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Research Article

ECONOMETRIC ANALYSIS OF THE INFLUENCE OF INVESTMENTS ON ECONOMIC GROWTH IN UZBEKISTAN

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ABSTRACT

Investments are one of the important factors determining the level of economic growth. The article analyzes the impact of centralized, decentralized investments and investments attracted on the basis of foreign credit on ensuring economic growth in our republic, as well as their econometric modeling. The relationship between investments and the level of economic growth was also analyzed by creating a multifactor econometric model.

KEYWORDS

Investment, econometric model, economic truth, investment and economic truth, centralized and decentralized investment, investment attractiveness, investment research, investment rating, investment methodology, investment potential, investment model.

INTRODUCTION

One of the main indicators of economic growth in our republic is investment. Investments have a multiplier effect, and investment in one sector necessarily has a direct and indirect impact on the production of gross domestic product in other sectors. Therefore, one of the urgent issues in ensuring economic growth in our republic is the analysis of the impact of centralized,

decentralized investments, as well as investments attracted on the basis of foreign loans, as well as econometric modeling.

Literature review

The Law of the Republic of Uzbekistan "On Investments and Investment Activities", adopted on December 25, 2019, defines investments as follows: "investments are tangible and intangible assets and rights to them, including rights to intellectual property objects, invested by an investor in social, entrepreneurial, scientific and other types of activities on a risk basis in order to obtain profit, and may include:"

Many scientists, economists, and researchers have conducted their scientific work on investments, investment activities, the economic content of investments, the investment environment, investment attractiveness, the economic efficiency of investments, and other investments, both abroad and among Russian economists, as well as in our country.

In their research on investment, Edwin J. Dolan, Colin D. Campbell, and Rosemary J. Campbell argue that in a modern market economy, when the annual expenses of a household are less than its income, the excess income of the household from goods and services, as well as taxes and other payments, is considered savings. Only when these savings are directed to sectors of the economy with the aim of generating income, is it considered investment capital.

There are also views that firms invest in two directions: "the first direction is the purchase or creation of fixed capital, that is, the purchase or creation of new production equipment, buildings, computers, and other production tools related to production, and the second direction is the investment in inventories, that is, the reserves of raw materials necessary for use in production processes and residual finished products.".

Investment theory has gone through several stages in its historical development. As a result of his research on investment, V.V. Aladin concludes that "the first signs of investment can be seen in the scientific works of the Austrian school of economists, including Behm-Bawer.".

According to Professor Sh.I. Mustafakulov, "A specific methodology for assessing the investment attractiveness of a country is not established by any international law, therefore, recently, various methodologies for assessing investment attractiveness have been used. According to some economists, investment attractiveness is determined by the level of return on investment. This approach covers a very narrow scope of application, since in order to obtain accurate and accurate results, investments must be made with the same level of risk, which is practically impossible."

METHODOLOGY

The methodological basis of this study is the dialectical method of research, systematic and process approaches. The work uses such research methods as econometric analysis, correlation coefficient matrix, scientific abstraction, synthesis, grouping and comparison, financial

analysis, as well as an official information base. In order to assess the validity and practical significance of the above-described methods for assessing the investment climate, scientifically and practically based recommendations were developed on the study of foreign experience and the implementation of its advanced and promising achievements.

For this purpose, multifactor econometric models were used to study the impact of investments on GDP growth in our republic and to build econometric models. Before building a multifactor econometric model, descriptive statistics were conducted on the factors participating in this model. The reason for this is to determine whether the variables participating in the multifactor econometric model are subject to normal distribution, to determine indicators such as arithmetic mean values, median, kurtosis, and asymmetry.

