Consideration of risk factor impact on efficiency of innovative projects by calculating break-even point in high-tech fields of economy.

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Abstract. The paper proposes the social potential of technological sectors of economy. It gives the comparison of the quality of the population life of different countries through the criterion of expenditures and consumption of home economics. It also compares the rates of introduction of residential houses and improvement of housing stock, which demonstrated the growth of indicators in technological sectors of economy, as an evidence of their social potential growth. It states the theoretical substantiation of the necessity of attracting additional resources for the development of the socio-economic potential of the technological sectors of economy and its structure. The motivation of the necessity of active involvement in the development of the territory of public organizations and the economic management system is also given here.

1. Introduction

The essence of the analysis of breakeven consists in the attempt to identify the break-even point (BP). This is such a situation when the proceeds of the sales equal the cost of production which means that profit is equal to zero. The break-even point (BP) can be expressed in a physical unit or as a utilization parameter of production capacity. Determining the break-even point is one of the targets in risk assessment of investment expenditures. The higher the figure of the output, the higher the risk of implementing the investment project because it is necessary to produce and to sell more product to provide the required level of profitability.

The analysis of the break-even point of production is based on the following assumptions [1]:

- production costs present the function of the quantity of manufactured products and their sales;
- the quantity of manufactured and sold products equals;
- fixed costs are invariable irrespective of the volume of manufactured and sold products;
- variable costs are directly proportional to the quantity of manufactured and sold products;
- contracted price of product unit stays invariable during the analyzed period;
- only single type products are manufactured and sold (in case of several types of products manufacture they are taken to one and the same representative);
- information for economy study is based on the data corresponding to annual average data over the period of expedient use of investment project.

2. Theory

The proceeds of the sales can be expressed in the following formula:

$$P = Cu \cdot X, \quad (1)$$

where P is proceeds of the sales of a definite quantity of goods at break-even point (in roubles);
Cu stands for the contracted price of product unit;
X - the quantity of product units sold at break-even point (in items).

Production costs are calculated by the formula [2, 3]:

$$Pc = Vu \cdot X + F, \quad (2)$$

where Pc means production costs of sold products (in roubles);
Vu means variables costs for a product unit (in roubles);
F - fixed costs for sold products (in roubles).

Taking into account that production costs equal proceeds from sales at a break-even point, the interconnection between above mentioned formulae can be written in the following way:

$$Cu \cdot X = Vu \cdot X + F$$

or

$$X = F / (Cu - Vu).$$

According to this equation, the quantity of units at a break-even point can be calculated from the relation of fixed costs to difference between contracted price of a product unit and variable costs for its manufacture. It can be concluded that the more the amount of fixed costs at constant contracted price is, the more it is needed to manufacture and sell the produce to provide its break-even.

3. Determining the required rates of return and assessing investment risk

If we possess detailed information about the probability of changes concerning an innovative investment project, probabilistic analysis method can be applied.

An economic analyst develops numerous variants to implement an innovative investment project. Cash flow and integrating performance indicators are determined or calculated for each variant on each stage. While calculating net present value a risk-free discount form is taken for each variant. The probability of implementation of each variant is set by calculations. Then the best project variant is chosen taking into account integrating performance indicators.

To check the financial feasibility and the effectiveness of the project according to the method of parameter variants of innovative investment projects, it is recommended to carry out calculations because the changes in parameters can lead to considerable deviation of analytical and estimating indicators. The following parameters fall within this group [4]:

- investment costs in general or according to their separate components;
- production volume;
- production and distribution costs;
- interest or loans;
- the projections of General inflation index, price index and the index of domestic inflation of foreign currency;
- delayed payments for sold production;
- the duration of implementation of innovative investment project;
- other parameters of project documentation possessing significant value to characterize its sustainability and efficiency.

The required rate of return is the rate reflecting modern capital cost and the risk of its use. Capital cost is the cost of financing source of investment expenditure. Capital cost can be assessed directly by the market or with the help of the conditional calculation method if net profit is used as an investment project.

