Aims & Scope (Economics)

Article

ASSESSMENT OF THE EFFICIENCY OF INVESTMENTS ATTRACTION AS A CONDITION FOR SUSTAINABLE DEVELOPMENT OF THE COMPANIES

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Abstract. The article offers a new solution to the scientific task – improvement of the already existing and development of the new provisions on economic assessment and regulation of the mechanisms on investments attraction to the company. In the course of the research, one improved the method of determining the viability of regulation of the mechanisms of the investments attraction to the enterprise; through the use of which, one can hold an analysis of the dependence of the bounding change in the volume of attracted investments for a certain mechanism on simultaneously the bounding change in duration and the cost of its use. The use of this method enables the possibility to determine whether the enterprise will be able to timely attract the planned volume of investments. The improved mathematical instrumentarium on determining the viability of regulation of the investments attraction mechanisms grounds on the formation of the power function of the dependence of the attracted investments volume on duration and cost of the investments attraction process. This function forms a figure in three-dimensional space, based on the volume change of which, it is possible to determine the dependence of the change in the volume of investments that the enterprise attracted on the cost of time and costs needed for the implementation of this process. The obtaining of power coefficients was carried out in two ways: the method of iterations and the method of achievements of Lagrange. The improved method of determining the viability of regulation of the investments attraction mechanisms can be used by employees of the analytical departments at the enterprises as well as by managers, maintaining investments activities. This method is implemented during the process of investments attraction and makes it possible, at early stages, to identify the shortcomings of the mechanisms, used by the recipient enterprise.

Keywords: investments; efficiency; sustainability; investments attraction; mechanism.

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Introduction

The success of companies' functioning significantly depends on the potential capabilities of timely attraction of the necessary volume of capital for implementation of the planned projects, the achievement of the set objectives, etc. The investments for the company are one of the most significant factors of its long-term economic development. Therefore, the use of the investments attraction mechanisms is a crucial component for the successful functioning of the company. It is investments that may serve as the source of resources for the improvement of the financial and economic state of the company, increasing its market share, the introduction of innovative products, creation and use of the competitive advantages, etc.

Quite often, the company's own resources act as the main source of investments (Wang etc., 2014; Duwe & Rocque, 2017; Li etc., 2017). This is due to the instability of the economic and

political environment of their functioning, as well as the lack of effective tools for interaction with investors. Thus, there is a need for the development of the new ways of cooperation between the recipients and capital donors with consideration of modern trends.

Literature review

Successful formation and use of the investment attraction mechanisms will make it possible for the companies to timely attract the necessary volume of capital, which will increase their competitiveness in conditions of an unstable external environment (Kucharcikova etc., 2018; Huang & Pearce, 2015; Yingjian etc., 2016). This will also provide the companies with the possibility of long-term economic development, entry into the new markets, creation, and implementation of new innovative and competitive products.

The process of attracting investments to the enterprise is a complex and extensive sequence of continuous use of elementary mechanisms of different types. Different processes of investments attraction can manifest themselves as different derivative mechanisms (Junkes etc., 2015; Bardazzi & Ghezzi, 2018; Owen & Mason, 2017).

The elements, interacting within the mechanisms of investments attraction, are characterized by the subjective character of reality assessment, and, therefore, the decisions of an investor, recipient, and other intermediaries involved in the process of investments attraction, are determined by the perceptual properties of their consciousness, experience, and information they possess (Decramer & Vanormelingen, 2016; Joghee etc., 2020).

The investment attractiveness of the recipient is a significant factor, affecting the success of the investments attraction process. There are many approaches to determining the level of investment attractiveness of the enterprise in the scientific literature (Pot, 2019; Skrodzka, 2015). Nonetheless, they are all presented based on a separate, segmental analysis of factors, affecting the success of the investments attraction process. It is difficult to predict which system the investor uses for making decisions. Thus, it is almost impossible to determine the factors he will consider as well as the methods he will use to assess their influence.

The research objective resides in the improvement of existing and development of new theoretical and methodological-and-applied provisions on the economic assessment of investments attraction into the company.

Methods

To present a method for determining the viability of regulation of the mechanisms for attracting investments in a company, it is necessary to provide an equation of dependence that will be used for the analysis of the dependence of the volume of attracted investments on the cost and duration of the investments attraction process (Lai etc., 2020; Guo etc., 2016).