Table 1

Dynamics of gross domestic product and investments in the Republic of Uzbekistan in 2001-2022, billion soums *

Years	GDP, (billion soums), Y	Centralized investments, bln. soum, X_1	Decentralized investments, billion soum, X_2	Investments attracted on the basis of foreign credit billion soum, X_3
200 0	3255.6	475.6	268.9	172.3
200 1	4925.3	621.2	699.7	369.6
200 2	7450.2	623.2	903.4	306.1
200 3	9844.0	720.9	1257.2	479.4
200 4	12261.0	1043.6	1585.3	659.9
2006	15923.4	978.2	2186.9	687.0
200 8	21124.9	1337.9	270 3 . 0	748.3
2009	28190.0	1610.2	4293.3	1447.7
20 10	38969.8	2231.1	7324.8	2863.9

20 11	49375.6	3001. 3	9530.6	4058. 1
2012	74042.0	3343.2	13120.5	4340.8
2013	96949.6	4056.6	15443. 4	3853. 8
2014	120242.0	5077.6	19377.7	4653.3
2015	144548.3	5952.7	24537.3	5532.7
2016	177153.9	6730. 7	30915. 5	6980. 1
2017	210183.1	6791.8	38018. 6	8309.5
2018	242495.5	8238. 5	42993.5	10611.4
20 19	302536.8	10102. 8	62052.3	17146.5
20 20	406648.5	23127. 6	101103.7	30154.8
20 21	510117.2	42543.8	153383. 5	85437.2
202 2	580203.2	33915.6	168084.5	87143.6

* **Source: prepared by the author based on the data of the Statistical Agency under the President of the Republic of Uzbekistan.**

When analyzing the impact of the relationship between investment and economic growth based on the data in Table 1 above, based on the Eviews 9.0 program recommended by I.M. Rozhkov, I.A. Larionova, and N.A. Isaeva, their descriptive statistical results represent the quantities below (Table 2).

Descriptive statistical results

	Y	X_1	X_2	X_3
Mean	145544.8	7739. 3	33323.0	13140.7
Median	74042.0	3343.2	13120.5	4058. 1
Maximum	580203.2	42543.8	168084.5	87143.6
Minimum	3255.6	475.6	268.9	172. 4
Std. Dev.	173101.9	11422.5	49168.4	25313.6
Skewness	1.3	2. 1	1. 9	2.4

Kurtosis	3. 6	6.2	5.1	7. 4
Jarque-Bera	6. 3	24. 3	15.4	37. 3
Probability	0. 1	0.	0.0	0.0
Sum	3056440. 0	162524.5	699783.8	275956.4
Sum Sq. Dev.	5.99E+11	2.61E+09	4.84E+10	1.28E+10
Observations	21	21	21	21

* Source: Author's calculations

According to the table, it can be seen that the average values of the influencing factors range from 7739.2 to 145544.8. The smallest amount corresponds to the indicator of centralized investments. The main reason for this is that in recent years the state has been paying attention to centralized investors in our Republic. The results of the analysis indicate that all factors included in the multifactor econometric model obey the normal distribution and their probabilities are less than 0.5. This, in turn, requires the inclusion of all influencing factors (x_i) in the model. Therefore, we consider the relationships between the factors, taking into account the normal distribution of the factors included in the model (Figure 1).
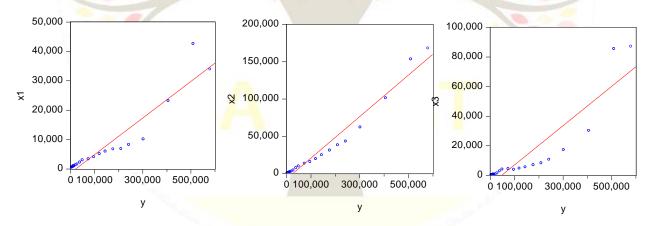

Figure 1. Relationships between the outcome factor y and the factors influencing it

From the graphs presented in Figure 1, it can be seen that there is a close relationship between the resulting factor y and the factors influencing it (x_i). In order to more accurately characterize these relationships and their impact on the level of investment and economic growth, it is advisable to calculate the correlation coefficients between the factors (Table 3).