4. Experiment

Shareholder value is defined according to one of the formulae given below [4]:

$$Shv = (D/m) \cdot 100,$$
$$Shv1 = (D0/m0) \cdot 100 + g,$$

where *Shv* means shareholder value (in per cent);

Shv1 is prospective shareholder value (discount rate of future dividends), (in per cent);

D is the expected dividend (in roubles);

m and *m0* are current market value of one share (in roubles);

g is the expected growth rate of dividends (in percent).

While assessing the effectiveness of innovative investment project, capital cost is regarded as the minimum standard of profitability or payback of investment expenditure. The situations in which investment projects have a profit or discount rate more than capital costs are ideal. It has been proved in economic scientific literature that interest rate on load serves as capital cost and constitutes the market rate of exchange between today's and future money. Thus, the appropriateness of the implementation of an innovative investment project depends on its profitability and market cost of capital (on market interest rates).

Consequently, the project can be adopted at one interest rates (at one cost of capital) and rejected at other ones. It implies that the cost of capital and interest rate on load perform a regulatory function and per variational parameters of innovative investment projects. They perform this function in conditions of uncertainty if interest rates, the financing sources of innovation investment project or proportions between financing sources change.

Thereby, the problem of defining of required profit rate depends on capital cost of various kinds (equity value, bonds, credits, etc.) or on proportions of distribution of different financing sources of innovation investment projects. Two methods to define the required profit rate are recommended in scientific papers [7]:

- via the cost of attracting different financing sources (weighted average cost of capital);
- via pricing model of the stock market.

The key factor while defining the required profit rate is the assessment of capital cost used to finance the innovation investment project. If the project is financed from one source, its capital cost is known. For instance, it can be interest on bank loan or equity value in percent. However, several financing sources of innovation investment projects are used simultaneously. Weighted average cost of capital namely total cost of all financing sources should be calculated in such situations.

Defining the weighted average cost of capital includes the following calculations:

- financing sources of innovation investment projects;
- costs of different types of capital;
- market price of financing sources;
- weighted average cost of capital.

The main financing sources under market economy conditions are credits, ordinary and preference shares, bonds, profit, etc. Capital cost attracted by emission of bonds depends on the level of dividend payments as well as on market price of shares. Credit cost is the function from the interest rate and is some European countries it is the function from income tax. For instance, if an interest on long-term loan is included in production cost or in the total amount of capital investments, credit cost should be determined by the following formula [5]:

$$Cat = Ce * (1 - S/100),$$

where *Cat* is the cost of the loan after tax (in percent);

Ce is the cost of the loan (in percent);

S is the standard of income tax.

Determining weighted average cost of capital is prerequisite for decreasing the degree of risk while calculating the required rate of return because the differences in capital costs of various types are taken into consideration. However, two problems connected with implementation of weighted average cost of capital as a required or minimum profit rate for estimating the efficiency of investment project remain unsolved. Weighted average cost of capital reflects the current capital cost and the respective market satiety with this capital. If the market situation changes during the implementation of innovation

investment project, additional research is needed to prevent the risk connected with the changes of financing sources structure that leads to the change in weighted average cost of capital.

Thus, the use of weighted average cost of capital does not always take into consideration all the risk connected with the implementation of investment project. In this regard it is highly recommended to use the pricing model of the stock market to determine the required profit rate taking into account the risks. Its essence lies in the fact that a risk premium is added to a risk-free rate of return otherwise known as a basic one. A risk-free rate of return is usually taken on be basis of risk-free investments. Government securities may be considered here [6].

A Risk premium is an extra profit which is added to risk-free rate of return when investing in risk projects. The amount of risk premium is directly proportional to riskiness of investment. However ever in this case definite problems arise. They are connected with the practical implementation of pricing model of the stock market from determining the required profit rate. The problem is to measure the degree of risk of an investment project and to define if the required profit rate corresponds the given risk level.

The concept of risk can be determined as a consequence of volatility of the market environment, variability in the cost of capital and investment income. This variability is the result of changes in the capital market. Investments are subjected to changes in varying degrees. The concept of a "beta ratio" is used in investment theory as a measure of risk [7]. A beta ratio reflects the market situation changes that demonstrates investment rates change accompanying the appropriate alteration of the market situation.

