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Phone: **+998 50 737 87 88**

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ECONOMETRIC EVALUATION OF INVESTMENT EFFICIENCY IN KHOREZM REGION

Otajanov Umid Abdullayevich

Professor at Ma'mun University, DSc

ORCID: 0009-0001-9949-2492,

Email: umidotajanov@rambler.ru

Abstract: This study examines the issues of improving the investment climate and enhancing the effectiveness of attracting investments in the Khorezm region of the Republic of Uzbekistan. The research employs economic analyses based on methods of scientific abstraction, analysis, synthesis, induction, and deduction. Currently, numerous agreements have been signed in the country regarding the promotion and protection of foreign investments. The main objectives of state policy for improving the investment climate and related proposals are presented.

Keywords: investment, economic analysis, foreign investments, investment climate, incentives, effectiveness, economic development.

Annotatsiya: Mazkur tadqiqotda O'zbekiston Respublikasi Xorazm viloyatida investitsion muhitni takomillashtirish va investitsiyalarni jalb qilish samaradorligini oshirish masalalari ko'rib chiqilgan. Tadqiqotda ilmiy abstraksiya, tahlil, sintez, induksiya va deduksiya usullariga asoslangan iqtisodiy tahlillar amalga oshirilgan. Hozirgi kunda mamlakatda xorijiy investitsiyalarni rag'batlantirish va himoya qilishga oid ko'plab bitimlar imzolangan. Investitsion muhitni yaxshilashga qaratilgan davlat siyosatining asosiy vazifalari hamda tegishli takliflar bayon etilgan.

Kalit so'zlar: investitsiya, iqtisodiy tahlil, xorijiy investitsiyalar, investitsion muhit, rag'batlantirish, samaradorlik, iqtisodiy rivojlanish.

Аннотация: В данном исследовании рассматриваются вопросы совершенствования инвестиционного климата и повышения эффективности привлечения инвестиций в Хорезмской области Республики Узбекистан. В исследовании использованы методы научной абстракции, анализа, синтеза, индукции и дедукции, а также проведены экономические анализы. В настоящее время в стране подписано множество соглашений, направленных на стимулирование и защиту иностранных инвестиций. Представлены основные задачи государственной политики по улучшению инвестиционного климата и соответствующие предложения.

Ключевые слова: инвестиции, экономический анализ, иностранные инвестиции, инвестиционный климат, стимулы, эффективность, экономическое развитие.

INTRODUCTION

Research conducted on the global economy shows that foreign investments in France increased by 3% in 2022, while the United Kingdom and Germany had the next best indicators. However, although activity increased by 1% compared to 2021, it decreased by 6% compared to 2019 [1].

Attracting direct investments helps connect a country's economy with global value chains and facilitates economic growth. Direct investments bring capital, jobs, increased exports, supply chain expansion, new technologies, and business practices to countries [2].

Accordingly, effective private sector investments remain an important component of growth strategies for developing countries. In order to realize the will of our people to build a free and prosperous, powerful New Uzbekistan in the Republic of Uzbekistan, create all opportunities for every citizen to develop their potential, educate a healthy, knowledgeable and spiritually mature generation, form a strong economy that has become an important link in global production, and guarantee justice, the rule of law, security and stability, the "Uzbekistan - 2030" strategy was adopted [3].

It sets important tasks for utilizing \$250 billion in investments, including attracting \$110 billion in foreign investments and \$30 billion in public-private partnership investments, bringing the volume of freely traded securities to \$8 billion, implementing over 500 strategically important technological and infrastructure projects with a total value of \$150 billion, maintaining an investment rating for regions, and further increasing the

attractiveness of each region to investors based on its capabilities.

Their full implementation, based on the existing level of technological and financial development in our country, demonstrates the need for scientific research on attracting foreign investments, including foreign direct investment, in individual regions of our country.