Table 3

Correlation coefficient matrix

	Y	X$_1$	X2	X3
Y	1.000000			
X$_1$	0.942468	1.000000		
	12.28887			
	0.0000			
X$_2$	0.981386	0.980043	1.000000	
	22.27449	21.48980		
	0.0000	0.0000		
X$_3$	0.906439	0.973033	0.966998	1.000000
	9.355298	18.38729	16.54348	
	0.0000	0.0000	0.0000	

From the matrix of correlation coefficients between factors, it can be seen that the specific correlation coefficient between the resulting factor and the influencing factors is greater than 0.9, that is, there is a close relationship between them. These results justify the need to take into account all the proposed factors when developing a multifactor econometric model of the relationship between investment and economic growth indicators. Since the results of our analysis show that all of these factors have a significant impact on the change in the volume of the republic's gross domestic product. Based on the data in Table 1 above, we determine the form of a multifactor econometric model (Table 4).

Table 4

Estimated parameters of a multivariate econometric model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X1	-1.3927	1.995244	-0.698027	0.4946
X2	5.8819	0.419645	14.01645	0.0000
X3	-4.2378	0.702452	-6.032922	0.0000
C	16008.23	5331.502	3.002574	0.0080
R-squared	0.9913	Mean dependent var		145544.8
Adjusted R-squared	0.9897	S.D. dependent var		173101.9
S.E. of regression	17544.31	Akaike info criterion		22.55249
Sum squared resid	5.23E+09	Schwarz criterion		22.75145
Log likelihood	-232.8011	Hannan-Quinn criter.		22.59567
F-statistic	643.3257	Durbin-Watson stat		1.799394
Prob(F-statistic)	0.000000			

According to the data in Table 4, the multifactor econometric model looks like this:

$$\hat{Y} = 16008.23 - 1.3927 \cdot X_1 + 5.8819 \cdot X_2 - 4.2378 \cdot X_3$$

$$(1)$$

$$R^2 = 0.9913, \ F_{\text{хисоб}} = 643.3257, \ DW = 1.799$$

The parameters of the calculated (1) multifactor econometric model show that if centralized investments increase by 1.0 billion soums, the gross domestic product may decrease by an average of 1.3927 billion soums. An increase in decentralized investments by 1.0 billion soums will increase the gross domestic product by an average of 5.8818 billion soums. An increase in the part of investments attracted on the basis of foreign loans directed only to social sectors by 1.0 billion soums can reduce the country's gross domestic product by an average of 4.2378 billion soums. Our analysis shows the validity of the theoretical views recognized by foreign scientists that the amount of centralized investments directed to social sectors is determined based on the level of the threshold of influence on the change in gross domestic product. Therefore, in our opinion, when developing programs for financing social facilities from centralized funds, it is recommended to determine the optimal level of GDP and funds allocated to the social sphere

based on econometric model analysis. Otherwise, the effectiveness of funds directed to a positive goal may decrease.

RESULTS

In order to assess the quality of the multifactor econometric model (1) calculated above, we determine the coefficient of determination. The coefficient of determination expresses the degree of dependence of the resulting factors affecting the relationship between investments and gross domestic product on the factors included in the model. The coefficient of determination (R2 - R-squared) calculated based on the data in the table is equal to 0.9913. The results of our analysis show that 99.13 percent of the republic's gross domestic product (Y) (1) consists of factors included in the recommended multifactor econometric model, and 0.87 percent (1.0-0.9913) of the change is due to the influence of factors not taken into account in the model. The fact that the standard errors of the factors (1) in this multifactor econometric model are also small indicates the high statistical significance of the model. To allow for comparison of models with different numbers of factors and to ensure that these numbers of factors do not affect the R2 statistic, a smoothed coefficient of determination is usually used, i.e.:

$$R_{adj.}^2 = 1 - \frac{s^2}{s_y^2} \qquad (2)$$

Adjusted coefficient of determination (Adjusted R-squared) equal to 0.9897 and its proximity to R 2 means that the model can accept values around the change in the number of influencing factors.

