Three-dimensional model representation of investment attraction for company

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Abstract – Proposed mathematic tools for analyzing three parameters puzzle in economics. It is counted the nonlinear character of the dependences between the elements of the economic system and designed the model for the calculation marginal change volume of the attracted investments.

Key words – investments, attraction investments, the mechanisms of the attraction investments to the enterprise, mathematic model of the marginal change of volume attracted investments.

I. Introduction

The implementation process of attracting investments should be based on the implementation of a particular set of mechanisms to attract investment, the implementation of which may result in loss of time and money on the part of the recipient. Therefore, the definition of probable relationship between the volume of investments and spending time and money caused by the present process is one of the most important tasks facing the company, attracting investment. This problem can be solved by applying a mathematical model that accurately reflect the relationship between the studied parameters. Outlines issues explored many different scientists. Among them we can mention IA Bobkov [1], IA Blanc [2], NM Yermoshenko [3], Buharya NI, AF Gojko, PS Rogozhin, VG Fedorenko [4] and many others. However, none of them offered a mathematical model that would reflect the process of attracting investments in the three-dimensional plane, the volume of investments, duration and cost of the process. Before you present this model, it should be noted that the process of attracting investment to the enterprise can not be described by conventional linear methods of mathematical statistics.

II. Mathematic model marginal change of the volume of attracted investments in the space: cost and duration of the process of attraction investments

This is due to the fact that during the implementation of the process is not "automatic" or "mechanical" interaction of several subjects of the capital market. This interaction is determined not only by economic factors, but also the individual characteristics of its members: their experience, beliefs, reputation, perception and so on. And at the same time mathematical model proposed by the author can not resist the existing methods, the so-called nonlinear statistics, since they require a significant amount of historical data and does not always give an opportunity to present the study process in the three-dimensional plane. Therefore, the author determined the three-dimensional model representation of the process of attracting investments will again stay in nonlinear regression. To describe the main principle of the model output try to analyze what can be represented by a nonlinear function of investments dependence of the duration and cost of the process. Obviously, the simplest function with which you can solve this problem in a plane described above, it will be an exponential function. Then we can give the following system of equations:

$$\begin{cases} I(Q_m) = Q_m^{\delta}; \\ T(Q_m) = Q_m^{\varphi}; \\ V(Q_m) = Q_m^{\lambda}. \end{cases} \qquad (1)$$

where $I(Q_m)$, $T(Q_m)$, $V(Q_m)$ - unctional relationships in accordance volume of investments, duration and cost of the process used on the number of instruments; δ, φ, λ – umbers some steel by the interval $(0; \infty)$.

So obvious is the assumption that:

$$I^{\frac{1}{\delta}} = T^{\frac{1}{\varphi}} = V^{\frac{1}{\lambda}}. \qquad (2)$$

As you can see, you can express the dependence of attracted investments on the duration and cost of the process:

$$I = T^{\frac{\delta}{\varphi}} = V^{\frac{\delta}{\lambda}}. \qquad (3)$$

Equality (3) makes it impossible to judge how on investment affect the other two parameters simultaneously . Therefore, we transform equation (3) in terms of the usual linear regression, considering the non-linear nature of the studied variables through the use of powers:

$$I(T,V) = a_0 + a_1 T^{\frac{\delta}{\varphi}} + a_2 V^{\frac{\delta}{\lambda}} + e, \qquad (4)$$

where a_0, a_1, a_2 - ome linear weights (can be obtained based on linear regression); e - errors of the model (4).

Owever, equation (4) does not solve the problem of three-dimensional presentation of the study depends, as a figure that describes the function (4) can be provided only in three dimensions, therefore the study of the function in terms of whether it is increasing or decreasing can be achieved only by analyzing volume change this figure (example shown in the figures. Fig. 1).

