

Enterprise Value Evaluation Based on Fuzzy Real Option Pricing Model

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Abstract: *With the continuous progress and development of my country's market economy system, my country's market economy is showing unprecedented prosperity. More and more companies are appearing in market competition to achieve common progress and development with the market economy. Enterprise value is the basis for an enterprise to survive and develop in the market, and it is also an important basis for investors to integrate funds. The addition of fuzzy numerical theory is conducive to scientific and effective enterprise value evaluation results. This article mainly starts from studying the theory of real option pricing model and analyzes the definition of fuzzy real option pricing model. Through the analysis of the status quo of fuzzy real option pricing models, we summarize the shortcomings of model theory in practical application, and put forward feasibility opinions or suggestions for fuzzy real option pricing models, so as to better conduct corporate value evaluation work and increase the effectiveness of evaluation results. Enabling corporate investors and managers to grasp corporate value data, so as to make scientific and reasonable investment.*

Keywords: *fuzzy theory; option pricing; corporate value; evaluation analysis*

1. Introduction

As a product of the development of the financial market, enterprises quickly entered people's vision. With the continuous development of world economic liberalization and integration, the ties between the economies of various countries have become closer and closer. As there are many uncertain factors in the real society, market changes are rapid and complex. Accelerating the exposure of financial market instability and complex change processes has made more and more financial professionals aware of the rapid changes in the financial field. Investors and managers will use relevant corporate value evaluation methods to carry out their work before conducting specific investment work. The real option pricing model was born from this, to maximize investment benefits as much as possible, and to summarize the experience of promoting enterprise development. However, there are certain shortcomings in the theory of real option pricing models. The addition of fuzzy theory to assist the process of enterprise value evaluation will help increase the scientificity and credibility of the data^[1].

2. Overview of fuzzy real option pricing model

Enterprise value evaluation needs to be carried out in a relatively scientific way and comprehensively analyze the enterprise value in order to obtain scientific data. This part mainly introduces the evaluation methods that can take into account the various factors that affect the value of the enterprise, and calculate the results of the enterprise value evaluation more accurately, to meet the multi-faceted consideration of the enterprise operators and managers on the evaluation results, and to avoid investors to a certain extent And the investment risk of managers^[2].

2.1. Real option pricing model

The results of enterprise value assessment can help managers adjust the direction of business management at any time, so that investors have a basic judgment about the risks of their investment projects. So the real option pricing model was born. Real To a certain extent, the emergence of the real option pricing model overcomes the shortcomings of traditional enterprise value evaluation methods. Extends the content of enterprise value evaluation, starting from more angles, considering the factors of

enterprise value evaluation. After years of development and practical testing, the model has gradually formed a scientific theory, applied to more fields, enriched financial mathematics to a certain extent, and promoted the connection between the real option pricing model and the corporate value index^[3].

After many years of development, the option pricing model has not concluded a general theory. Relatively speaking, there are three types of real option pricing models with the highest application level. Among them, the partial differential method is the most common, and the dynamic programming method and the simulation method are complex and strict. Among them, the Black-Scholes option pricing model requires that the price of financial assets maintain a log-normal distribution in actual use. During the validity period of the option, financial asset returns need to remain stable, taking full account of interest rate factors, among which the financial market environment remains stable and there are no other risks. Black-Scholes differential equation:

$$\frac{\partial C}{\partial t} + r_f S \frac{\partial C}{\partial S} + \frac{1}{2} \frac{\partial^2 C}{\partial S^2} \sigma^2 S^2 = rC . \quad (1)$$

The binary tree model is simple and easy to understand. Monte Carlo simulation requires multiple experiments, and the inferred average value tends to approach the theoretical value. The above three real option pricing models are the most widely used models. After a lot of practical exploration, the actual effects of the Black-Scholes model and the binary tree model are significant, and the evaluation effects of the two models are highly credible^[4].

2.2. Fuzzy real option pricing model

Many uncontrollable factors will appear in the process of carrying out the enterprise value evaluation work, and the enterprise value evaluation work will be affected. The traditional real option pricing model system has fixed values and many requirements, which cannot meet the needs of actual enterprise value evaluation. Traditional real option pricing models need to consider absolute conditions. In the actual evaluation process, the Black-Scholes model and the binary tree model cannot consider factors such as market and dividends, and the evaluation results are limited. To a certain extent, they are idealized enterprise value evaluation methods. Monte Carlo simulation requires repeated verification and evaluation results, which is time-consuming and labor-intensive. Real option pricing models are subject to certain conditions, which affect the results of enterprise value evaluation. Therefore, people use fuzzy real option pricing model theory to improve the objectivity of the enterprise value evaluation results^[5].

