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Methodological Aspects of Regional Investment Risk Management

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Abstract

Investment activity as a kind of economic activity provides for the securing of expanded reproduction processes, which is extremely important for the regional economy. An increase in the volume of reproduction is necessary in order to compensate an investor for the amount that it has invested in the project, and in the long term, to obtain profit from financing, and further to develop the facility. Investment risk is one of the most important components of the investment climate. In the modern socio-economic conditions of 2020, investment activities are carried out in conditions of increased risks, since there is a likelihood of receiving less profit than planned.

Various methods of risk assessment and management are analysed to minimize risks in the investment activity. Risk management is defined as a set of methods for assessing, minimizing and preventing accidental losses to an individual or business through the use of insurance, market expertise, and security measures. Risk management at the regional level is critical in today's world.

The purpose of the study is to identify methodological aspects of investment risk management in a region.

Keywords: Investments, Risk, Regional Economy, Investment Risks, Competitiveness, Investment Attractiveness.

I. INTRODUCTION

The relevance of the study lies in the fact that investment risk is one of the most important components of the investment climate in a region. There is a common national or federal legislative space on the territory of most regions, but it differs in individual regions. When developing methods for managing investment risks in the region, two areas were considered: a) investment attractiveness of the region itself; b) investment attractiveness of specific investment objects. Not always effective investment policy and partly inappropriate use of borrowed funds can be significant factors holding back the development of the regions. At the moment, balanced recommendations, and also assessing the effectiveness of determining investment risks are required for managing the risks of investment activities [1]. This necessitates the development of an investment risk management system. The multidimensionality of existing issues on the analysis of the risks of investment projects makes the search for updated methods and management mechanisms actual.

II. METHODS

During the study, a set of methods of scientific knowledge was used, including: analysis and synthesis, comparison and generalization, abstraction, logical method, system and process approaches, inductive and deductive methods, method of technical and economic calculations, modern mathematical apparatus, including the use of such methods like interpreting information in the form of graphs.

III. RESULTS AND DISCUSSION

The wording of the "investment risk" concept in the regional aspect has been clarified as a result of the study. "Investment risk is a different degree of risk that may arise in various sectors of economic activity of economic entities, where it is assumed that there is a possibility of constant loss of capital or an increase in profitability within a given period of time, depending on the strategy used to diversify risks in the field of investment." The study analyses the current methodological aspects of investment risk management in the region, and the system of analysis and assessment of investment risks at the regional level. Methods for analysing the level of risk of investment projects are presented; recommendations are formulated.

The practical significance of the study is determined by the application of the developed recommendations to minimize investment risks in the field of economic activity, including at the regional level. The results obtained make it possible to solve the following practical problems of investment management: a) to use integrated investment design in conditions of limited access to borrowed sources of financing; b) to assess the risks of investment projects under conditions of uncertainty; c) adjust the main economic indicators for evaluating the effectiveness of investment projects. The developed recommendations can serve as a basis for improving the risk management system in many sectors of the economy, including at the regional level.

Among the main recommendations for reducing investment risk in an uncertain state of the economic result there are [2]:

a) redistribution of risk among all parties involved in the investment project; b) formation of reserve funds to cover unforeseen costs; c) reduction of risks in the process of financial support of the investment project; d) collateral to investment; e) insurance; f) guarantee system and obtaining additional information [3]. Based on the above, we can conclude that minimizing the risks of investment activities in most cases is conditioned by the organization of management activities in relation to the investment project. The process of rationalizing decisions that arise in the settlement of various issues, including effective regional policy, is important.

In order to effectively implement any investment project, the mechanisms should be applied that consist of a set of tools to reduce investment risks and manage them depending on the level of each specific risk-forming aspect, as well as the measures of its impact on the final result of investments [4]. Investment risk is measured in absolute and relative terms. When using the statistical method of analysis, the risk is assessed by two criteria: a) the average expected value; b) fluctuation (variability) of the possible result. This technique can be used in a comprehensive manner to analyse the investment risks of the region.

Average expected value measures the result expected on average. The average expected value is calculated using the following formula [5]:

$$M(x) = \sum_{i=1}^{k} x_i\, p_i \quad (1)$$

Where M(x)– average expected value (mathematical expectation);

x_i – Expected value for the i-th case;

p_i– Probability of the i-th case.

k – Number of observed cases (frequency).

