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Application of Fuzzy Logic in Portfolio Management: Evidence from Iranian Researches

Meysam Kaviani[1],* iD **, Seyed Fakhreddin Fakhrehosseini[2]**

[1] Department of Financial Management, Tonekabon Branch, Islamic Azad University, Iran; meysamkaviani@gmail.com;
[2] Department of Business Management, Tonekabon Branch, Islamic Azad University, Iran; f_fkm21@yahoo.com.

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Abstract

Over the past decades, financial researchers have proposed different methods in portfolio selection, so that, Markwotiz [1] introduced risk and return criteria for a portfolio selection. Since it is difficult how to select an adequate stock portfolio, fuzzy models have been able to help researchers by considering uncertainty. In this research, we surveyed a portfolio management by reviewing the relevant literature of fuzzy model in financial management. The results showed that a fuzzy model can to determine an optimal portfolio.

Keywords: Fuzzy Logic, Portfolio, Optimization.

1 | Introduction

Portfolio is important because it is related to profitability and can lead to higher profits by providing a better model for portfolio selection. The first model for the portfolio problem was proposed by Markwotiz [1]. He stated that a rational investor not only focus on maximizing portfolio returns but also focuses on returns and risk [2]. Our decisions are made in conditions of uncertainty because investment environments are uncertain and financial markets are often accompanied by incomplete information. Fuzzy collections are one of the powerful tools to deal with uncertainly financial markets and predict investor's behavior. One of the most important features of these models, like humans, is the ability to intelligently design patterns to process qualitative information. These models, in fact, while creating flexibility in the model, take into account factors in the model such as knowledge, experience and human judgment and provide fully practical answers [3]. In recent years, with development of theories of using fuzzy logic in financial researches, we have seen the development of use of this model in domestic researches. Therefore, this article intends to refer to some of these researches in order to better understand the fuzzy models in investment decisions under portfolio management branch. Therefore, this article consists of three sections: Introduction to fuzzy logic, portfolio management, and the function of fuzzy model in portfolio management with research approach.

2 | Fuzzy Logic

The theory of fuzzy sub-sets constitutes a very wide context in which to situate multivalent logic. Their origin can be found in the works, which in 1965 were developed by Zadeh [4], professor at the University of California, and today constitutes a mathematical theory constructed in all rigor that allows for the treatment of subjectivity and/or uncertainty. Its development has brought up an epistemological problem in the sense that is it better to use a certain model, which is unlikely to represent reality, or a fuzzy model that constitutes a valid reflection. In our understanding, it is necessary to observe economic and financial phenomena and determine their nature. It will be when they are presented in a fuzzy, vague manner, with limits that it will be necessary to use fuzzy mathematics. But we should not fall into the temptation of converting into fuzzy that which is not, but neither should we qualify as certain that which appears as fuzzy. Knowledge of the fact, persons and things is situated at different levels the specification of which is difficult. Between perfect knowledge of a phenomenon and total ignorance, knowledge that is more or less imprecise can be found.

3 | Portfolio Management

Investment management includes two main topics: Securities analysis and portfolio management. Securities analysis includes to estimate each investment portfolio's benefits; while portfolio management includes to survey investments composition and investments management maintenance. Over the past decade, stock selection methods in investment topics have been shifted to portfolio management [5].

One of the most important issues in financial sciences is optimal portfolio selection, in which to achieve specific goals, are distributed a specific capital among the assets. In traditionally portfolio selection approach, when an investor invests in securities with the highest expected return that his aim to be obtain the highest expected return. But in 1952, this view was challenged by Markwotiz [1]. In his view, it is irrational when an investor just pays attention to stock returns. Because in addition to maximizing stock return, the investor must be sure that it will be realize. On the other hand, if investors are only looking to maximize their returns, then they should only invest in a specific type of asset with the highest returns. According to Markwotiz, investors should pay attention to both phenomena of risk and return at the same time. Accordingly, investors are faced two conflicting goals that they must balance them against each other [6]. In today's world, however, investment challenges are uncertainty in the future. What will be happened in the future about investment environment and what will be impacted these events? The traditional approach to uncertainty is to consider the return on assets as a stochastic factor. But this approach will impose unrealistic assumptions on optimal portfolio selection and will lead to many problems about finding the random distribution and related parameters. But we can done modeling more simply and efficiently this uncertainty by fuzzy logic. Experts' opinion is easily included in the model using fuzzy logic. Due to the fuzzy logic efficiency to take into account expert opinions and uncertainty in financial markets, one of the useful solutions for modeling return on assets in portfolio problem is using that approach. So, researchers have concluded that fuzzy logic can be useful, in which returns are considered as a fuzzy number. In next section, function of this model in portfolio management is discussed.