Fuzzy theory refers to the consideration of uncertainty in the process of enterprise value evaluation. In the actual evaluation work, the factors affecting the evaluation are affected by the external environment and will change. When investing in the project, the initial value of the discounted cash flow and the cost at the beginning of the investment will have a budget, which will be affected by the actual situation. After a lot of theoretical calculations and practical exploration, will choose to add trapezoidal fuzzy value or standard three. The linear universe of angular fuzzy values, even nonlinear triangular fuzzy values. After adding fuzzy values, the model regionalizes the factors that affect the enterprise value evaluation, fully taking into account the impact of uncertain factors in future investment, and realizing as far as possible the true consideration of all the factors included in the enterprise value evaluation process. Certainty factors. The improved models of three fuzzy values are more complex in the actual demonstration process, and have very strict requirements for the actual mastery of the evaluator, which promotes the real development of enterprise value evaluation results^[6].

3. The status quo of enterprise value evaluation with fuzzy real option pricing model

After years of development, the financial economy has taken shape. Enterprises are the mainstay of the financial market and often appear in people's vision. After a long period of research, more and more companies use real option pricing models to evaluate the value of the company. Among them, fuzzy theory is added to avoid the problems of real option pricing model to a certain extent. It is by far the most widely used enterprise value evaluation method^[7].

3.1. Wide range of practical applications

The fuzzy real option pricing model is favored by many corporate investors and managers because

of the relatively scientific evaluation results in the process of enterprise value evaluation. Corporate investors and managers need to use a relatively scientific option pricing model to calculate the investment risk of investment projects, avoid risks as much as possible, and optimize investment benefits. And fuzzy real option pricing model, in the process of evaluating the actual value of the enterprise, because the influence of instability factors is fully considered, compared with the traditional real option pricing theory, it is more objective and convincing. The scope of practical application is wide, and the results of enterprise value evaluation are unanimously affirmed by various industries^[8].

According to incomplete statistics, the real option pricing model is by far one of the most widely used models. After adding the fuzzy value, the shortcomings of the evaluation process of the traditional real option pricing model are improved to a certain extent, and the scope of application is expanded. For example, the value evaluation of entrepreneurial enterprises, stock investment income, and auto sales company value evaluation are all involved. Fuzzy real option pricing model enterprise value evaluation work can not only perform evaluation work for real enterprises, but also evaluate and analyze investment projects with high risks such as stocks. The fuzzy real option pricing model can predict the future value of investment enterprises. Because of the numerous content of enterprise value evaluation and countless influencing factors, the evaluation results can only be used as a reference. Therefore, to a certain extent, enterprise investors and managers are exposed to the risks of investment projects. There is a prediction. Fuzzy real option pricing model is widely used in enterprise value evaluation work in various industries, and the actual evaluation effect is significant and the acceptance degree is high^[9].

3.2. The evaluation results are relatively scientific

The value of an enterprise depends on the maximum benefit the enterprise can bring to investors, that is, the ability of the enterprise to make profits. For companies, stable cash inflows are very important and can even increase the company's market value. Therefore, the ability of an enterprise to obtain profit in the future market competition directly determines the value of the enterprise. The factors that affect the future profitability of a company are generally divided into three types, namely, tangible asset factors, corporate core competitiveness factors, and corporate market influence factors. Among them are the influence of external factors such as intangible assets. Therefore, the evaluation process of enterprise value is very complicated, there are many contents to be considered, and the evaluation workload is huge^[10].

In the actual application of the binary tree model theory, the future price of project assets can only rise or fall. The price value is public. The favorable conditions of the spot market and the capital lending market are fully utilized by investors to achieve synchronization with the change of option compensation or other assets. Combination, which does not consider external factors such as transaction costs and tax burden, to achieve unlimited division of securities. The influencing factors of enterprise value considered by the real option pricing model are of typical significance. After adding fuzzy values, the negative effects of insufficient consideration of influencing factors can be reduced. For example, when using the trigeminal tree real option pricing model, the net income of the investment project and the investment cash in other stages are all fixed values, referring to the value of the project investment budget. In the actual project investment process, the cost of the investment will generally be affected by the outside world and produce certain changes. Adding fuzzy numerical theory at this time is conducive to constructing a new option pricing model, reasonably considering the uncertain factors of the future investment environment, and making the model better simulate the reality. Therefore, the fuzzy real option pricing model, the enterprise value evaluation results are relatively scientific, and better simulate the actual situation^[11].