It is worth noting that even though the application of linear dependence is easier in practice, its use is complicated by the process of search for the linear coefficients. Of course, the introduction of these coefficients can be considered unreasonable as the determination of the inequalities of the relations between them can be carried out through the usual least-squares method for an array of log values. Nonetheless, it will make it impossible to calculate the relative change of the three-dimensional figure “volume of attracted investments (I) – duration of the investments attraction process (T) – the cost of the investments attraction process (V),” which makes it impossible to assess the bounding volume of investments, accounting for the unit of money and expenditures during the process of investments attraction. Therefore, it is advisable to consider the possibility of the use of power dependence when forming the equality of the equation (1).

Let us give the equation of power dependence in its initial form:

$$I(T,V)=b_0 T^{b_1} V^{b_2} \quad (1)$$

where b_0, b_1, b_3 – parameters of power dependence.

To obtain the parameters of power dependence, it is necessary to transform it through taking logarithms:

$$\ln(I)=\ln(b_0)+b_1\ln(T)+b_2\ln(V) \quad (2)$$

In practice, one will use the following equation:

$$\exp[\ln(I)]=\exp[\ln(b_0)+b_1\ln(T)+b_2\ln(V)] \tag{3}$$

$$\left.\begin{aligned}&I^{\frac{1}{\alpha}}=b_0T^{\frac{b_1}{\beta}}V^{\frac{b_2}{\chi}}\Rightarrow\exp\left[\frac{1}{\alpha}\ln(I)\right]=\exp\left[\ln(b_0)+\frac{b_1}{\beta}\ln(T)+\frac{b_2}{\chi}\ln(V)\right]\\&\frac{1}{\alpha}\ln(I)=\ln(b_0)+\frac{b_1}{\beta}\ln(T)+\frac{b_2}{\chi}\ln(V)\end{aligned}\right\}\Rightarrow \tag{4}$$

$$\Rightarrow\frac{1}{\alpha}\sum_{n=1}^{N}\ln(I_n)-\frac{b_1}{\beta}\sum_{n=1}^{N}\ln(T_n)-\frac{b_2}{\chi}\sum_{n=1}^{N}\ln(V_n)=N\ln(b_0)$$

where N – the number of observations over the values of volume of the attracted investments, duration, and the cost of the investments attraction process.

Thus, it is possible to form a system of linear equations, for which the sought coefficients α,β,χ will become solutions:

$$\begin{cases}y_1\frac{1}{\alpha}+y_2\frac{1}{\beta}+y_3\frac{1}{\chi}=Y\\y_1'\frac{1}{\alpha}+y_2'\frac{1}{\beta}+y_3'\frac{1}{\chi}=Y'\\\frac{1}{\alpha}\sum_{n=1}^{N}\ln(I_n)-\frac{b_1}{\beta}\sum_{n}^{n}\ln(T_n)-\frac{b_3}{\chi}\sum_{n}^{N}\ln(V_n)=N\ln b_0\end{cases} \tag{5}$$

Based on the coefficients $y_1,y_2,y_3,y_1',y_2',y_3'$, one sets the initial conditions, under which one looks for one of the solutions of the equation system (5). Herewith, one also considers the values Y,Y', which are also set before solving the system of equations.

The formation of a system of equations (5) by the Lagrange achievement method is a partial case of the implementation of the above-given method of determination of the coefficients α,β,χ. Obtaining an equations system in this way starts with the selection of a certain parameter L, which is the sum of the values α,β,χ (this value is selected randomly, its choice does not affect the result as the equation obtained by implementing this sequence will be analyzed in terms of the relationship between the parameters α,β,χ).

$$\begin{cases}\alpha+\beta+\varphi+0+0=L\\\alpha\sum_{j=1}^{N}I_j+\beta\sum_{j=1}^{N}T_j+\chi\sum_{j=1}^{N}V_j+0+0=0\\2\alpha\,Var(I,I)+\beta\,2Cov(I,T)+2\chi\,Cov(I,V)-l_1\sum_{j=1}^{N}I_j-l_2=0\\2\alpha\,Var(T,I)+\beta\,2Cov(T,T)+2\chi\,Cov(T,V)-l_1\sum_{j=1}^{N}T_j-l_2=0\\2\alpha\,Var(V,I)+\beta\,2Cov(V,T)+2\chi\,Cov(V,V)-l_1\sum_{j=1}^{N}V_j-l_2=0\end{cases} \tag{6}$$

where $Var(I,I)$ - the variation of the volume of the attracted investments; $Cov(I,T),\ldots,Cov(V,T)$ - paired covariance of values of the attracted investments volume, duration, and cost of the process of their attraction; l_1,l_2 - products of Lagrange.