REVIEW OF LITERATURE ON THE SUBJECT

The attraction of foreign investment to the economy and small business, which is its integral component, as well as various aspects of the activities of enterprises established with their participation, have been reflected in the scientific research of numerous foreign and domestic economists. The theoretical foundations of attracting foreign investments and their effective utilization have been studied by leading foreign scholars such as L.J. Gitman, M.D. Johnk, J. Dunning, R. Narullo, T.G. Kubakh, S. Hladii, A.O. Malay, and L. Krkosa [4, 5, 6, 7]. Issues concerning the formation and development of foreign investments in the small business sector of developing countries have been addressed in the scientific works of CIS scholars including A.A. Agafonov, V.K. Bugaev, Z.V. Gerasimchuk, L.V. Davydova, V.V. Ignatyuk, Yu.A. Malakhova, V.M. Sukmanyuk, E. Kocherin, Z. Vdovenko, M.S. Ilyasov, O.V. Fadeeva, V.K. Spilnichenko, L.A. Sarkisyan, and E.A. Rudenko [8, 9, 10, 11, 12, 13, 14, 15, 16, 17].

The theoretical and practical aspects of attracting foreign investment into the economy of Uzbekistan and its regions, as well as its effective utilization, are reflected in the scientific research works of A.V. Vakhobov, N.G. Karimov, B.T. Baykhonov, U.A. Otajanov, Sh.G. Yuldashev, R.Z. Yuldashev, D.D. Rustamova, E.A. Makhmudov, and others [18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29].

The works of the aforementioned authors focus on the content and essence of foreign investments and their attraction to the small business sector of the national economy. However, specific scientific research on econometric models for attracting foreign investment in the development of small business entities in the context of economic modernization has not been conducted. This, in turn, necessitates carrying out scientific research within the framework of the chosen topic.

RESEARCH METHODOLOGY

During the research process, methods of scientific abstraction, analysis and synthesis, induction and deduction, comparison, grouping, econometric analysis, and forecasting based on a system of equations were employed.

ANALYSIS AND RESULTS

Currently, the Republic of Uzbekistan has signed intergovernmental agreements on the promotion and protection of investments with more than 80 countries worldwide. Along with improving legislation, mechanisms have been developed for attracting foreign direct investment, maximizing the simplification of procedures regulating relations between the state and entrepreneurs in the field of attracting foreign investment, guaranteeing the stability of long-term financing conditions for investment projects, and other measures.

Thus, the tasks of state policy on creating a favorable investment climate include: ensuring an attractive investment image; developing a comprehensive program to increase household incomes and GDP per capita; establishing a set of laws regulating guarantees for foreign investors; increasing the number of investment projects; developing an investment development model based on private investment; systematizing the results of implementing relevant legal documents at the industry, enterprise, and regional levels; creating an investment climate monitoring center to develop forecasts of investment attractiveness for regions of the Republic of Uzbekistan; developing programs to stimulate foreign investment based on local conditions and experience in cooperation with foreign investors; legislatively regulating additional tax and customs benefits for foreign investors in priority sectors; and creating an attractive image of the country in international capital markets [18, 19].

Based on the scope of the topic, we will examine improving the investment climate in the Khorezm region of the Republic of Uzbekistan, the use of investments, factors influencing changes in investment volume in fixed capital of small business entities, and assessment of investment attractiveness. For this purpose, we will conduct a multifactorial econometric analysis of the dynamics of changes in the volume of investments utilized in fixed capital of the Khorezm region, which is the object of research, as well as foreign and foreign direct investments included in its composition [20].

In this context, we will conduct an econometric analysis of factors influencing the volume of investments in fixed capital of small business entities in the Khorezm region - YAKI, considering the following factors: number of university graduates - X1, number of small business entities - X2, volume of products produced by small

business entities - X3, and total number of labor resources - X4 (Table 1) [20, 21, 22].

