

## ECONOMETRIC MODELING METHODS IN INVESTMENT FINANCING

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**Abstract:** This article provides for the development, discussion and conclusions based on the study of the specifics of the theoretical foundations of the development of sources and methods of financing investment projects in national economy.

**Key words:** investment, investor, investment activity, financing, investment projects, sources of financing, stock markets, real investments, financial investments.

Economic-statistical analysis of the economy of the country, especially its regions, is very important in the current strategic economy. As a clear example of this, the decree of the President of the Republic of Uzbekistan dated January 28, 2022 No. PF-60 "On the new development strategy of Uzbekistan for 2022-2026" states that "Further improving the investment environment in the country and increasing its attractiveness, 120 billion US dollars in the next five years, including "Taking measures to attract foreign investments of 70 billion dollars" defines the goals aimed at socio-economic and investment and innovation development as a priority[1].

- Establishing a new system based on the "bottom-up" principle for effective use of investments and increase in export volume;

- Implementation of the strategy of attracting foreign and domestic investments until 2026;

- On the basis of public-private partnership, to attract investments equal to 14 billion US dollars in energy, transport, health, education, ecology, communal services, water management and other sectors;

- Establishing foreign economic relations between the regions of the republic and business representatives of foreign countries, including development of investment and foreign trade relations with the business circles of the People's Republic of China of the Syrdarya region, the Russian Federation of the Surkhandarya region, and the Indian business circles of the Jizzakh region;

- Provide practical assistance to entrepreneurs by organizing "Investor Support Center" in Surkhandarya Region, "Business Support Center" by Navoi Mining and Metallurgical Combine in Navoi Region, "Advanced Projects and Engineering Center" and "Innovation and Technology Centers" in each district;

- Holding "Tashkent International Investment Forum" every year in Tashkent city.

International experience shows that the expansion of financing of investment activities should have a significant positive effect on the economic environment, that is, it should contribute to the expansion of production potential and production volumes. This requires concentration in financing high-value-added profitable and investment-worthy sectors of the economy, self-sustaining projects, innovative new businesses, etc.

Financing of investment activities means the purposeful use of allocated funds for the needs of a specific investment project. Activity financing is mainly used to finance investment projects involving investments in real assets rather than financial assets.

In particular, it serves as the most important way of financing innovative activities aimed at developing and mastering new types of products and new technological processes.

In order to implement large-scale infrastructure projects, build modern high-tech production facilities, to rapidly develop the economy, and actively attract foreign investments, large-scale work is being carried out in the country.

At the same time, the effectiveness of the activity in this field is negatively affected by a number of shortcomings related to the superficial use of available resources, the economic expediency and profitability of the projects included in the investment program.

There is no concept of long-term development of economic sectors and regions, taking into account the available resources, as well as the real possibilities of attracting investments, especially foreign investments.

As a result, there are cases of initiating economically unpromising projects, inefficient spending of financial resources, which ultimately leads to a decrease in the investment attractiveness of the country as a whole.

These circumstances require a fundamental revision of the procedure for forming investment programs, the mechanisms of its financing, increasing the transparency and efficiency of the selection of projects proposed for implementation. Therefore, development of sources and methods of financing investment activities and creation of necessary conditions is one of the important issues.

As the investment activity is based on the mobilization of the investor's own resources to the investment object, this activity requires that it be organized and financed according to the investor's goal.

The need to finance investment activity is explained by the fact that any investment directed to investment activity, ultimately, by itself cannot provide the interests of the investor. We know that investors are always looking for great profit and efficiency from their investment activities. In this way, they want to increase their capital and protect it from loss of value under market risks. For this, they direct their capital to the most optimal investment project and strive to achieve their goal by regularly managing its movement.

Accordingly, the need to finance investment activities can be explained as follows:

- the investor has his own goal in organizing the financing of investment activities;
- the desire of the investor to further increase his own capital through investment activities;
- organization of investment activities cannot be effectively implemented without its permanent management;
- the effect of various risk factors on the effective course of investment activity may occur;
- the participation of many other participants in the investment activity besides the investor and the existence of their interests;
- that any investment activity is necessarily aimed at serving the development of the interests of the state and society;
- strong competition in the market;
- limited investment resources of the investor, therefore, the desire to use them maximally in the most effective investment object in a limited time, etc.