3.3. Remarkable theoretical research results

In foreign countries, the real option pricing theory was put forward relatively early, and related discussions have already appeared in the 1970s. Real options refer to the profits generated in investment projects. The sources of profits include the original cash flow and future investment opportunities. Real options are not trading behaviors, they belong to multi-party cooperation. It is necessary to seize the right investment opportunities and the results of various cooperation. Mainly concentrated in developed regions such as North America and Europe. Foreign real option analysis methods are divided into simple real option methods and multi-stage real option methods. The real option method has been explored and processed by many experts, forming the basic working framework of real option. Summarize the practicality of option pricing model evaluation, which

overcomes theoretical shortcomings to a certain extent. Real option pricing model theory was first proposed by Louis Bachelier in the early 20th century. After years of development, many scholars have enriched the content of real option pricing models, and added fuzzy numerical theory on this basis to increase the truthfulness of enterprise value evaluation data^[12].

At the beginning of the founding of New China, due to conditions, my country implemented a publicly owned economy, and capital and private enterprises were nowhere to be found. After a long period of building a new China, in the 1980s, my country improved its corporate management strategy, broke the framework of public ownership, and achieved liberalized development of enterprises. The theory of fuzzy real option pricing model in my country is mainly imported from abroad. In the 21st century, valuable industry development experience has been obtained. The introduction of fuzzy numerical theory into my country's financial industry has brought new impetus to enterprise value evaluation. Through practical demonstration, the fuzzy real option pricing model has developed rapidly in my country and has been applied to various fields. The theoretical and practical work has made progress, and the effect of enterprise value evaluation work is significant^[13].

4. The insufficiency of the fuzzy real option pricing model of enterprise value evaluation

To a certain extent, the fuzzy real option pricing model improves the shortcomings of the traditional real option pricing model. It increases the influence of uncertain factors in enterprise value evaluation and promotes the progress and development of real option pricing theory. Because the fuzzy real option pricing model is a model that simulates the actual enterprise value evaluation process, it is unstable, which will cause errors in the evaluation results, inherit the limitations of the traditional real option pricing model, the evaluation process is complicated, and the evaluation process is subjective. Increasing risks and other deficiencies. It is necessary to avoid unfavorable factors in the actual enterprise value evaluation process to make the evaluation results more scientific and effective^[14].

4.1. Errors in the evaluation results

When carrying out enterprise value assessment work, due to the limitations of practical conditions, it is impossible for us to summarize all the factors that affect the assessment. Many factors need to be analyzed when the fuzzy real option pricing model evaluates the value of an enterprise. In the case of incomplete consideration of the factors affecting the enterprise value evaluation, it is easy to affect the evaluation results. It is impossible for the fuzzy real option pricing model to consider all the evaluation factors, and the influence of the factors that are not considered cannot be ignored. In the case of incomplete consideration of influencing factors, the enterprise value evaluation will cause certain errors in the evaluation results. The range of error cannot be determined, which will cause instability and affect the accuracy of the enterprise value assessment results. For example, when using the fuzzy trinomial tree option pricing model to evaluate corporate value, the assumed risk-free rate of return is a fixed value. This assumption does not meet the reality in real life, and even the model cannot meet all assumptions. The fuzzy real option pricing model has its own limitations, and the model itself cannot satisfy the value evaluation of all enterprises. For example, a value evaluation system suitable for entrepreneurial enterprises cannot be applied to all enterprises for value evaluation. The results of enterprise value evaluation will produce certain errors, which affect the selection of investment projects by enterprise investors and managers and the prediction of investment project risks^[15].