Fluctuation (variability) of an expected result is the degree to which the expected value deviates from the mean one. It is recommended to use two closely related criteria: variance and standard deviation.

The variance is calculated by the formula:

$$D = \sum_{i=1}^{k} (x_i - M(x))p_i \quad (2)$$

Where D is the variance.

The standard deviation is calculated by the formula:

$$y = \pm\sqrt{D} \quad (3)$$

For conducting the analysis, it is recommended to use a relative indicator called the coefficient of variation (CV). It represents the ratio of the standard deviation to the average expected value:

$$CV = \frac{y}{M(x)} \quad (6)$$

The higher the coefficient, the stronger the fluctuations, the higher the degree of risk:

CV < 10% – low risk;

10% < CV <25% – mean risk;

CV > 25% – high risk.

To account for investment risk, we can use the Capital Asset Pricing Model (CAPM), or the capital market equilibrium model. The Capital Asset Pricing Model displays the graphical dependence of the investment return on risk. The expected rate of return on the i-th securities (R_{expi}) is determined by the formula [6]:

$$R_{exp\,i} = R_{RF} + (R_A - R_{RF}) * B_i \quad (5)$$

Where R_{RF}– risk-free (guaranteed) rate of return;

R_c– average rate of return for a given market;

B_i– sensitivity coefficient (systematic risk indicator) of the i-th securities.

The Value-at-Risk (VaR) methodology is used to measure market risks. VaR is a statistical assessment of the maximum portfolio losses for a given distribution of market factors over a given period of time in all cases, except for a small percentage of situations [7]. Value at Risk (VAR) is a financial indicator that assesses the risk of investments. Specifically, VAR is a statistical technique used to measure the amount of potential losses that can occur in an investment portfolio over a given time period. Value at Risk provides the probability of loss value which is greater than the given amount in this portfolio.

To analyse the investment risks of the region, we will use the historical method. Let's consider it in more detail. Market data from the last 250 days is used to calculate the percentage change for each risk factor each day. Each percentage change is calculated with the given current market values to represent 250 scenarios for future value. For each of the scenarios, the portfolio is valued using full non-linear pricing models. It is assumed that the third worst chosen day should be 99% VAR [8].

$$VAR = v_m \frac{v_i}{v_{i-1}} \quad (6)$$

Where v_i is the number of variables for day i.

m is the number of days for which historical data is taken.

If to perform our analysis comprehensively, we also can use the parametric method. Two factors need to be assessed: expected return and standard deviation. This method is best suited for risk measurement tasks when distributions are known and reliably estimated. The method is unreliable when the sample size is very small. Let us assume that the loss would be equal *l* for the portfolio *pσn* with the corresponding number of instruments.

$$l_p = l_1 + l_2 + l_3 + .. + l_n$$

$$\sigma^2{}_p = \sigma_1^2 + \sigma_2^2 + \sigma_3^2 + \ldots + p_{1,2,3,,,n}\sigma_1\sigma_2\sigma_3\ldots\sigma_n \quad (7)$$

Where σ_p^2 is the standard deviation for the portfolio loss;

σ_1^2– Loss of risk *l*;

$p_{1,2,3\ldots n}$– Correlations between risk loss taking values from 1 to n.

According to the method of statistical modelling, and simulation modelling, price changes in assets occur pseudo-randomly according to the established parameters. Accordingly, the VAR is calculated by randomly generating a series of scenarios using non-linear pricing models to estimate the change in value for each scenario, and then calculating the VAR according to the worst-case loss. This method is suitable for a wide range of risk measurement problems, especially when dealing with complex factors.

The Monte Carlo method is used quite widely in mathematical finance to evaluate and analyse investments by simulating various sources of uncertainty that affect their value, and then determining the distribution of their value over a range of output results. This is usually done using stochastic asset models [9]. The advantage of Monte Carlo methods over other methods increases with the growing of the magnitude (for sources of uncertainty) of the problem. Monte Carlo methods are used in project finance to build probabilistic financial models, rather than traditional static and deterministic models. To analyse the characteristics of the net present value (NPV) of a project, the components of cash flows affected by uncertainty are modelled taking into account any correlation between them, which mathematically reflect their "random characteristics". These results are then combined into an NPV histogram and the average NPV of potential investments, as well as their volatility and other values, are observed.