Fisher's F-criterion is used to check the statistical significance of the multifactor econometric model (1) or its adequacy (suitability) to the studied process. Fisher's calculated F-criterion value is compared with its value in the table. If F calculation > F table, then the multifactor econometric model is said to be statistically significant and it can be used to forecast the resulting indicator - the republic's gross domestic product (Y) for future periods. So, we find the table value of F-criterion to check the statistical significance of the model. For this, we calculate the values of the degrees of freedom and the level of significance. Based on the level of significance and the degrees of freedom and, the table value of the F-criterion is equal to. The calculated value of the F-criterion F calculation = 643.3257 and the table value F table = 3.20 and the condition of F calculation > F table is fulfilled, so it can be said that the multifactor econometric model is statistically significant and it can be used to forecast the size of the gross domestic product of the republic (Y) for future periods. comes and goes. Student's t-test is used to check the reliability of the calculated parameters (regression coefficients) of multifactor econometric modeling. By comparing the calculated (t calculation) and table (t table) values of Student's t-meson, we accept or reject the N 0 hypothesis. For this, the probability of reliability and the degree of freedom j are selected for the

table of the t-criterion. we find based on the conditions. Here- the number of observations, - the number of factors. Reliability probability and degree of freedom then the tabular value of the t-criterion is equal to.

It can be seen from the regression calculations that the calculated values of the t-meson according to the factors X 2 and X 3 are greater than the table value in accuracy (Table 4). And these factors are in the multifactor e conometric model q allows them to have sex. We use the Durbin-Watson (DW) test to check for autocorrelation in the residuals of the resulting factor according to the multifactor econometric model. Using Fumio Hayashi 's Econometrica

tutorial calculated DW value j adval DW L v a DW is compared with U. If DW is less than <DW L, then autocorrelation is called autocorrelation . If DWcount>greater than DWU, there is no manual autocorrelation. The lower limit value of the Durbin-Watson criterion is DW L =1.03 and the upper limit value is DW U =1.67. DW count = 1.79. Therefore, since DW calculation > DW U, there is no autocorrelation in the residuals of the resulting factor (the volume of the republic's gross domestic product (Y)). The absence of autocorrelation in the residuals of the resulting factor and the actual (Actual), calculated (Fitted) values of the multifactor econometric model presented above (1) and the differences between them (Residual) are presented in Figure 2 below.
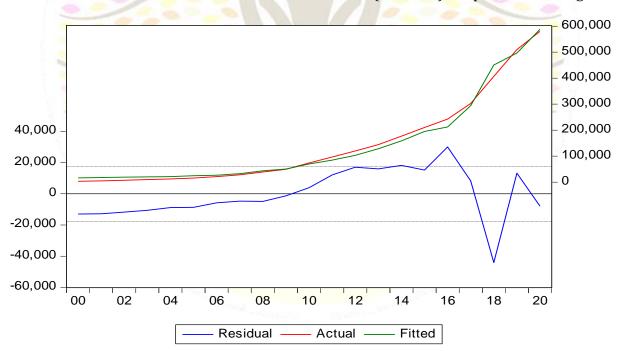

Figure 2. Multifactor econometric model

The graph of the estimated values of the republic's gross domestic product according to the multifactor econometric model is very close to the graph of its actual values, and the differences between them are not

very large. This is another proof that (1) the multifactor econometric model can be used to forecast the republic's gross domestic product for future periods.

1. The multifactor econometric model of investments in the industrial sector has the following form:

2.
$$\hat{Y} = 3828.965 - 3.9778 \cdot X_1 + 2.2465 \cdot X_2 + 0.0111 \cdot X_3 \qquad (3)$$

$$R^2 = 0.9954, \ F_{\text{хисоб}} = 1229.42, \ DW = 1.3288$$

2. The multifactor econometric model for investment in the agricultural sector looks like this::

$$\hat{Y} = 3826.264 + 2.8300 \cdot X_1 + 16.9024 \cdot X_2 - 12.7540 \cdot X_3 \qquad (4)$$

$$R^2 = 0.9735, \ F_{\text{хисоб}} = 208.599, \ DW = 2.1862$$

3. The multifactor econometric model for investments in the construction sector looks like this:

$$\hat{Y} = 1253.195 - 1.6557 \cdot X_1 + 10.6988 \cdot X_2 - 12.2367 \cdot X_3 \qquad (5)$$