Table 1

Correlation coefficient among factors affecting changes in the volume of investments in fixed assets of small business entities in Khorezm region¹

	YAKI	X1	X2	X3	X4
YAKI	1				
X1	0,849244	1			
X2	0,907835	0,629103	1		
X3	0,726686	0,565732	0,598336	1	
X4	-0,689223	0,636556	0,648646	0,69734	1

If we examine the values in the table, we can observe that for small business entities in Khorezm region, the investment in fixed capital (YAKI factor) is strongly correlated with the number of university graduates - X1 ($r_{YAKI,X1}=0.849244$) and the number of small business entities - X2 ($r_{YAKI,X2}=0.907835$), while it has a moderate positive correlation with the volume of products manufactured by small business entities - X3 ($r_{YAKI,X3}=0.726686$). However, the volume of investments in fixed capital of small business entities in the region has a moderate negative correlation with the total number of labor resources - X4 ($r_{YAKI,X4}=-0.689223$), which implies that the current increase in labor resources in the region leads to a decrease in the resultant factor. Since there is no multicollinearity between the factors according to the condition $r_{x1,x2}<0.8$, we can proceed to determine the regression equation for the observed relationship using the EViews program (Table 2).

Based on the values provided in the coefficient column of the calculation table results, the following regression equation can be formulated:

$$\text{LnY}_{AKI}=3,35\text{LnX}_1+0,68\text{LnX}_2+0,36\text{LnX}_3+0,81\text{LnX}_4-34,55614 \quad (1)$$

Now, based on the values presented in the remaining columns of Table 2.3.2, the quality criteria of the first regression equation are examined. To do this, we first focus on the significance of the parameters according to the t-Statistic criterion. Given that $\alpha=0.05$ and $df=11$, $t_{Tab}=2.200985$. Only the number of university graduates - X1 ($t_{X1}=3.905676>t_{Tab}=2.200985$) is significant, while the actual significance or insignificance of the remaining parameters is verified using retrospective quality criteria: MAPE (Mean Absolute Percentage Error) and TIC (Theil Inequality Coefficient – Theil's alternative measure of forecast accuracy) (Table 2; Figure 1) [20, 21, 22].

Table 2

Results of the regression equation for changes in investment volume in fixed assets of small business entities in Khorezm region²

Dependent Variable: LNYAKI

Method: Least Squares

Date: 05/13/23 Time: 09:08

Sample: 2007 2022

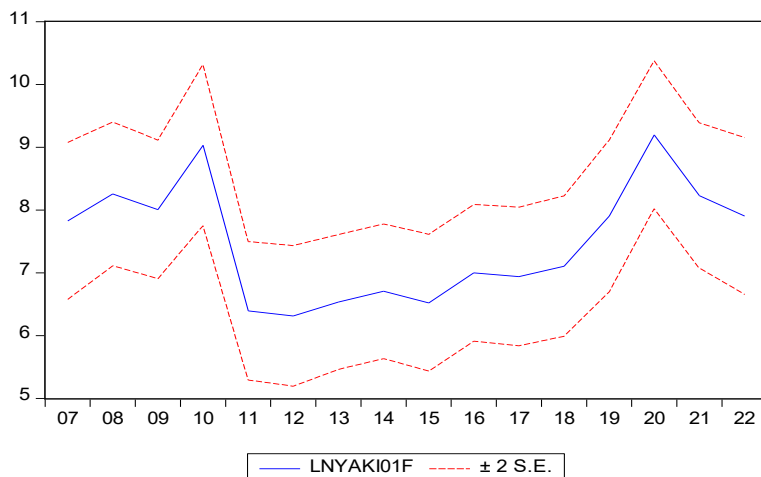
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN _{X1}	3.351084	0.858004	3.905676	0.0025
LN _{X2}	0.681821	0.589919	1.155788	0.0372
LN _{X3}	0.364055	0.589655	0.617403	0.0495
LN _{X4}	0.805215	0.44512	1.808984	0.0168
C	34.55614	18.61435	1.856425	0.1726
			$t_{jad}=2,200985$	
R-squared	0.592067	Mean dependent var		7.490881

1 Source: developed by the author.

2 Source: developed by the author.

Adjusted R-squared	0.443728	S.D. dependent var	1.021842
S.E. of regression	0.762127	Akaike info criterion	2.544899
Sum squared resid	6.389211	Schwarz criterion	2.786333
Log likelihood	-15.35919	Hannan-Quinn criter.	2.557263
F-statistic	3.991310	Durbin-Watson stat	1.893995
Prob(F-statistic)	0.030710	F _{jad} =0,297913	