The most commonly used statistical techniques to account for measurable uncertainty are scenario analysis and project sensitivity analysis. Scenario analysis provides for the formation of a number of scenarios: realistic, pessimistic, optimistic, and inertial. The investment project efficiency is calculated during the scenario analysis as follows [10]:

$$NPV = \sum_{i=1}^{n} NPV_i \, p_i \quad (8)$$

Where NPV – integral economic effect of the project;

NPVi – NPV at i-th scenario;

pi – the probability of the i-th scenario;

n – number of scenarios.

NPV (Net Present Value) is calculated for the project as the difference between the discounted cash flows of receipts and payments that are associated with the implementation of the investment project for its entire period:

$$NPV = \sum_{t=0}^{T} \frac{CIF}{(1+E)^t} - \sum_{t=0}^{T} \frac{COF}{(1+E)^t} \quad (9)$$

Where NPV – net present value of the project;

T – duration of the investment project;

CIFt – receipts (incoming cash flow) at the time moment t;

E – discount rate (threshold value of profitability), which is selected for the investment project;

COFt - payments (outgoing cash flow) at the time moment t.

The positive value of NPV justifies the feasibility and necessity of implementing the investment project; however, when comparing with other projects, it is customary to recognize those projects as most successful which have a greater economic result. In this technique, the value of the economic result, as a rule, is set by the discount rate selected by the calculation as a parameter that is used in order to realize the estimated cash receipts and payments with regard to the time factor. In practice, the interest rate of government securities acts mainly as a guideline for the selection of the target discount rate [11].

Sensitivity analysis provides for the calculation and assessment of the impact of changes in the performance indicators of an investment project in the event of possible deviations of external and internal factors from the planned ones. This methodology provides an assessment of the stability degree for an investment project to different conditions of impact, in other words, to different risk groups. Particularly, it allows identifying such risk groups that will have more pronounced impact on the project.

At the same time, one of the methods for assessing investment risk is the calculation and analysis of the beta coefficient (β). The beta coefficient is an indicator of systematic market risk; it is used to assess the sensitivity of the risk of an individual market asset to the risk of the entire market as a whole. [12]:

$$\beta_i = \frac{cov(r_1, r_m)}{D(r_m)} \quad (10)$$

Where β_i is the beta coefficient of the i-th asset;

r_i is the profitability of the i-th asset;

r_m is a market profitability (index);

cov (r_i, r_m) - covariance of the random values for the profitability of the i-th asset and the market (index) profitability;

D (rm) - variance of market returns.

Thus, the considered methods can be applied to analyse the investment attractiveness of a region, which is a decisive condition for intensive investment activity. It should be noted that investment activity in the region is also associated with the following types of risks: financial, economic, social, crime, political, and legal, but this study focuses on the methodology for assessing investment risks.

IV. SUMMARY

Analysing and comparing the methods of managing investment risks in a region developed by domestic and foreign scientists, the following conclusions can be drawn: a) financial risks in a region are determined, in many ways, by the situation of debts between the region and the Federal Centre, which requires regular monitoring; b) the need to assess the internal mutual debt of enterprises in the region [13]. When analysing financial risks in a region, one should take into account the financial status of the region and the availability of financial guarantees. The economic risk of a region is largely determined by the structure of the regional economy. When developing a methodology for studying the economic risk of the region, it is important to take into account: a) the proportion of unprofitable enterprises; b) the

index of growth in the value of the consumer basket; c) the region's share in the gross national product, etc.

V. CONCLUSIONS

Finally, we can conclude that the methodology for managing investment risks in the region is a relevant topic that requires improvement and adaptation to situations of high risks in 2020. It is necessary to revise the factors of the effectiveness of existing investment programs. Despite the fact that there are methods allowing for assessment of risks with the use of a small margin of error, each region has unique features of development, which is important to take into account. In general, the existing methods can be divided into three groups: a) probabilistic analysis (plotting the probability curve of values); b) analysis of critical points (for example, break-even points); c) calculation of the sensitivity of the project to changes in the key parameters of the initial data [11]. The application of these methods allows us to create prerequisites for comprehensive and effective management of investment risks at the regional level.

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