4 | Fuzzy Logic and Portfolio Management

There is a lot of research on portfolio optimization. Given uncertainty in financial data, fuzzy logic tools help us to have a more accurate estimate in the future. Hence in our country as well, in this field various researches have been done that the results are remarkable. For example, Shams Lahroudi et al. [3] dealt with affecting factors to selection of optimal portfolio by integrated fuzzy MCDM techniques. Didehkhani [7] showed the multiobjective portfolio rebalancing model with fuzzy parameters is solved by fuzzy goal programming and a hybrid intelligent algorithm that combines fuzzy simulation with a genetic algorithm. The results in their paper demonstrated the effectiveness of the solution approach and efficiency of the model in practical applications of rebalancing an existing portfolio.

Khanjarpanah et al. [2] expressed portfolio selection always has been one of the interesting subjects in financial problems and markets. In this paper, the proposed model for evaluating, performance testing and logicality approved, is applied to some monthly return of company's stock of Tehran Stock Exchange and the results is reported. The results showed that in lower values of confidence level in proposed portfolio problem, it's possible to obtain a higher profit with low risk.

Ghehi et al. [8] remarked the multi-period models running by MOPSO algorithm indicated for the models Mean-AVaR, Mean-Semi Entropy, and Mean-VaR, respectively, performed better, in terms of Sharpe and Treynor measures.

Jafaria and Dezfouli Khajehzadeh [6] explained investment portfolio selection as one of the most important issues raised in the area of financial engineering Mean-Variance model revolutionized portfolio selection problems. They showed a multi-objective portfolio selection model is considered including the uncertainty data. In particular, the aim of their paper presented a robust-fuzzy multi-objective model for portfolio selection. After presenting multi- objective optimization approach, robust optimization approach and fuzzy optimization approach, fuzzy-robust multi-objective model for portfolio selection is expressed. Finally, using real data to solve the proposed mode. Behnamian and Moshrefi [9] considered fuzzy concepts in the discussion of portfolio selection optimization in order to pursue this uncertainty. Then by using Bonison method, they determined priority and preference among the portfolios so that the investor can decide without confusion and finally through introducing combined metaheuristic algorithm for variable neighborhood search and genetics, can optimize the resulting model of previous process and comparing it with other solving algorithms. Fallahpoor et al. [5] showed that there is a significant difference between the mean of monthly sharpe ratio of 3, 5 and 50 shares portfolios obtained from the proposed model and Markwotiz model. However, there is no a significant difference between the mean of monthly sharpe ratio of 10 shares portfolio obtained from the proposed model and Markwotiz model. Nabizade and Behzadi [10] indicated that the proposed approach is well-suited, especially for portfolio models with higher moments. Conclusion: The findings showed that using entropy as a diversification index cannot cause any significant decrease in optimized values for other goals. Using Shannon entropy and Gini-Simpson entropy models can lead to an increase in return and Shannon entropy model can yield more diversification compared to Gini-Simpson entropy model Nabavi Chashmi and Yousefi Kerchangi [11] explained regarding to exerting the model in two unique investment companies during the years 2008 through 2009, research results represent that model application can provide a particular position for better and more precision adjustment recognition of investment companies portfolio in order for easier decision making of investors.

5 | Conclusion

Portfolio selection is one of the fascinating issues in uncertainty planning. In recent years, we have seen studies in finance's field, in which extensive research has been done in portfolio selection and various methods have been presented for stock selection. One of these models has been using fuzzy approaches, which indicates its function in increasingly portfolio management efficiency. Therefore, it is expected that mutual funds managers will achieve to desirable return in the least risk and the shortest time by recognizing this application.

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