Forecast: LNYAKI01F	
Actual: LNYAKI01	
Forecast sample: 2007 2022	
Included observations: 16	
Root Mean Squared Error	0.415531
Mean Absolute Error	0.313048
Mean Abs. Percent Error	4.201087
Theil Inequality Coefficient	0.027518
Bias Proportion	0.000000
Variance Proportion	0.048476
Covariance Proportion	0.951524
Theil U2 Coefficient	0.506944
Symmetric MAPE	4.156435

Figure 1. Results of retrospective quality criteria for regression parameters³ (1)

Based on the data presented in Figure 3, it can be noted that MAPE=4.201, which satisfies the inequality $MAPE=4.201 < 10\%$. Additionally, the fact that the value of $TIC=0.0275 < 1$ tends to zero indicates that all parameters of the first regression equation are significant. To utilize the properties of the logarithmic function, simplify the calculation process, and achieve accurate results, the first regression equation obtained above is exponentiated, resulting in the following equation:

$$Y_{AKI} = \frac{X_1^{3.35} * X_2^{0.98} * X_3^{0.36} * X_4^{0.81}}{e^{34.55614}} \quad (1^*)$$

Considering that the calculated Fisher value $F_{calc} = 3.991310$ is greater than the tabulated value $F_{tab} = 0.297913$ at $\alpha=0.05$ and $k_1=11; k_2=4$, the significance of the 1*-regression equation is confirmed. Furthermore, with $DW=1.894$, the absence of autocorrelation indicates the reliability and adequacy of the equation.

According to the 1* regression equation, if the number of university graduates, small business entities, and labor resources in the Khorezm region increases by 1.0%, the volume of investments in fixed capital of small business entities in the region will increase by 158.7 billion soums, 31.8 billion soums, and 37.9 billion soums, respectively. If the volume of products produced by small businesses in the region increases by 1.0%, the volume of investments in fixed capital in the Khorezm region will increase by an additional 16.8 billion soums.

Now we will conduct an econometric analysis of foreign investments in small business entities using statistical data on foreign investments in fixed capital of small business entities in the Khorezm region, obtained from the regional statistics department for 2010-2024. For this purpose, we will determine the correlation coefficient between the resulting factor - the volume of foreign investment and loans to small business entities in the Khorezm region (Y_x) – and the following factors: the number of university graduates (X_1), the number of small business entities (X_2), the volume of products produced by small business entities (X_3), and the total number of labor resources (X_4) (Table 4) [20, 21, 22].

3 Source: developed by the author.

Table 4.

Correlation coefficient between factors affecting the change in volume of absorbed foreign investments in small business entities of the Khorezm region⁴

	Yx	X1	X2	X3	X4
Yx	1				
X1	0,925899	1			
X2	0,884067	0,829103	1		
X3	0,892058	0,779559	0,783095	1	
X4	0,725455	0,636556	0,848646	0,852719	1

If we examine the values of the calculation results presented in the table, we can observe that the volume of foreign investments assimilated by small business entities in the Khorezm region (YX factor) is strongly correlated with the number of university graduates - X1 ($r_{YAKI,X1}=0.925899$), the number of small business entities - X2 ($r_{YAKI,X2}=0.884067$), and the volume of products manufactured by small business entities - X3 ($r_{YAKI,X3}=0.892058$). It also has a moderate positive correlation with the total number of labor resources - X4 ($r_{YAKI,X3}=-0.689223$) in relation to the volume of investments in the fixed capital of small business entities in the region. Consequently, an increase in all these currently selected factors leads to an increase in the resultant factor in the region.

Since there is no multicollinearity between the factors selected as influencing the change in the volume of foreign investments assimilated by small businesses in the Khorezm region (according to the condition $r_{x1,x2}<0.8$), we can proceed to determine the regression equation for the observed relationship using the EViews program. For this purpose, it is first necessary to logarithmically transform each of the selected factors, considering the variety of their units of measurement. Therefore, we will take the natural logarithm (base e) of all factors, including the resultant factor (Table 5).