In practice, since the financing of investment activities is organized directly depending on the investment project, the process of financing investment projects occurs during the financing of investment activities on a specific project. The need to ensure this process is as follows:

1. Implementation of project investment in conditions of financial instability increases the risk of reducing its efficiency. This reinforces the need to manage the project in order to ensure the expected results. The efficiency of the project is determined based on the application of several modern methods of its financing. This project plays an important role in financing and based on its results, it gives the project manager, founders, investors and other participants the opportunity to make appropriate changes to the project or, ultimately, to abandon it in time;

2. Financing of investment projects is carried out over time. This, in turn, plays an important role in optimizing the impact of time on project results. The fact that money loses its value over time creates and implements the need to ensure the correct and optimal use of capital in the investment process in order to ensure that the investor will produce the results expected from the project.

Investing takes place at the expense of attracting free funds. Monetary resources that are not in motion continue to lose their value. This loss occurs more in investments that do not have a clear goal and have not analyzed the results. However, under the influence of various factors, the cost of capital may change or remain unchanged even in the case of investing in a well-designed investment project over time;

3. Inflation is one of the important factors affecting the final result of project implementation. This, in turn, is a chronic change in the interest rate, changes in the exchange rate, changes in supply and demand, instability in legislation (interest rates on deposits and loans, required reserves, refinancing rate, currency policy, customs policy (circumstance of the internal market, etc. .) occurs as a result of;

4. There are various uncertainties in investment activity. Knowing the modern principles, mechanisms and methods of effective financing of investment projects and processes, taking into account the factors of uncertainty, and their optimal use will allow to move to a new quality of economic system development;

5. Taking into account the strengths and weaknesses of any project, it is necessary to develop measures for making decisions about the risks encountered in the process of project implementation and exiting the crisis situation through their econometric analysis.

Investment activities are financed from various financial sources. Among them, it is possible to include centralized budget funds, population savings, funds of economic entities, bank loans and foreign investments.

It is necessary to solve a number of other scientific-methodical and practical issues in order to forecast the features of sources of financing of investment activity. Among these issues, the following are important:

1. Identify the factors that describe the characteristics of investment sources and determine their effective use, imagine their value depending on whether it is large or small.

2. Each source of funding ( $x_i$ ) determination of the causes of interdependence and their resulting signs - capital flows and the correlation with the indicator of the national economy GDP (Y), correlation relationship ( $S_{xy}$ ) matrix and pairwise correlation coefficient ( $R_{xy}$ ) to see.

3. Multifactor analysis of investment financing sources and multilevel correlation indices ( $R_{xy}$ ) differentiating depending on the level of influence on the efficiency of the national economy.

4. To find a stable share of investment sources (total and private correlation coefficients for each factor) in the growth of the economy and GDP, which represents the power of the country's economy.

Based on the factors selected on the basis of regression analysis, the type of connection is determined. An overview of the type of connection between the resulting indicator Y and the group of factors affecting it can be expressed using the following function:

$$y = f(x_1, x_2, \dots, x_n)$$

Depending on the form of analytical expressions, the connections are straight-line (or completely linear) and curvilinear (or non-linear). If the factor symbols in the equation of the connection ( $x_1, x_2, \dots, x_k$ ) participating only with the first level, and their higher levels and mixed multiples do not participate, i.e

$$y_x = a_0 + \sum_{i=1}^K a_i X_i \quad (1)$$

is called a linear relationship or rectilinear relationship.



2016	16789,2	141564,7	64,9
2017	21781,3	185423,2	168,3
2018	23654,7	269432,4	234,3
2019	40511,1	569871,7	364,7
2020	36465,4	486124,2	564,3
2021	34566,1	429025,5	350,1
2022	37355,2	468127,1	382,3

Analyzing the process, we achieved the following result (implemented in Excel).

The Durbin-Watson (DW) criterion is used to check the presence of autocorrelation in the residuals of the resulting factor according to the model:

$$DW = \frac{\sum_{i=1}^{n-1} (Y_i - Y_{i-1})^2}{\sum_{i=1}^{n-1} Y_i^2} \quad (4)$$

Possible values of the DW criterion lie in the range 0–4. If the series has no autocorrelation, its values will oscillate around 2. The calculated actual values are compared with the critical value in the table.

If  $DW_{\text{хак}} < DW_{\text{паст}}$ , the series is autocorrelated

$$DW_{\text{нақ}} > DW_{\text{юқори}}$$

if it has no autocorrelation;

$$DW_{\text{паст}} < DW_{\text{хак}} < DW_{\text{юқори}}$$

If there is, it is necessary to continue the examination. Here  $DW_{\text{паст}}$  and  $DW_{\text{юқори}}$  – lower and upper limits of the criterion.<sup>1</sup>

If there is a negative autocorrelation (has a minus sign), then the criterion values lie between 2–4, so the DW4- DW values should be determined for verification.