The definition of a generalized increase in the efficiency of attracting investments can be based on analysis of the dynamics of volume three-dimensional figures, an example of which is shown in Fig. 1 a. The volume of this figure can be calculated by the formula of double integral:

$$V_D = \iint_D \left(a_0 + a_1 T^{\frac{\delta}{\varphi}} + a_2 V^{\frac{\delta}{\lambda}} \right) dTdV \qquad (5)$$

According to one of the properties of double integrals we obtain: (6) Integrating element of integration:

$$\begin{aligned} V_D &= \iint_D a_0 dTdV + \iint_D a_1 T^{\frac{\delta}{\varphi}} dTdV + \iint_D a_2 V^{\frac{\delta}{\lambda}} dTdV = \\ &= a_0 \iint_D dTdV + a_1 \iint_D T^{\frac{\delta}{\varphi}} dTdV + a_2 \iint_D V^{\frac{\delta}{\lambda}} dTdV. \end{aligned} \qquad (6)$$

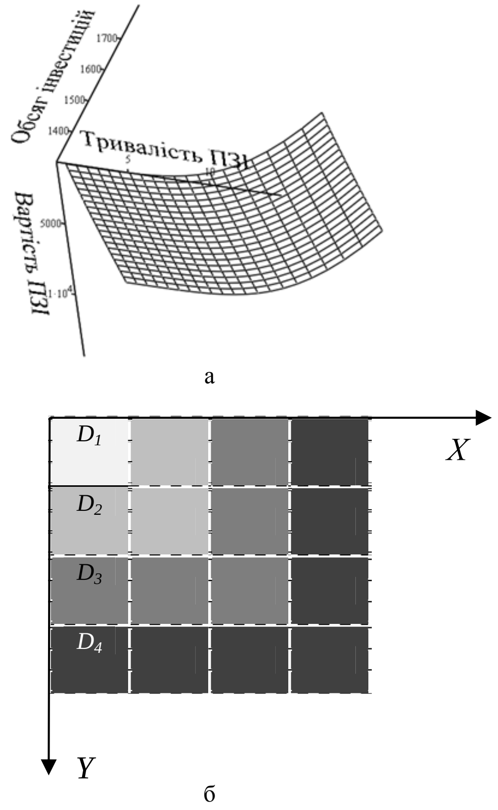

Fig. 1. An example of the figure, which describe the volume change of the formula (7, 8) and schematic distribution range of values that analyze the dynamics of the studied volume figures

Notes: «PAI» -the process of investment attraction.

Integrating element of integration:

$$V_D = a_0 \iint_D dTdV + a_1 \iint_D T^{\frac{\delta}{\phi}} dTdV + a_2 \iint_D V^{\frac{\delta}{\lambda}} dTdV =$$

$$= a_0 \int_V dV \int_{T(V)} dT + a_1 \int_V dV \int_{T(V)} T^{\frac{\delta}{\phi}} dT + a_2 \int_V V^{\frac{\delta}{\lambda}} dV \int_{T(V)} dT.$$

$$T(V) = T \Rightarrow V_D = a_0 \int_V dV \int_T dT + a_1 \int_V dV \int_T T^{\frac{\delta}{\phi}} dT +$$

$$+a_2 \int_V V^{\frac{\delta}{\lambda}} dV \int_T dT = \frac{a_0}{2} \int_V T^2 \Big|_{t_1}^{t_2} dV + a_1 \int_V \frac{\phi T^{\frac{\delta}{\phi}+1}}{\delta+\phi} \Bigg|_{t_1}^{t_2} dV +$$

$$+a_2 \int_V \frac{\lambda V^{\frac{\delta}{\lambda}+1}}{\delta+\lambda} \Bigg|_{t_1}^{t_2} dT = \frac{a_0}{2} v\left(t_2^2 - t_1^2\right) \Big|_{v_1}^{v_2} +$$

$$+a_1 v \left(\frac{\phi t_2^{\frac{\delta}{\phi}+1} - t_1^{\frac{\delta}{\phi}+1}}{\delta+\phi} \right) \Bigg|_{v_1}^{v_2} + a_1 t \left(\frac{\lambda v_2^{\frac{\delta}{\lambda}+1} - \lambda v_1^{\frac{\delta}{\lambda}+1}}{\delta+\lambda} \right) \Bigg|_{t_1}^{t_2}. \quad (7)$$

$$T \in D; V \in D;$$

$$\left[t_1 ... t_{end}\right] \in T; \left[v_1 ... v_{end}\right] \in V.$$

$$E = \frac{V_{D_3} - V_{D_4}}{V_{D_2} - V_{D_1}}, \quad (8)$$

Conclusion

Thus, formulas (7, 8) reflect the ratio between the volume of investments and the duration and cost of the process.

Also they can be used to set the rate of change of the volume of investments adjustable length and cost of funds for the implementation of the process of attracting investments.

Therefore, the output value can be viewed as a model the three-dimensional representation of the process of attracting investments.

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