Table 5

Results of the regression equation analyzing changes in the volume of foreign investments assimilated by small business entities in the Khorezm region⁵

Dependent Variable: LNYX

Method: Least Squares

Date: 05/13/23 Time: 10:05

Sample: 2007 2022

Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN1	2.182364	0.709958	3.073934	0.0106
LN2	1.200421	0.958765	1.252049	0.0265
LN3	0.622015	0.231326	2.688913	0.0211
LN4	0.004674	0.470687	0.009929	0.0023
C	-26.84367	8.474349	-3.167638	0.0093
			$t_{jad}=2,200985$	
R-squared	0.934672	Mean dependent var		4.960758
Adjusted R-squared	0.910917	S.D. dependent var		1.831444
S.E. of regression	0.546627	Akaike info criterion		1.880208
Sum squared resid	3.286817	Schwarz criterion		2.121642
Log likelihood	-10.04166	Hannan-Quinn criter.		1.892571
F-statistic	39.34552	Durbin-Watson stat		1.915266
Prob(F-statistic)	0.000002	$F_{jad}=0,297913$		

4 Source: developed by the author.

5 Source: developed by the author.

Based on the coefficient values provided in the table data, the following equation is derived:

$$\text{LnY}_X = 2,1\text{LnX}_1 + 1,2\text{LnX}_2 + 0,62\text{LnX}_3 + 0,01\text{LnX}_4 - 26,84367 \quad (2)$$

Now, according to the established procedure, the significance of the equation parameters is checked using the t-Statistic criteria for the identified 2nd regression equation, with $\alpha=0.05$ and $df=11$, where $t_{\text{Tab}}=2.200985$. Based on this, the significance of the parameters for the number of university graduates - X_1 ($t_{X_1}=3.073934 > t_{\text{Tab}}=2.200985$) and the volume of products manufactured by small business entities - X_3 ($t_{X_3}=2.688913 > t_{\text{Tab}}=2.200985$) factors is established. Consequently, it is necessary to check the significance or insignificance of the remaining parameters using the retrospective quality criteria MAPE and TIC (Figure 2) [20, 21, 22].

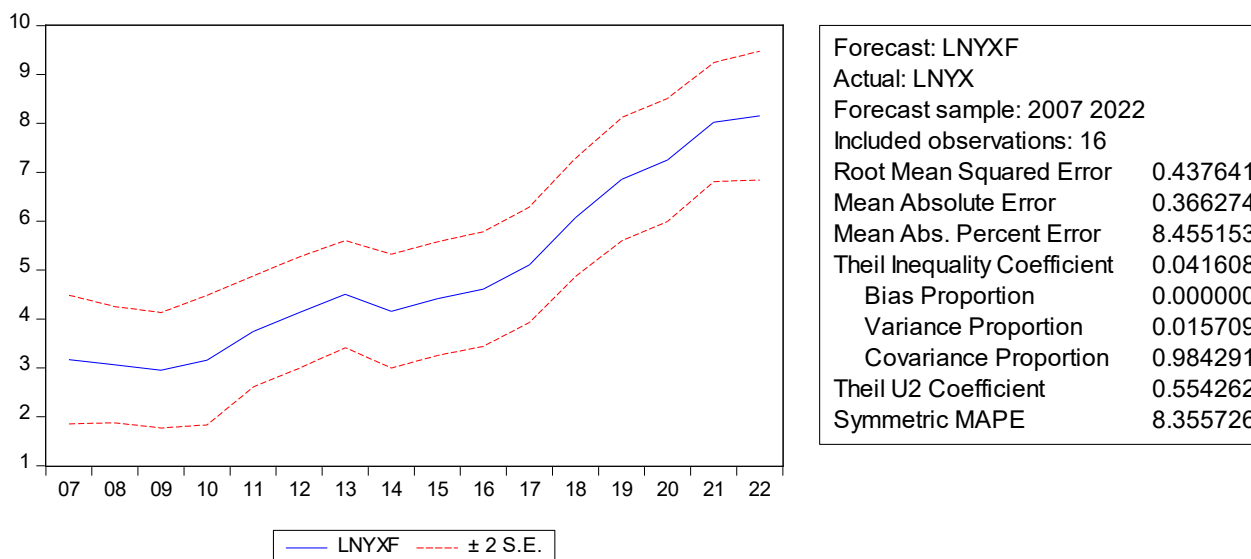


Figure 2. Results of retrospective quality criteria for regression parameters⁶ (2)