Usually, the coefficient of determination takes values in the interval [0;1]. The closer the value of the coefficient is to 1, the stronger the relationship. In this case, the coefficient of determination equal to 0.97 means that there is a sufficiently strong relationship between these economic indicators in the model. In order to be able to compare models with different number of factors, and this number of factors does not affect the statistics, a corrected coefficient of determination is usually used, i.e.:

$$R_{\text{текс}}^2 = 1 - \frac{s^2}{s_y^2} \quad (5)$$

In this case, this leveled coefficient of determination should be equal to the value of 0.97 and its  $R^2$  proximity to, the change in the number of influencing factors of the model means that values are accepted around.

To determine the statistical significance of the constructed multifactor econometric model and its suitability for the studied process, Fisher's  $F$  - we use the criterion

<sup>1</sup>Gujarati D.N. Basic Econometrics. McGraw-Hill, 4<sup>th</sup> edition, 2003 (Gu),Inc.p. 472

It is possible to check the adequacy of the complete model, i.e., its compatibility with the real economic process, using Fisher's criterion.  $F$  - The actual value of the criterion is calculated using the following formula:

$$F_{his} = \frac{R^2}{1-R^2} \cdot \frac{n-m-1}{m} \quad (6)$$

Here:  $R^2$  - coefficient of determination;

$n$  - number of observations;

$m$  - the number of influencing factors in the model.

The calculated Fisher criterion is compared with its value in the table. To find the Fisher coefficient in the table  $k_1$  row and  $k_2$  it is necessary to define the column  $k_1 = n - m - 1$  and  $k_2 = m$ . If:

$$F_{his} > F_{jad}$$

if the model is significant, that is, the regression equation is considered to be correctly defined.

$F$  - the actual value of the criterion  $F_{his} = 190,98$  is equal to If the actual value is greater than the table value, then the constructed multifactor econometric model is said to be statistically significant or adequate for the process being studied.  $F$  - table value of the criterion  $F_{jad} = 3,98$  is equal to

$F_{his} > F_{jad}$  satisfies the condition that  $F$  - since the calculated value of the criterion is greater than the value in the table, it is statistically significant, and the econometric model can be used in forecasting for future periods.

Student's t-test is used to check the reliability of multifactor econometric model parameters and correlation coefficients. In this case, their value is compared with the values of random errors.

We created the following empirical model:

$$y = 4450,2 + 0,06964x_1 - 1,347x_2$$

According to the results of the model, an increase in the volume of product production by an enterprise ( $x_1$ ) by one unit leads to an increase in the volume of innovative activities in enterprises by 0.06964 units, a change in the volume of investments attracted to enterprises for product production by one thousand soums ( $x_2$ ) by one unit, the profit from product production is 1,347 units will change.

Statistical and econometric analysis methods are widely used in evaluating the economy of the country and its regions. However, the methodological and organizational possibilities of this analysis are not effectively used in studying the development of the economy of the country, especially the regions. This situation hinders their further socio-economic development. One of the important problems of the present day is the transition to the path of innovative development in order to achieve competitiveness in the world market due to technical and technological renewal of production, promotion of scientifically demanding sectors. The innovative way requires the development and implementation of new projects, investment, technical and technological renewal of production, structural changes in the country's economy. Particular attention is paid to the work carried out in order to attract investments in order to implement projects related to structural change of the country's economy, modernization of industries, technical and technological renewal.

We will perform statistical analysis and econometric modeling of the above-mentioned issues, the following points are related not only to their theory, but also to their statistical practice. In particular, it consists in studying the investment and innovation situation of the country in the region,

including their development prospects. The main results for statistical and econometric knowledge are normative and analytical models of investment and innovation potential of regions.

Methods that are suitable for the practical application of forecasting of investments in the economy of the republic and help to develop the theory should be developed based on the priority directions of the policy in the economic sphere.

Econometric modeling can be used not only to forecast investment, but also to forecast the overall economy of the economy, its separate sectors, inter-sectoral and regional production complexes, as well as to forecast labor resources and employment, interstate relations, production-financial relations and the standard of living of the population.

Undoubtedly, the degree of correctness of normative investment forecasts is determined by how close to reality they will be realized in the future. This, in turn, depends on whether the means necessary to achieve the planned results are sufficient, and the factors influencing their implementation are fully taken into account.

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