$$R^2 = 0.9828, \ F_{\text{хисоб}} = 324.2296, \ DW = 0.8416$$

4. The multivariate econometric model for investment in the service sector looks like this:

$$\hat{Y} = 5080.561 - 1.6892 \cdot X_1 + 4.3127 \cdot X_2 - 1.2505 \cdot X_3 \qquad (6)$$

$$R^2 = 0.9916, \ F_{\text{хисоб}} = 669.3632, \ DW = 0.5938$$

If we evaluate the estimated parameters (3) - (6) of the multifactor econometric models established for the leading sectors of the economy, they all meet the conditions of the Fisher and Student criteria. Using this situation,

Now we will build multifactor econometric models of centralized, decentralized and foreign investments in the gross domestic product of the leading industries of our republic.

we forecast the gross product of these sectors for the next five years. Table 5 below shows the dynamics of investments in 2001-2021 and the forecast values for 2021-2025.

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Table 5

Dynamics of investments in Uzbekistan in 2001-2022 and quantitative forecast for 2025

year	Gross domestic product (billion soums)	M centered investments, billion soums	Decentralized investments are six billion soums	X is original credit based on attracted investments billion soums
2000	3,255.6	475.6	268.9	172.4
2001	4,925.3	621.2	699.7	369.6
2002	7,450.2	623.2	903.4	306.2
2003	9,844.0	720.9	1,257.2	479.5
2004	12,261.0	1,043.7	1,585.3	659.9
2005	15,923.4	978.3	2,187.0	687.0
2006	21,124.9	1,338.0	2,703.0	748.3
2007	28,190.0	1,610.2	4,293.3	1,447.8
2008	38,969.8	2,231.1	7,324.8	2,863.9
2009	49,375.6	3,001.3	9,530.6	4,058.1
2010	74,042.0	3,343.2	13,120.5	4,340.8
2011	96,949.6	4,056.6	15,443.4	3,853.8
2012	120,242.0	5,077.6	19,377.7	4,653.3
2013	144,548.3	5,952.8	24,537.3	5,532.7
2014	177,153.9	6,730.7	30,915.5	6,980.1
2015	210,183.1	6,791.8	38,018.6	8,309.5
2016	242,495.5	8,238.5	42,993.5	10,611.4
2017	302,536.8	10,102.8	62,052.4	17,146.5
2018	406,648.5	23,127.6	101,103.7	30,154.8
2019	510,117.2	42,543.9	153,383.5	85,437.2

2020	580,203.2	33,915.6	168,084.5	87,143.6
2021	664,237.0	34,039.2	189,275.7	98,557.3
2022	699,742.3	35,930.1	199,553.2	103,822.5
2023	735,247.6	37,821.0	209,830.8	109,087.6
2024	770,752.9	39,711.9	220,108.3	114,352.8
2025	806,258.1	41,602.8	230,385.8	119,617.9

