

Research on Capital Portfolio Decision Based on Fuzzy Decision-making Theory

Lijuan Yao^{1, a}

¹ Nanchang Institute of Science & Technology, Nanchang, 330108, China

^a ylij1984@163.com

Keywords: capital portfolio; investment portfolio; fuzzy decision-making theory

Abstract: In the financial market, investors should combine the subjective desire and the knowledge of experts in the decision-making process, and apply it to the portfolio. The fuzzy decision-making theory provides a good solution to this problem. This paper uses fuzzy decision theory to study portfolio selection problem, and analyze the basic process, model establishment and expected revenue to provide some references for the relative researchers.

1. Introduction

From a narrow sense, portfolio is a package of securities that stipulates the proportion of investment [1]. A single stock can also be regarded as a special portfolio. People invest, in essence, in the uncertainty of the income and risk of choice. The portfolio theory describes these two key factors by means of mean variance. The mean value refers to the expected return rate of the portfolio, which is the weighted average of the expected return rate of a single stock and the corresponding proportion of the investment. Of course, the earnings of the stock include two parts: dividend payout and capital appreciation. The so-called variance refers to the variance of the rate of return of the portfolio. We call the standard deviation of the rate of return as the volatility, which portrays the risk of the portfolio. Portfolio theory studies how "rational investors" choose to optimize portfolios. The so-called rational investors refer to such investors: they maximize the expected return to the regular risk level, or minimize the expected risk under the regular expectation level. Therefore, the above optimized investment is depicted in a two-dimensional plane with the fluctuation rate as the horizontal coordinate and the yield of the longitudinal coordinate, forming a curve. There is a point on this curve, which has the lowest fluctuation rate, which is called the minimum variance point. The part of the curve above the minimum variance point is the effective boundary of the famous portfolio, and the corresponding portfolio is called the effective portfolio. The effective boundary of the portfolio is a monotonically increasing convex curve. In practical applications, limiting the effective boundary of the short selling portfolio is much more complex than the case allowing short selling, and the amount of calculation is much larger. On the two dimensional plane of volatility yield, any portfolio is either on the effective boundary or under the effective boundary. Therefore, the effective boundary contains all the optimal portfolio, and the rational investor only needs to choose the portfolio on the effective boundary [2].

2. Fuzzy Decision-making Theory

2.1 Summary of Fuzzy Decision-making Theory

Fuzzy decision is the mathematical theory and method of making decision under the fuzzy environment. Strictly speaking, most of the real decisions are fuzzy decisions. In the study of fuzzy decision method, the expected value of the intuitionistic fuzzy number is usually used as an important index to measure its advantages and disadvantages. At present, scholars have given the definition of the expected value of intuitionistic fuzzy numbers from different angles. For example, the expected values of the intuitionistic fuzzy number are defined according to the algebraic operation of the membership function and the non-subordinate function. According to the geometric center of gravity of membership function, non-membership function and hesitant function, we define the expectation

value of intuitionistic trapezoid fuzzy number, and give a new fuzzy multiple attribute decision making method. Influenced by many uncertain factors such as the international situation and the enterprise itself, the variables such as turnover rate, return rate and risk value cannot be measured accurately. Intuitionistic fuzzy sets can describe the fuzzy uncertainty of things more finer than those without considering hesitation. Therefore, it is more important to use intuitionistic fuzzy sets to study investment decisions. Some scholars use the intuitionistic fuzzy theory to study the membership function and the non-subordinate function of the portfolio problem to determine the proportion of the portfolio. In this paper, a new intuitionistic fuzzy decision method based on the improved intuitionistic trapezoid fuzzy number expectation is given and applied to the investment decision. After a given set of programs and a variety of objective functions and constraints, the search for the optimal solution becomes an optimization problem. If the objective function or constraint condition is fuzzy, the optimization at this time is called fuzzy optimization. One way of russification of objective function is to use fuzzy number as the objective function value, and to find the Condition Extremum through the analysis and operation of the fuzzy number. The russification of constraints is a definition of a constraint as a fuzzy set. In linear programming, this generalization results in the research of fuzzy linear programming, and the result is that the application of ordinary linear programming is wider and more flexible to adapt to various situations [3].