Based on the data presented in Figure 6, MAPE=8.455, which satisfies the condition MAPE<10% as the inequality MAPE=8.455<10% is fulfilled. Additionally, the prediction accuracy TIC=0.0416<1 approaches zero, indicating the significance of all parameters in the second regression equation. To ensure compliance with mathematical rules and the properties of logarithmic functions, as well as to align the model values with real-world statistical data, the

$$Y_X = \frac{X_1^{3.35} * X_2^{0.98} * X_3^{0.36} * X_4^{0.81}}{e^{26.84367}} \quad (2^*)$$

second regression equation is exponentiated. As a result, the following equation is derived:

Of course, in the next stage of verification using quality criteria, we will check the actual significance of the 2*-regression equation using the Fisher criterion and its adequacy using the Durbin-Watson criterion. According to this, considering that $F_{\text{Tab}}=0.297913$ when $\alpha=0.05$ and $k1=11$; $k2=4$, the calculated Fisher value is $F_{\text{calc}}=39.35$. Based on the condition $F_{\text{Tab}} < F_{\text{calc}}$, the significance of the 2.3.1*-regression equation is confirmed. Additionally, since DW=1.915, the absence of autocorrelation indicates the reliability and adequacy of the equation.

If we interpret the identified regression equation from an economic perspective, it reveals that if the number of higher education graduates, small business entities, and the total labor force in the region is increased by 1.0% for each factor separately, the volume of foreign investments and loans to small business entities in the region will increase by 59.2 billion soums, 32.4 billion soums, and 0.3 billion soums, respectively. If an increase in the volume of products produced by small businesses in the region by 1.0 billion soums is achieved, then the volume of foreign investments and loans attracted to small businesses in the region will increase by an additional 1.2 billion soums.

Summarizing the results of the analysis, it was determined that increasing the selected initial factors - the number of higher education graduates, the number of small business entities, and the volume of products produced by small business entities in the region - contributes to expanding the possibilities of attracting investments in fixed assets, especially foreign direct investments. In this regard, first and foremost, it is necessary to pay special attention to increasing the number of specialists with higher education in the region and to develop measures for creating new small business entities and joint ventures to ensure their employment.

6 Source: developed by the author.

CONCLUSIONS AND SUGGESTIONS

In conclusion, this ratio is determined by the economic specialization of individual regions. The existing forms of territorial organization of labor resources are characterized by the functioning of labor potential with its specific qualitative and quantitative features. The nature of production processes determines the level of employment and its structure by industry, gender, and age, and influences all aspects of labor resource reproduction.

The formation of modern approaches to increasing the effectiveness of the organizational foundations of public administration in attracting investments through various methods and means of influence should be based on identifying them in this way and considering opportunities to enhance the economy's attractiveness for investments. The following measures can be effective in stimulating investment in the country's economy:

- establishing investor search centers, whose main work should focus on studying potential investor markets and conducting policies to attract them to investments by presenting the most interesting projects for investing their resources;

- implementing activities related to charitable investments (in socio-cultural sphere objects) that involve pooling financial resources of large and small businesses to invest in selected objects. Charitable investments can be carried out through wide-ranging, open, and transparent media coverage to attract and popularize investor attention;

- forming, developing, and strengthening interstate relations, establishing cooperation with neighboring territories of other countries based on developing cooperation programs, collaborating in specific industries and areas of activity, creating personnel exchange programs, maximizing the focus of such cooperation, and attracting innovative methods, cutting-edge equipment, and production technologies;

- establishing a procedure for granting permits to construct large shopping centers in cities (or other objects characterized by maximum demand from investors in the region) in connection with their construction, provided that the developer first commits to investing in other economic objects.

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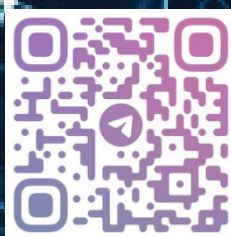
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