objectives related to the expected return, loss aversion, and a deviation measure of risk. For the optimization process, three evolutional multi-objective algorithms are considered, with special genetic operators to handle cardinality and other portfolio constraints.

In the fourth paper, Methling and von Nitzsch examine the performance of thematic portfolios, which consider the investors' personal beliefs and ethical concerns, socio-economic trends, and trading on various emerging themes, thus extending the traditional portfolio selection framework through the introduction of non-monetary objectives. Such investment strategies have attracted much interest among institutional investors and investment funds. The study uses a multi-objective optimization approach to examine the efficiency and performance of thematic portfolio investing.

The special issue closes with the paper by Salas-Molina, Rodriguez-Aguilar, and Pla-Santamaria, which involves cash management systems in financial institutions. The authors develop a general stochastic goal programming model that considers multiple goals, as well as the uncertainty in expected cash flows. The proposed model is illustrated through a case example using goals related to cost, risk, and cash balance stability.

Closing this editorial, we should express our sincere thanks to the authors whose contributions have been essential in completing this special issue. We should also acknowledge the support of all reviewers who devoted considerable time to provide critical evaluations, insightful comments, and constructive suggestions for the submitted papers. Without their help it would be impossible to achieve this issue's high standards.

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