



BASIC CONCEPTS OF THE THEORY OF UNCERTAIN SETS AND ACTIONS RELATED TO INVESTMENT PROCESSES

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ABSTRACT

The theory of ambiguous collections is a new approach to expressing business processes, and there is uncertainty that undermines and complicates even precise quantitative methods and approaches. In this sense, it is possible to include linguistic variables in the analysis as the main distinguishing features of vague collection theory.

Keywords: uncertainty kits, investment processes, risk, investment projects.

INTRODUCTION

It is desirable to use the theory of a vague set of mathematics in order to fully assess the risk, that is to say, quantitative estimation. Because, in our view, the selection of a vague set theory is a new, dynamically evolving approach to risk assessment, and is one of the most active and promising areas of applied research in modeling, management and decision-making. It should be noted that the purpose of the quantitative method of analysis is to illustrate how a certain quantitative description of risks can lead to any risk for an investment project.

Table 1
The main ways to take risks in the analysis of investment projects¹

№	Types of analysis	Purpose	Pros	Disadvantages
1.	Qualitative analysis	Finding specific types of project risks can affect cash flow patterns and possible causes of their occurrence.	- specific results; - identified risks can be used to develop recommendations for minimization	There is no quantitative assessment of risk
2.	Quantitative analysis	Specify a quantitative characteristic of risks, and show the consequences for a particular investment project.	- dispersion, standard deviation, coefficient of variation of annual cash flow of investment project, etc.	There are no negative aspects
3.	Sensitivity analysis	Determine the sensitivity of the criteria to the "consecutive	- Simplicity in use; - Demonstration of results	- the hypothesis that one factor may be altered, while other factors are considered

¹ Author's development

		single" change of each variable		invariant
4.	Scenario analysis	Estimation of ineffective project risk as a sum of negative NPV probability of the project	- Simplicity in use; - Demonstration of results	- subjectivism in the probability assignment for each scenario under consideration; - does not cover all possible variants and scenarios
5.	Simulation models (Monte Carlo method)	For the set of NPV values, the mean and the amount of risk are calculated	- gives a clear and quantitative assessment of project risks; - successfully combines other economic-mathematical methods and other methods of game theory and operation research	- Inability and consistency of variables (their correlation) and complexity of calculations

The parameters of an investment process X_1, X_2, \dots, X_n The corresponding weights or probability

values of the indicators are evaluated by an uncertain number $P_1, P_2, \dots, P_n, P_i \geq 0, \sum_{i=1}^n P_i = 1$ overall

investment efficiency $q_i = \sum_{i=1}^n P_i \cdot X_i$ isotope. If values of indicators $X_i = (x_{i1}, x_{i2}, x_{i3}, x_{i4}), i = 1, 2, \dots, n$

If there is an uncertain number of trapezoids, then the efficiency of investment in economic sectors - E, risk - R and risk - I The levels are as follows

$$E = Y a_1 + 2M a_2 + 2Z a_3 + X a_4 \tag{1}$$

$$R = \frac{(X-Y)^2 + 2(X-Y)(Z-M)^2 + 3(Z-X)^2}{Y a_1 + 2M a_2 + 2Z a_3 + X a_4} \tag{2}$$

$$I = \frac{1}{4} \sqrt{R \frac{(X-Y)^2 + 2(X-Y)(Z-M)^2 + 3(Z-X)^2}{Y a_1 + 2M a_2 + 2Z a_3 + X a_4}} \tag{3}$$

formulas can be identified by the system.

Here it is: Y too bad, M bad, Z well and X Good things in God;

a_1, a_2, a_3 and a_4 the values of the indefinite set by the circumstances.

If the ultimate expected return on the total investment fund is determined, it is expressed as the sum of the average expected return on investment in production in each economic sector. This, in turn, is important in the use of uncertain collections in investment allocation, which means that, as far as possible, the accuracy of the results, including the lower and upper limits, and the interim values, is scientifically justified.

There are advantages and disadvantages, as well as a number of other sets, from the inclusion of the theory of uncertain collections to models of investment distribution across sectors of the economy (Table 2).