2.2 Comparison of Fuzzy Decision-making Theory and Risk Decision-making Theory

In the uncertain decision, there are many disputes about risk decision and fuzzy decision. There is a view that there is a certain overlap between the fuzzy decision and the risk decision. Another view is that fuzzy decision is not a special and complex risk decision. The separation of risk decision and fuzzy decision. This view holds that there are different mechanisms for fuzzy decision making and risk decision. Fuzzy decision two order probability theory that the risk assessment decision does not exist two order probability, and individual scenarios used in the fuzzy probability mode of thinking was characterized, and the risk decision of subjective probability and objective probability processing, from this point of inference, fuzzy decision and risk decision between the two different psychological mechanism. Methionine allele in patients with obsessive-compulsive disorder injury only fuzzy decision is affected, the risk decision-making ability influence is not significant, that the prefrontal cortex dysfunction associated and through the technology also found under fuzzy condition selection can predict the activation of lateral prefrontal cortex, while the risk preference activation region in the parietal cortex. In addition, there is also evidence that the neural mechanisms of fuzzy decision making and risk decision are different in some other studies. The striatum is associated with reward expectations by element analysis technology research on uncertain decision making in the field of the existing inspection, found that there are significant differences in the activation of frontal regions risk decision and fuzzy decision making, these findings provide the basis for the separation of neural circuits to risk decision and fuzzy decision making, but also reflects the different participation in the process of heat emotion and cognition of the cold. Risk decision-making is a thermal cognitive process, including the emotional participation of meaningful rewards and wins and losses. Fuzzy decision-making is a cold cognitive process, with less emotional participation and less risk and reward. Human decision-making process is regulated by the biological signals of decision-makers expressing their emotions and emotions. Therefore, emotional and emotional deficiency plays an important role in decision-making impairment [4].

2.3 Research Progress of Fuzzy Decision-making Theory

Fuzzy decision is a decision making when people cannot give a definite result and the probability of the occurrence of this uncertain result is also unknown. As the research of fuzzy decision is becoming more and more rich, the theory of fuzzy decision is gradually improved. The decision-making preferences in the scene is dependent on visual representation, fuzzy probability interval to characterize the ratio of risk probability is more complicated; with reduced uncertainty, decision reaction time decreased, and the rate of correct decision can be improved; experimental results show that the EEG activation of the decision making in different degree of ambiguity when the

show is not the same, the reference point is dependent on the relative. Time pressure compared with no time pressure caused a higher level of autonomic nerve activity, resulting in insufficient time under the pressure of emotional arousal, the subjects made an adverse decision behavior, no time pressure was conservative in the decision-making behavior, time pressure to subjects of risk in decision-making behavior. When a decision maker makes decisions in the case of the other, it is necessary to apply the game theory. If both parties accept certain fuzzy constraints in selection strategy, which requires the application of fuzzy game theory.

3. Capital Portfolio Decision Based on Fuzzy Decision-making Theory

3.1 Venture Process

It is the prerequisite for investment to find the right projects and obtain investment opportunities. According to the project plan to judge the development potential of the enterprise, the market value of technology and other factors, the initial screening of the project is carried out. After initial screening, investors need to make a practical investigation of the project, and check and evaluate each item according to the items listed in the evaluation book, so as to verify the accuracy of the material of the risk enterprise. After completing the project evaluation, the investor negotiated with the entrepreneur on the selected items, and made clear in the contract agreement on the responsibilities and obligations of both parties. After signing the capital injection, Vc firm should take part in the operation and management of enterprises, so as to help Vc firm with their expertise and rich social resources to help them reduce risks. In order to ensure continuity of capital chain, Vc firm often withdraw from public market and merger and acquisition to maximize its own interests after successful investment. Broadly speaking, the real option is a kind of thought, representing a right of choice in the future. It is mainly a way of thinking, introducing the rules of financial market into the strategic investment decision of an enterprise. When people apply the idea of options to the evaluation of investment decisions, they tend to be successful. The research on real option pricing has become active, and the pricing of portfolio options has also been developed. For a series of real options, the existence of subsequent options can effectively improve the value of the underlying assets of the preceding option, and the execution of the former real option may change the state of expansion or contraction of the underlying assets, thereby changing the value of subsequent options. Therefore, the value of combined real options is not additive. The portfolio value of a group of real options contained in an investment project cannot be added to the value of a single option.