Based on the econometric model recommended above, the change of macroeconomic indicators of our country in 2001-2022 was determined. In 2001, the level of investments from all sources was 89 percent compared to 2000, the gross domestic product was 1669.7 billion. increased to sum. In 2019, the volume of investments compared to 2010 is 80 billion. increased by more than sum, the amount of gross domestic products increased by 5 percent, respectively. The results of our calculations based on the recommended econometric model show that if the growth trend of 2001-2022 is maintained and the rate of investments directed to the economy is maintained, the forecast of the country's gross domestic product for 2025 will be 806,258 1 billion is soum. Our findings show that as a result of these correlations, there is a positive change in GDP growth. However, as noted above, it would be appropriate to include the volume of investments directed to the social sector into state programs based on the econometric model. Based on the above studies (Table 5), the results of calculating the results of investment sources are expressed in the following quantities (Figures 4-7).
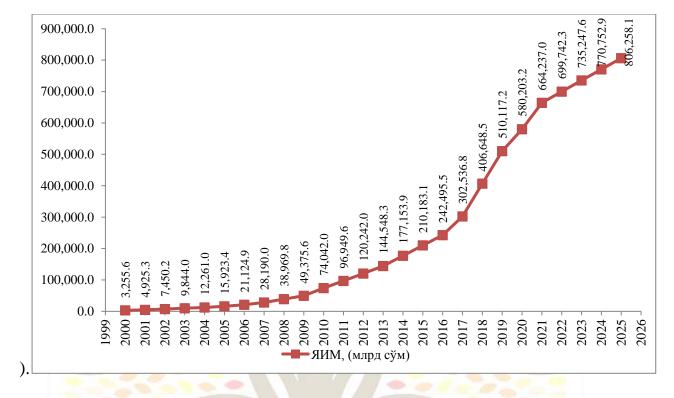
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Figure 4. Dynamics of 2001-2022 and forecast values for 2025
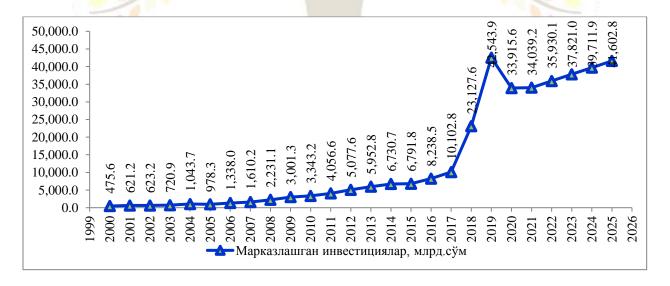
Figure 5. Dynamics of centralized investments in Uzbekistan in 2001-2022 and forecast values for 2025

Figure 6. Dynamics of centralized investments in Uzbekistan in 2001-2021 and forecast indicators for 2025.

As noted in our research, the most effective part of investments in the economy are investments made from decentralized resources. Because these investors directed their funds to the most profitable sectors of the economy based on the principle of "measure seven and cut one". In the conditions of centralized investments, the effectiveness of investments is evaluated not by their profitability, but by the implementation of the strategic tasks of the state. Therefore, the recommended econometric model is 2001-2022 (Figure 6). The results of our research predict that the volume of investments in decentralized (portfolio and real sector-oriented) investment sources will increase in accordance with the development trend in the coming years. Based on the results of our studies, we think that this growth trend, in turn, will serve to ensure employment of the population along with the growth of the gross domestic product, increase the income of the population and the export potential of the country, and a positive change in the currency balance.

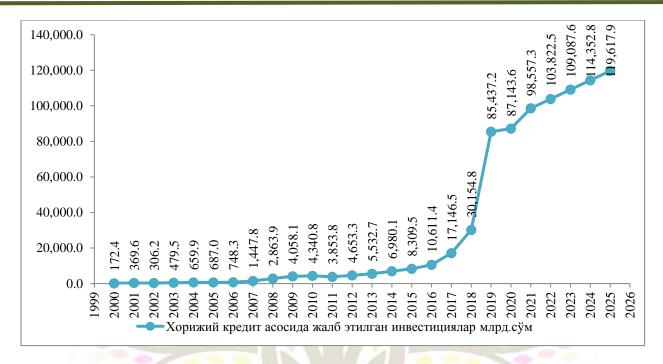Crossref doi | Google Scholar | WorldCat | MENDELEY

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Figure 7. Dynamics of investments attracted to Uzbekistan on the basis of foreign loans in 2001-2022 and forecast indicators for 2025

CONCLUSIONS

The results of our analysis, conducted on the basis of the proposed econometric model of the sources of investment financing and the forecast of indicators for 2025, show that the investment efficiency of centralized funds has a decreasing trend since 2019 (table. 5). This situation can be explained by the increase in the volume of investments in the social sphere in our country since 2019, aimed at supporting the low-income segment of the population.

As a result of the positive reforms implemented by the government in terms of investment support in our country, an increase in the volume of foreign investments has been observed since 2018 (Figure 7). It is known that a part of foreign investments is made up of foreign loans. The observation of sharp growth trends in this direction also had an impact on the changes in the volume of the gross domestic product. But as we mentioned above, the allocation of our funds to socio-economic areas has its positive result. is giving

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