Table 2
Advantages and disadvantages of using indefinite collection methods²

№	Advantages	Disadvantages
1.	It allows you to evaluate the distribution of the investment based on the whole package.	Existence of subjectivity in the choice of function and formulation of vague rules.
2.	The expected return on investment is not the point, but rather reflects the range of intervals that have the value of their expected distribution, and indicates that the relevance function has an uncertain number.	Insufficient attention to financial position of financial institutions and lack of direct quantitative indicators and lack of information on the method.
3.	Including quality variables in the analysis, operations on uncertain input data, working with linguistic criteria, rapid modeling of complex dynamic systems, and comparisons with given accuracy.	Even though there is a need for specialized software to determine the distribution of investment, there is a lack of qualified specialists who know how to work with them.

Apart from the data presented in Table 2, the application of the theory of uncertainty to the models of economic cross-sectoral allocation of investments can eliminate the disadvantages and limitations of existing methods. It should be noted that, despite the disadvantages and limitations of this method, this method has been recognized by many large companies as a promising method with clear results. (Motorola, General Electric, Otis Elevator, Pacific Gas & Electric, Ford)³ This results in the fact that the vague set method does not reject the use of statistical methods and is an active analysis method when other methods cannot be used.

It is recommended to use experts in the evaluation of linguistic indicators in the theory of uncertain sets. "Linguistic indices are words or expressions of natural or artificial language." From this definition, it is also possible to say that variables that cannot be expressed using mathematical language, that is, indicators that are difficult to give an accurate objective quantitative assessment (Figure 1). Based on the research topic, the inter-sectoral allocation of investments has been applied to the theory of inaccurate aggregation in order to investigate, analyze, and analyze the "very bad", "bad", "medium", "good" and "very good" situations. .

Each of these values is a null variable. If X is an indefinite variable, then the constraint associated with that name can be interpreted as the meaning of the variable X. Thus, if the threshold resulting from indefinite variables is "very good", then the set of $U = [0, 1]$ is an uncertain set, which can be considered as a linguistic value. An important aspect of the notion of linguistic variables is that this variable is of higher order than the nonlinear variable because of its linguistic variables.

By summarizing Figures 1 and 2, a triangular and trapezoidal line is formed. It should be noted here that the surfaces formed from these geometric shapes represent the state of the investment distribution. Of course, this also requires calculating the differences between curves and trapezoids and triangles. Only then will the surface be fully reflected and the result will be clear.

Based on the aforementioned uncertainty theory, it is necessary to distinguish between allocation of investments on the basis of specific conditions, based on the methods of intersectoral distribution of investments. It is noteworthy that expert evaluation of investment processes based on uncertain collections is

² Author's development

³ Chan D.Y. (1996) «Application of extent analysis method in fuzzy ahp». Europeanjournalofoperationresearch, 95, pp. 649-655.

recommended by experts. However, based on the results of the research, it is possible to express linguistic variables in quantitative values using statistical data on the existing sectoral distribution of investments.

RESULTS

The allocation of investments is primarily aimed at reducing the risks and earning more. Because each asset is interconnected with other processes, for example, when stocks go up, bonds often fall. Real estate starts earning more than average income at the beginning of the market. It is clear that each sector is unique and has different operating principles, so different levels of risk in access to investment are different. Diversification of investments means covering the losses from one sector with the profit on the other. Thus, a number of factors must be taken into account in the distribution of investments. In this context, the following eight key factors are relevant to the study.

The explanation for the 8 factors of the investment distribution presented in Figure 8.6 is that in the first place in investment, the size of the investment must be consistent with the needs of the investment route and the money demand. You can invest in long-term (over 5 years) investments because of the availability of stocks, which can save you time. Short-term investment prospects require stable and liquid investments.

The type of investment tool chosen can have a significant impact on expected revenue and costs. Therefore, the closing of some securities and bonds has the advantage of replenishing them with several stock exchanges on the other hand. Low cost means avoiding products with high commissions or higher management fees.

Keeping low costs / costs is crucial for long-term success. It is desirable that the long-term real (after inflation) coefficient is 6.5% and the expenditure is 1.5%, which is about 25% of the total investment.

The level of risk tolerance is determined by the investment's risk-based risk tolerance and maturity. Also, in the distribution of investments, everyone should not tolerate the loss of their principles. Because, for human qualities, the danger is the loss of loved ones. The best course of action for higher returns is to invest more actively when prices are low. The best way to prevent loss of investment is to use diversification.

