Editorial

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Biographical notes: Woo Chang Kim is an Associate Professor in the Industrial and Systems Engineering Department at Korea Advanced Institute of Science and Technology (KAIST) and Head of KAIST Center for Wealth Management Technologies. He serves on the editorial boards for several journals, including *Quantitative Finance*, *Journal of Portfolio Management*, *Optimization and Engineering*, and *Quantitative Finance Letters*. He is a member of the Voting Rights Committee and the Fund Management Refinement Committee for Korea's National Pension System, member of Technology Advisor Group for Financial Services Commission, and Advisor for Samsung Asset Management. He earned his BS and MS degrees from Seoul National University, and PhD from Princeton University.

Jang Ho Kim is an Assistant Professor of Industrial and Management Systems Engineering at Kyung Hee University and member of KAIST Center for Wealth Management Technology. He is on the editorial advisory board of the *Journal of Portfolio Management*. He received his Doctorate in Industrial and Systems Engineering from KAIST where he gained research interest in portfolio management, especially in robust portfolio optimisation. Prior to earning his doctorate, he worked in the Electronic Trading Unit of Bank of America Merrill Lynch in New York City. He obtained his MEng and BS in Computer Science from Cornell University.

Optimisation has always been a key component of financial modelling. Application of optimisation in finance includes finding the optimal investment, optimal portfolio, optimal risk factors, and optimal asset values, among others. In particular, the development of mean-variance portfolio optimisation by Harry Markowitz was followed by extensive research in financial optimisation by academics and practitioners of financial engineering. Consequently, advancements in robust optimisation, multi-stage optimisation, and stochastic programming have been applied to various stages of investment management including portfolio selection, asset allocation, and asset-liability management. Optimisation is effectively applied to portfolio construction because

investors' utility or investment objectives can be expressed as convex functions and many investment constraints can be added to the model without affecting its tractability.

The wide application of optimisation in finance is also evident in this special issue. The special issue presents research in topics that are gaining much interest by investors such as factor-based investing, smart beta strategies, goal-based investing, and machine learning. The studies presented here will provide recent advancements in investment management and illustrate the value of optimisation in those developments. Furthermore, this issue contains contributions from leading researchers in academia and investment firms, and thus readers will be able to gain practitioners' insights as well.

In the first paper, optimisation is used for regime detection based on trend filtering, a technique often employed in machine learning. The trend filtering algorithm is able to filter out noise in a time series data and extract signals of a trend, which are regime identifications in this case. The paper demonstrates separating the US market into two regimes based on movements in S&P 500 and expected inflation. Trend filtering is shown to be effective at estimating downside risk and therefore improves the robustness of mean-variance models with a single-regime assumption.

In the second paper, a multi-stage portfolio optimisation model is derived when incorporating an alpha that is composed of two signals, short-term and long-term signals. The short-term component better predicts the returns at the end of a rebalancing period but decays quickly whereas the long-term component has less predictive power but more persistence. Here, alpha is formulated as having two components with each signal following a first-order autoregressive process. The paper discusses practical implementation of the model that solves a sequence of two-stage problems where only the first-stage solution is executed.

The next paper also studies portfolio optimisation in a multi-stage setting; portfolio optimisation is extended to address personalised wealth management. Since individuals have investment targets, the asset-liability management framework is suitable for comprehensively modelling income, investment goals, and consumption goals of individuals. The model introduced in this paper is formulated as a stochastic programming problem with the objective being minimisation of expected shortfall of investment targets. The paper illustrates several examples of personalised retirement planning where an investor's financial situation is fully reflected in their proposed formulation.

Application of optimisation in fixed-income securities is studies in the fourth paper. In particular, the paper addresses creating fixed-income exchange-traded funds (ETFs) and its challenges due to low liquidity in bond markets. The paper develops an optimisation-based approach for replacing current ad-hoc methods for ETF creation. The optimisation problem is formulated as a utility maximisation where the utility of the chosen fixed-income portfolio increases with attractiveness such as liquidity and decreases with larger tracking error, and this formulation is shown to increase efficiency compared to current practices.

In the final paper, building blocks of portfolio optimisation are discussed by investigating the value of factors within a portfolio construction framework. The paper shows theoretically and empirically that while factors or smart beta strategies may be valuable as individual investments, they are not appropriate candidates for portfolio building blocks.

Finally, we would like to thank all the authors for contributing their work and also send our special gratitude to Professor Frank J. Fabozzi for his advice and contribution in putting together this special issue.