3.2 Model Establishment

We assume that the market is frictionless, that is, it does not consider the transaction cost and the dividend. Dividends and capital gains are taxed, and the market does not allow lending and short selling, but only one risk-free interest rate is affected by various factors. In fact, the securities market is not in a state of equilibrium. As a result, it is possible for us to gain excess investment from the market and also take on the risk of loss. It is clear that every investor wants the portfolio to produce the highest expected rate of return and the least risk. However, the theory and practice show that the securities investment returns, risky securities often contains large, at this time, investors will need to test the individual's intelligence, courage and experience test of investors under the uncertain market environment of risk attitude, which can be done by the utility curve to describe the investment. It may be possible for investors to keep a prudent and conservative attitude towards securities investment. For the portfolio problem, the model is usually a convex two order programming, so there is a global optimal solution. Given the investor's risk aversion coefficient b , the solution model can get the portfolio suitable for investors. However, the risks and benefits of securities investment is dynamic, rational investment decisions should be based on their own preferences and evaluation of the current situation of the securities market, timely adjustment of the risk aversion coefficient, to develop in line with their own needs and the optimal portfolio strategy with objective reality. In general, the greater the risk aversion coefficient means, it means that investors are more inclined to be conservative. At this point, the risk of portfolio investment will be reduced, but at the same time the income will be

reduced. As we all know, every investor who participates in the securities market is pursuing profits as the ultimate goal. Therefore, investors should weigh the risk and earnings to choose the appropriate risk aversion coefficient.

3.3 Expected Earnings

Financial theory describes the nature of financial assets by using two aspects of income and risk. In the same way, the income of an entity project can be measured with its yield, and the risk is defined as the uncertainty or volatility of the rate of return. If the rate of return of a single project is regarded as a random variable, its average and variance can be used to measure the level of income and the level of risk. The mean and variance of a number of projects can be calculated by a certain weight calculation to get the benefits and risks of the project portfolio. The benefit of the project investment also contains the risk, which is usually proportional to the income and the risk. Therefore, faced with many investment projects, the important decision of investment companies is to choose a reasonable portfolio and investment ratio to meet their benefits and risk preferences. Breakeven analysis, sensitivity analysis and probability analysis can describe the impact of single project investment risk on return, but the risk analysis results of different projects cannot be accumulated, making the risk of project portfolio difficult to measure. From the angle of relevance, negative correlation, that is, investment decentralization can dissolve or reduce risk. But in real market operation, there is a discrepancy between normal distribution theory and practice. That is, the way of normal distribution theory does not fully describe the movement of market price. However, based on the normal distribution method, a set of more complete theoretical system has been formed for a long time, with the more mature application of some correction methods and mathematical tools. For example, the instability of the variance can be explained and corrected by the no equilibrium random process. Therefore, in many fields, its living space is still very large. But in the face of an effective market, capital price movement has a stern fat tail character. The traditional Brown movement and Gauss distribution as a description tool are likely to have large deviations. The results show that the application of the stable distribution method will bring more profits for the investment production.

4. Conclusion

Project investment decisions are usually based on a large amount of information collection and finishing deliberation on the draft more reasonable decision, and difficult to distinguish the pros and cons level scheme among decision makers rely on each one has its own merits, their ability to experience and intuition accumulation. There are many factors affecting the choice of the scheme. In the process of making use of this method, the sensitive factors should be considered synthetically according to different projects.

Acknowledgement

The work is partially supported by the Science and Technology Project of Jiangxi provincial educational department of China (Grant No. GJJ151602).

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