Diversification is one of the most important concepts of investment, but is often misused. Diversification means investing in multiple areas at the same time, but that does not mean that they can be profitable at all. This is because they use assets that offer the best valuation-based properties, such as stocks, bonds, money, real estate.

Rebalancing is the process of reallocating an asset portfolio weight, which involves the periodic purchase or sale of assets in a portfolio to maintain the initial intended level of investment. Balance (supply and demand) in investment allocation is one of the most powerful risk management strategies. Careful monitoring and control of the calculations will focus on what is important and important to the investor. This allows for quick adjustments to optimize probabilities as the situation changes.

The result of any measures taken is, first and foremost, the return on equity. This, in turn, depends on the proper allocation of investments, which depends on the proper valuation of supply and demand for investments.

Many people like to follow the example of famous investors and learn from their experience. Certainly, it has a number of advantages - elimination of risks, risks and shortcomings, and high profitability. However, every investor should not forget about his / her own ideas and available opportunities and conditions.

Now is the time to consider the investment allocation plan. These 8 factors reduce the level of investment risk and provide the basis for developing a plan for investing in areas (sectors) that increase investment. Of course, when it comes to investment allocation, it should be noted that there are laws of distribution, which have their own specifics and limits.

The distribution law is said to be a function that allows the random variable X to be probable to fall within a particular value x_i or a given time interval. The distribution function is a universal form of distribution law corresponding to a random variable.

The cross-sectoral allocation of investments was performed using linear and logarithmic normal distribution formulas in order to achieve the accuracy of the study. Based on the law of normal distribution (partially or "officially distributed") system of random variables X_1, X_2, \dots , The random variable is a linear function of these variables,

$$Y = \sum_{i=1}^n a_i X_i + b$$

The law of normal distribution of the y-line function is to be checked. Indeed, even when a few random variables with a normal distribution are added, the value of the linear function is the sum of the linear functions of X and the linear function as above .

We continue to find the parameters of the y-axis function. To do this, the distribution center equals the standard deviation (mean squared difference) according to the mathematical expectation and the linear function dispersion theorem:

$$m_y = \sum_{i=1}^n a_i m_{x_i} + b,$$

$$\sigma_y^2 = \sum_{i=1}^n a_i^2 \sigma_{x_i}^2 + 2 \sum_{i < j} a_i a_j r_{ij} \sigma_{x_i} \sigma_{x_j},$$

Here: $r_{ij} = X_i$ and X_j correlation of values.

If X_1, X_2, \dots, X_n The formula (7) is expressed as follows:

$$\sigma_y^2 = \sum_{i=1}^n a_i^2 \sigma_{x_i}^2$$

The mean squared differences (standard deviations) in formulas (6) and (7) can be substituted by the proportional probability.

The distribution laws of the random variables that are usually in formula (8) are not known, but their quantitative features are known, namely, mathematical expectation and dispersion. If X_1, X_2, \dots, X_n If the value is independent at the same time and their number is greater, as a rule, the y-linear function approaches the normal distribution law, regardless of the form of the X_i -quantitative distribution laws.

In order to obtain a distribution law that can be considered normal in practice, it is usually sufficient to have 5-10 conditions in formula (8). It should be noted that the dispersion of one of the parameters in formula (8) is not applicable when it is larger than the others, but it is assumed that the random variables in formula (8) are approximately the same.

The assumption is accepted if these conditions are met for the normal amount of law with the parameters specified by (6) and (7). This means that the linear function is subordinate to the normal distribution law and that if all the above considerations in the distribution law are appropriate, this function is linear rather than linear.

The logarithm of a random variable with a logarithmic normal distribution is distributed according to the normal law. This distribution represents the distribution of positive values compared to traditional distributions. This law is important to characterize the inter-sectoral distribution of investments by circumstances.

DISCUSSION & CONCLUSION

The use of uncertain sets of methods allows you to include qualitative variables in the analysis, the presence of transactions on uncertain data, and the use of linguistic criteria, and rapid modeling and comparison of complex dynamic systems, and the disadvantages and limitations of existing methods for assessing investment risks. .

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