4.2. The traditional model has far-reaching influence

Whether adding trapezoidal fuzzy numbers, standard triangular fuzzy numbers, and nonlinear triangular fuzzy numbers, adding fuzzy numerical theory is based on real option pricing models. The fuzzy real option pricing model has a very strong advantage compared with the traditional project evaluation method and the classic real option method. The traditional real option pricing theory tends to restrict people's thinking. For example, in the process of enterprise value evaluation, the replacement cost method does not take into account the continuous operation of the enterprise and is not forward-looking. It is suitable for the value evaluation of liquidation enterprises, suitable for the value evaluation of a few types of enterprises, and is not conducive to extensive development. The fuzzy real option pricing model is based on traditional theory and formed through practical exploration. The market basis is relatively reliable. The content of the enterprise value evaluation is optimized to ensure the accuracy of the results as much as possible, although the various internal and external factors that affect the valuation of enterprises, but apply to high-tech industries and other enterprises that are

subject to greater external influence, and do not apply to the valuation of liquidation and restructuring enterprises. Therefore, in the actual evaluation process, it will be affected by the traditional real option pricing model. The shortcomings of the traditional real option pricing model will be inherited, which will affect the improvement and establishment of the fuzzy real option pricing model^[16].

4.3. The evaluation process is complex and diverse

The fuzzy real option pricing model is complicated. There are many types of real option pricing models, but there are three most commonly used in the actual enterprise value evaluation process. The Black Scholes option pricing model is widely accepted by people for its simple operation. The parameters in the option pricing model are relatively simple and fixed, in which tax and transaction costs are not within the assumptions, and the premise is European options. The actual operation of my country's corporate value assessment will be difficult. Due to the constraints of the economic environment, my country's financial market environment is completely different from the European financial market environment, which increases the difficulty of improving the localization of real option pricing models. The improved real option pricing model adds fuzzy values to form a fuzzy real option pricing model to ensure the effective development of enterprise value evaluation. After adding the fuzzy value, the fuzzy set in a certain universe is carried out by a function on the interval of real numbers. To a certain extent, the influence of other factors on the value evaluation results of the enterprise is taken into account. However, it is proved that there are many data and complicated steps. Each step requires repeated comparisons and demonstrations to realize that the data generated in the evaluation process is true and effective. The evaluation process steps are complex and diverse, time-consuming and labor-intensive. At the same time, it is necessary to select different real option pricing models and add different reference value improvement models according to different types of enterprises. Strong professionalism is not conducive to the general population to carry out enterprise value assessment work.

4.4. Strong subjectivity increases risk

The use of fuzzy real option pricing model to evaluate the value of an enterprise needs to consider many factors that affect the evaluation of enterprise value, and the summary of the influencing factors can only be carried out by the internal personnel of the enterprise. When analyzing the importance of various factors, the internal personnel of an enterprise often rely on experience and subjective judgments, which will make the results of enterprise value have a certain degree of subjective arbitrariness. Fuzzy real option pricing model to evaluate the value of enterprises will increase the damage and influence of financial risks on the market economy. Especially when the financial market is unstable, corporate investors and managers need to understand the investment risks of investment projects and will inevitably increase corporate value evaluation. Financial derivatives have dual attributes. While bringing convenience to people, risks come with them. The leverage effect of financial derivatives has an impact on the financial market, expands the scope of the crisis, and causes immeasurable losses. The fuzzy real option pricing model is developed from the real option pricing theory, and the real option pricing model is developed from the option theory. Fuzzy real option pricing models are very similar to options, both of which belong to financial derivatives and have the hidden danger of destroying financial markets. In particular, the fuzzy real option pricing model has certain subjective judgments and strong randomness in the process of enterprise value evaluation. If it is not managed and controlled, it will affect the development of option pricing theory and the construction of the model.

5. Improved method of enterprise value evaluation of fuzzy real option pricing model

The survival and development of everything will have certain limitations, and the fuzzy real option pricing model is no exception. As a financial derivative tool, it has practicality and historical period. Some real option pricing methods are suitable for value evaluation of liquidation companies, and fuzzy real option pricing models are more suitable for high-tech companies. The improvement process of real option pricing methods is also the development process of financial markets. Therefore, so far the theoretical and practical circles have not reached agreement on the discussion of establishing a universal real option pricing model. Because there is no real option pricing model that can be applied to evaluate the value of all enterprises.