The next stage will involve the solution of the equations system (6) and obtaining a power dependence of the volume of attracted investments on the duration and cost of the process of their attraction. After determining the equation of this dependence, one determines the relative change in

the three-dimensional figure “the volume of attracted investments – the duration of the process of investments attraction – the cost of the investments attraction process.” To do this, it is necessary to calculate a certain double integral based on the obtained equation of dependence between the investigated indicators:

$$I_D = \iint I(T,V) = \iint \left(b_0 T^{\delta} V^{\varepsilon}\right) dT\, dV,\ D \notin T', V'$$
$$T' \in [T_1, \ldots, T_e];\ \ V' \in [V_1, \ldots, V_e];\ \ \delta = \frac{\alpha b_1}{\beta};\ \ \varepsilon = \frac{\alpha b_1}{\alpha} \tag{7}$$

where I_D - the volume of the sector of the figure, which is formed in three-dimensional space by the parameters under investigation.

After integrating them, we get:

$$I_D = \iint\limits_D I(T,V) = \iint\limits_D \left(T^{\delta} V^{\varepsilon}\right) dT dV = b_0 \int\limits_T \left(\int\limits_V \left(T^{\delta} V^{\varepsilon}\right) dV \right) dT =$$
$$= b_0 \int\limits_T T^{\delta} \frac{V^{\varepsilon+1}}{\varepsilon+1}\Bigg|_{V_1}^{V_2} dT = b_0 \frac{V^{\varepsilon+1}}{\varepsilon+1}\Bigg|_{V_1}^{V_2} \frac{T^{\delta+1}}{\delta+1}\Bigg|_{T_1}^{T_2} = b_0 \left(\left[\frac{V^{\frac{\alpha b_1}{\beta}+1}}{\frac{\alpha b_1}{\beta}+1} \right]\Bigg|_{V_1}^{V_2} \right) \left(\left[\frac{T^{\frac{\alpha b_2}{\chi}+1}}{\frac{\alpha b_2}{\chi}+1} \right]\Bigg|_{T_1}^{T_2} \right) \tag{8}$$

The obtained volume values are analyzed with the use of formula 1, based on which, one determines the viability of regulation of the mechanisms for the attraction of investments in the company.

Results and Discussion

The outcome of the investments attraction mechanisms can be determined based on their economic assessment. Nonetheless, sometimes in the process of the application of the mechanisms, one faces the need for determining the appropriateness of their regulation based on the latest information. This circumstance is especially relevant when the recipient enterprise, after the launch of the investment attraction process, found out that it can take place with deviations due to the possible influence of factors, which were not considered during economic assessment.

Table 1. Natural logarithms of average values of investments volume and values of the investments attraction process cost

Duration of the investments attraction process	The cost of the investments attraction process	The volume of attracted investments
0	7.090077	6.907755
0.693147181	7.17012	7.600902
1.098612289	7.272398	8.006368
1.386294361	7.185387	8.29405
1.609437912	7.192934	8.517193
1.791759469	7.352441	8.699515
1.945910149	7.489412	8.853665
2.079441542	7.090077	8.987197
2.197224577	7.196687	9.10498
2.302585093	7.349874	9.21034
2.397895273	7.275865	9.305651
2.48490665	7.377759	9.392662
2.564949357	7.438384	9.472705
2.63905733	7.495542	9.546813

Notes: the duration of the process corresponds to the sequence numbers of the months during which one carried out the observation (01.12.2021 – 28.12.2022)

The solution to this problem is possible based on the forecasting the results of the application of the mechanisms for determining the viability of their regulation.

The choice of the starting parameters takes place until one finds a solution, which will meet the condition, specified by the third equation of the equations system (5). Let us give an example of coefficients α, β, χ calculation for the Volkswagen company, based on the data from Table 1.

Let us provide a graphical illustration of the relationship between natural investments (Figure 1).

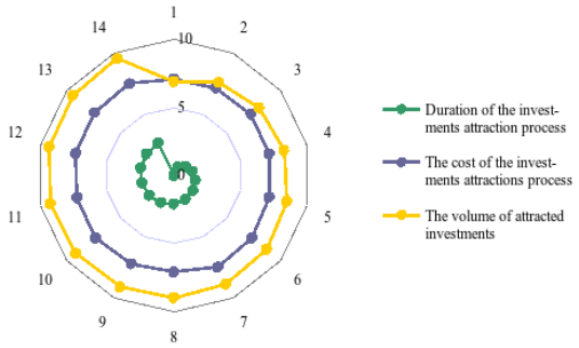

Fig. 1. The spectrogram of natural logarithms of average values of investments volume and the value of the investment attraction process cost

Let us make further calculations. Based on the method of the smallest squares, we get:

$$\ln(I)=6.487+0.977\ln(T)-0.89\ln(V) \quad (9)$$

The correlation takes the form:

$$\frac{131.989}{\alpha}-\frac{34.93}{\beta}-\frac{8.36}{\chi}=97.567 \quad (10)$$

May the starting conditions be: $y_1^{'}=1, y_2^{'}=1, y_3^{'}=1$, with all other coefficients amounting to zero. Let us set the number Z as the one amounting to 0,22, the number Z' as the one amounting to 1.