If a project has a low risk rate, a beta ratio takes the values less than one. This suggests that a project profitability is more than the general situation at the capital and commodity market. If government bonds are issued with absolute risk-free rate of income, the beta-ratio value equals zero. In case when the profitability of the project is subjected to the change that is characteristic of a market situation in general, a beta-ratio equals to one. If a beta-ratio is more than one, investment project profitability depends on the impact of market fluctuations to a greater extent.

The difficulty of a beta-ratio application to measure the degree of risk consists in the complexity of practical determining its exact value for a definite innovation investment project. Thus, this approach to determining the degree of risk is not widely used. The value of beta-ratio when analyzing the degree of the risk of an innovation investment project is calculated by means of stock market data. The information about a company profitability, which is characterized by the price of its stocks, is taken from stock exchange data [8].

If the investment project of the company is analyzed and the stocks are listed on the stock market, a beta-ratio can serve as the indicator of the degree of risk of an innovation investment project.

If the innovation investment project (IIP) is aimed at providing the manufacturing of new product uncharacteristic for a company activity, a beta-ratio can be calculated by means of the data of the company's manufacturing similar product. However, difficulties arise in this case Firstly, stock market data contain information about stock returns but not about the rate of return on all the assets and it is not the same thing. A beta-ratio of another company displays the financial structure intrinsic to it while another financial structure should be used for a definite IIP. Therefore, to calculate a beta asset coefficient it is necessary to eliminate the risk resulting from a financial structure.

It is recommended that a beta bond coefficient is assumed to be zero in practical calculations. It will mean an absolutely risk-free rate of income [9].

The second problem of calculating a beta coefficient arises if several investment projects are being implemented by a firm simultaneously. It is characteristic of the situations when the company pursue a policy of diversification, i.e. the distribution according to various types of activities, of their investments [10]. In such case it is recommended to calculate a beta coefficient for the whole investment portfolio as well as for each separate investment project. A beta coefficient is used together with the cost model of the stock market that depicts the interconnection of the degree of the investment risk and the required rate of return.

In determining the required rate of return, a range of problems arises. To overcome these difficulties,

the following assumptions are used:

1. A market mechanism acts effectively and the value of market beta coefficients is reliable.
2. The cost model of the stock market developed at a certain time period can be extrapolated for the whole period of an IIP use.
3. A beta bond coefficient is assumed to be zero.
4. Investors act rationally and avoid risk whenever possible.

Despite some assumptions mentioned, the method of the cost model of the stock market is considered to be acceptable in case of calculation of the required rate of return of a definite investment project.

Along with this method, there is a simplified one to define a required rate of return. Its essence is as follows. Weighted average cost of capital is assumed as a reference level of the required rate of return for medium risk projects. To estimate the degree of the risk of IIP the scale of risk categories is developed. For instance, a risk-free course and the lowest required rate of return per capital correspond to government bonds. Low-risk capital is applied to the second group. The required rate of return exceeding a risk-free course is accepted for it. In addition, the rate of return is set for medium and high risks. After that a weighted average cost of capital is compared to the rate of return corresponding to a medium risk. Investment projects which rate of return per capital exceeds the rate of return of medium risk are thoroughly analyzed. The results of the analysis are used to specify the required rates of return of innovation investment projects [9].

Being insufficiently substantiated, the simplified method of defining the required rate of return is at the same time advantageous as compared to the method of weighted average cost of capital. The essence of these advantages is as follows: the probability of taking a wrong management decision reduces because risks are taken into consideration and this fact makes the company management carry out additional analytical calculations with the purpose of increasing the validity of the required rate of return.

The probabilistic analysis method requires the specialist making investment decisions to be able to predict various possible results of an investment project and to estimate the probability of the predicted or studied phenomenon. The bases for the probabilistic analysis are the expertise of the specialists possessing knowledge and experience on the problem under study.