5.1. Improve the model to reduce the impact

Due to the different nature of enterprises, real option pricing models are relatively flexible in choice. It is possible that a company's value evaluation process may have multiple models for evaluation. The content of the real option pricing model needs to be optimized to better serve the enterprise value evaluation. According to the Black-Scholes real option pricing model, the option value model of corporate investment is:

$$op = SN(d_1) - Ke^{-r(T-t)} N(d_2), \tag{2}$$

$$d_1 = \frac{\ln\left(\frac{S}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}}, \tag{3}$$

$$d_2 = \frac{\ln\left(\frac{S}{K}\right) + \left(r - \frac{\sigma^2}{2}\right)(T-t)}{\sigma\sqrt{T-t}} = d_1 - \sigma\sqrt{T-t}. \tag{4}$$

Later, the model was improved by adding fuzzy values. The value of the option pricing problem proposed by Balck and Scholes is the stock price s , the stock price volatility σ , the exercise price K of the option, and the time from the expiration date of the option. A function of the five variables t and the risk-free interest rate r . Where f is the price of European call options, and the improved fuzzy real option pricing model is:

$$f(s, t, K, r, \sigma) = sN(d_1) - Ke^{-rt} N(d_2), \tag{5}$$

$$d_1 = \frac{\ln(s/k) + (r + \sigma^2/2)t}{\sigma\sqrt{t}}, \tag{6}$$

$$d_2 = d_1 - \sigma\sqrt{t}. \tag{7}$$

After the improved model, fuzzy numbers are added, and the evaluation range is wider. Because there are many models developed for real option pricing models, not only fuzzy values can be added, but also actual conditions can be referenced to improve the model to reduce the impact on the results of enterprise value evaluation.

5.2. Repeated calculations from multiple angles

In the process of enterprise value evaluation, traditional real option pricing thinking has a far-reaching impact, so it is necessary to improve model thinking to reduce the impact. The real option pricing model needs to adapt to the development needs of the new era, so it needs to be improved, adding auxiliary factors that can help improve the evaluation effect and improve efficiency. For example: In the trigeminal tree real option pricing model, the fuzzy number theory is added, and then the model is improved through practice. It is also possible to quote other fuzzy values and calculate repeatedly from multiple angles. It is used to reduce the influence of traditional option pricing theory on enterprise value evaluation, and make the fuzzy real option pricing model better perform the evaluation work.

5.3. Choose the best evaluation method

Every company has a variety of real option pricing models that can be used for reference when assessing corporate value. It is very important to choose the best assessment method suitable for the enterprise. For example, the replacement cost method can be used to evaluate the value of a liquidation company. Although the replacement cost method is an early option pricing method, its value cannot be ignored. For companies with stable cash flow, other suitable methods can be selected for evaluation to increase the evaluation of cash factors. Proceeding from reality, choose a suitable option pricing model to achieve efficient operation in terms of time and human resources as much as possible. Reduce unnecessary links and promote the improvement of fuzzy real option pricing models steadily.

5.4. Strengthen the construction of laws and regulations

Enterprise value evaluation is a serious and rigorous process. Many uncertain factors will be

encountered in the evaluation process, which will affect the normal development of the evaluation work. It is necessary to increase the intensity of the introduction of professional talents, and use professional knowledge to measure the factors that affect enterprise value evaluation, rather than the experience of the employees themselves. Consider the factors that affect the company's value evaluation from multiple perspectives to achieve the scientific goal of the evaluation results. Increase the construction of relevant laws and regulations, use laws to restrain the financial market, and avoid chaos in the financial market. Use a professional vision to carry out enterprise value assessment work to increase the accuracy of the assessment results. Strengthening the construction of financial laws and regulations is conducive to ensuring the safe operation of the financial market to a certain extent, and urging the fuzzy real option pricing model to conduct corporate value evaluation in a fair and reasonable manner. It is helpful to promote the improvement of fuzzy real option pricing model to a certain extent, and make the model better evaluate the value of enterprises in the new era.

6. Conclusion

In summary, the use of fuzzy real option pricing models can promote the development and progress of real option pricing theory, and the lack of enterprise value evaluation results makes it relatively scientific and effective to realize the enterprise value evaluation results. After a long period of exploration, the option pricing model has initially formed a theoretical system. There are still problems in practical application. There are many limiting factors that require different types of enterprises to improve the model. The improved model can adapt to the evaluation process of part of the enterprise value. Therefore, the development level of the fuzzy real option pricing model needs to be improved to adapt to the changes in the financial market under the new situation in the future.

Acknowledgement

This research is supported by Department of Science and Technology Guizhou Provincial (Research and Application of Real Option Pricing Model, 2018 Basic Research Project, No.[2019] 1052) and the research project of introducing the talented person of Guizhou University of Finance and Economics in 2018.

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