Let us write down the equality (2) with consideration of the obtained coefficients:

$$0.22\ln(I)=6.487+0.977\ln(T)-0.89\ln(V)\Rightarrow$$
$$\Rightarrow\ln(I)=33.352+5.054\ln(T)-0.264\ln(V)$$

Let us write the equality:

$$\exp[\ln I)]=\exp[33.352+5.054\ln(T)-0.264\ln(V)]$$

Let us draw the equality of dependence of the investments volume on the duration and cost of the investments attraction process:

$$I=33.352\times T^{5.054}\times V^{-0.264}$$

The obtained power dependence reflects the nature of the relationship between the volume of attracted investments and the duration and cost of the investments attraction process. Nonetheless, the parameters set at the beginning are not the only solution for the system of equations (5). Without the change of the coefficients of the first and second equation, let us change the value of a single parameter – the number Z. In this case, we can obtain other solutions. Thus, this parameter can be selected in such a way that the resulting equation reflects the sought trend.

Let us write the equations (2) and (3) with consideration of the obtained coefficients:

$$\ln(I)=6.82+0.957\ln(T)+0.007\ln(V)$$

$$\exp[\ln I)]=\exp 5.82+0.957\ln(T)+0.007\ln(V)]$$

$$I = \exp(6.82) \times T^{0.957} \times V^{0.007}$$

Thus, based on the held calculations, one can sum up that $\alpha(0.91) < \beta(0.92)$, and, therefore, the time component is revalued, the enterprise should increase the duration of the process of investments attraction, but, at the same time, consider the possibility of its cost reduction.

Thus, the sequence of implementation of the method of determining the viability of regulation of the mechanisms for investments attraction to the enterprise is as follows:

1. Obtaining the equation of the volume of attracted investments on the duration and cost of the investments attraction process.

2. Determination of volumes of sectors of the three-dimensional figure "volume of attracted investments – the duration of the investments attraction process – the cost of the investments attraction process".

3. Calculation of the relative change in the volume of sectors of the three-dimensional figure "volume of attracted investments – the duration of the investments attraction process – the cost of the investments attraction process".

4. Based on the application of the equation (1), one makes a decision about viability or unreliability of regulation of the mechanisms for investments attraction to the enterprise.

The nonlinear nature of the given dependencies is inherent to them due to various reasons. The main one is that the participants of the process of investments attraction are subjects, possessing an ability to think abstractly, namely such their features as work experience with investors, personal qualities, an ability of efficient communication, reputation in the world of business, etc.

A three-dimensional representation of the relationship between the volume of attracted investments and the cost and time, involved in the process of investments attraction determines the optimal directions for cheapening or reduction of the duration of this process. Thus, the enterprise, analyzing the process of investments attraction, determined that their volume grows faster due to an increase in the cost of this process or vice versa – due to the increase in duration. This makes it possible to plan the procedure for the implementation of mechanisms for investments attraction in such a way that it corresponds as accurately as possible to the planned tasks that the recipient enterprise sets for itself, starting with investments attraction. Therefore, it is quite possible that the change of the mechanisms list and their application will happen in the process of investments attraction, which stands for the regulation of mechanisms.

Conclusion

The main idea, based on which one formed the mathematical instrumentarium, resides in the fact that the interaction of the enterprise and the investor takes place in a non-linear form. Its result is influenced by various kinds of subjective factors, the influence of which can manifest itself, in the temporal aspect, temporarily and not predictably. Therefore, it is appropriate to analyse the functions of boundary change of the volume of attracted investments from the duration and the cost of the investments attraction process.

This is because the increase in the volume of attracted investments with each additionally used mechanism should take place faster than the increase in consumption of time and costs for the implementation of this mechanism. The article provides an analysis of the function of the change of the growth rate of attracted investments volume from the duration and the cost of the process of their attraction. This approach is not unique and can be used for the analysis of both investment cash flows at the enterprise and during the study of any other cost flows in the economic systems and structures. The article highlights a method of feasibility forecasting for regulation of the mechanisms of investments attraction to the enterprise, which is the peculiarity of this study.

The directions for further research include the development of strategies for implementation of the mechanism of the companies investments attraction, analysis of efficiency assessment of these strategies, and formation of the appropriate implementation instrumentarium.

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