The probabilistic analysis allows to avoid both too optimistic and too pessimistic assessments. Such an analysis requires numerous calculations and to facilitate them a simplified approach to carrying out the probabilistic analysis is often used [10].

Market situations of increase and decrease in demand of product frequently occur in real conditions of firm management. In this context discounted net cost as a rule increases or decreases as compared to that involved by the project.

This is only a part of numerous methods assisting a firm manager to increase the validity of management decisions made on the adoption of an investment project at risk. These methods allow one to increase the accuracy of investment calculations concerning the determining of the required rate of return from investment costs necessary for the implementation of the project [7].

Special attention was paid to the risk factors analysis by means of the following methods:

- the method of risk assessment with calculating of breakeven point and the dynamism of the project;
- the method of risk assessment on the basis of determining the required rate of return;
- the method of determining the probability of the outcomes (a probabilistic method of analysis).

The method of risk assessment with calculating of breakeven point and the dynamism of the project is appropriate to use when estimating the projects complying with core activities of the firm. The changes in the structure of activity and financing sources do not occur as well as in the cost of separate types of capital, raised for the implementation of the project.

The method of a breakeven point is advisable to use when analyzing the risks arising at manufacturing and product sales stages as well as when analyzing macroeconomic risks, such as the changes of normative legislative acts on taxation, profit, defining the cost structure, included in a cost price, etc.

Analyzing the risks on the basis of required rate of return, three approaches have been considered.

The first approach is based on determining the required rate of return by means of weighted average cost of capital. It was demonstrated that this approach can be useful for consideration of risks connected with the change of structure of various types of capital used for investment project financing as compared to capital structure of the firm. The application of this method is possible if the composition and structure of the product do not differ significantly from the general activity of the firm.

The second approach is based on the pricing model of the stock market. This method allows to estimate a greater number of risks arising when implementing the project. The disadvantage of this method are as follows: it possesses too many assumptions that allow to abstract real market conditions, it is difficult to obtain information about the cost of capital of other companies at the stock market and their activity is considered for reference in calculating the required rate of return.

In addition to this approach, the simplified method of defining the required rate of return was considered. It is based on risk classification according to the cost of risk-free capital. Being a judgmental approach, it nevertheless allows to conduct in-depth research taking into account a significant number of risk factors.

In conclusion, the method of probabilistic analysis for estimating the effectiveness of investment projects was considered. It is difficult to apply this method because it requires profound knowledge of the market and of the subject of research from the specialists. This knowledge allows to predict numerous possible results and to estimate the probability of their onset. The weak point of this method is its subjectivity. Different estimations of possible onsets may lead to completely contrary results at decision-making about the expediency of an investment project.

Other risk analysis methods are proposed in economic research papers. Among them are a modelling method, sensitivity analysis, a game theory, a forecast method, etc. [4, 5].

As it was mentioned, there are numerous methods of risk analysis that let a firm manager make decisions in conditions of uncertainty. Nevertheless, these methods do not contain reasonable rules that allow to avoid a risk totally. This can be explained by the fact that the developed risk analysis methods are based on rather abstract concepts that are difficult to present in a quantitative form.

To improve the reliability of uncertainty analysis, the classification of investment risks according to the stages of investment projects and to the possibilities of risk prevention is essential. The solution to this problem as well as the correct choice of the methods of analyzing investment risks with provision for their specific content and the place of implementation of the investment project will allow one to improve the validity of assessment significantly.

5. Conclusions

In conclusion, it is necessary to note that determining the break-even point is one of the targets in risk assessment of investment expenditures. The quantity of units at a break-even point can be calculated from the relation of fixed costs to difference between contracted price of a product unit and variable costs for its manufacture. To check the financial feasibility and the effectiveness of a project according to the method of parameter variants of innovative investment projects, one must carry out calculations because of the changes in parameters. The appropriateness of the implementation of an innovative investment project depends on its profitability and market cost of capital. Besides, a beta-ratio can serve as the indicator of the degree of risk of an innovation investment project. Thus, analyzing the risks on the basis of required rate of return, three approaches have been considered.

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