

## **ANALYSIS OF FACTORS AFFECTING THE INVESTMENT ENVIRONMENT AND ITS ATTRACTIVENESS IN THE ECONOMIC DEVELOPMENT OF THE REGIONS**

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**Abstract.** This article provides an econometric analysis of factors affecting the investment environment and its attractiveness in the economic development of regions.

In our econometric analysis, the factors affecting the investment environment of the Samarkand region, which is the object of the study, are analyzed. According to it, the impact of investment, foreign trade turnover (export, import), industrial production on the GNP of the region is analyzed.

**Keywords:** economy, investment, investment climate, investment attractiveness, econometrics, analysis, foreign trade.

### **Introduction**

In order to increase the economic potential of the regions of Uzbekistan, further accelerate the attraction of foreign direct investment in the sectors of the economy, create a favorable investment environment for entrepreneurs/investors, ensure its attractiveness and further liberalize the economy in the development process, reform the public administration system in this regard on the basis of advanced foreign effective experience, as a result of minimizing the interference of employees and the apparatus of state bodies in the activities of business representatives and business entities, reducing and simplifying the stages in these processes as a result of further improving the procedures for licensing and permitting activities in the field, organizing and improving the gratuitous use of goods (works and services), and it is also important to create the necessary industrial infrastructure in the regions. , to modernize the existing ones from a technical and technological point of view.

In this regard, reducing the tax burden on entrepreneurial activities, simplifying the taxation system for foreign and domestic investors in a single and digital format, creating and maintaining a healthy competitive environment in the field of economic activity, tariff and notary mechanisms: digitalization of tax policy and the customs and tariff system, regulation through the implementation of the necessary measures in the field of investment, it is possible to improve the investment environment in the country and its regions, and by creating constantly favorable conditions to increase investment activity, and ultimately achieve the development of regions at an economically sustainable pace [1].

This article provides an econometric analysis of factors affecting the investment climate and its attractiveness in the economic development of regions

### Analysis of factors affecting the investment environment

In our econometric analysis, as an object of study, we analyze the factors influencing the investment environment of the Samarkand region of the Republic of Uzbekistan. It analyzes the impact of investments, foreign trade turnover (export, import), industrial production on the region's GNP.

According to it, as an indicator of economic growth, the volume of GDP (Y, the observed value of an arbitrary variable, the result) and 3 arbitrary explanatory variables, a number of indicators representing inclusive growth as factors and the volume of investments in fixed capital ( $x_1$ -Invest) as a result indicator, external 13-year (2010-2022) cumulative data was used in the econometric analysis of the effect of trade turnover (export, import, ( $x_2$ -Foreign trade), industrial production volume ( $x_3$ -Industrial product) [2]:

Variable	Obs	Mean	Std. Dev.	Min	Max
YGDG	13	27250.8	18267.27	6585.8	63506.8
Invest	13	6596.415	6052.631	1083.1	18199.7
Foreigntrade	13	1187.49	522.3627	452.4	2037.874
Industrial~t	13	10016.96	7301.635	2011.2	22834.27

**Figure 1. Descriptive statistics of indicators**

*[Completed by the author via Stata software]*

From the descriptive statistics of indicators, it can be seen that the smallest volume of GDP is 6585.8 billion soums, the largest volume is 63506.8 billion soums. Also, the change in the volume of GNI in 2010-2022 averaged 27250.8 billion soums over 13 years. In addition, factor signs:

- the smallest volume of investments in the main capital ( $x_1$ -Invest) was equal to 1083.1 billion soums, the largest volume was equal to 18199.7 billion soums. The change in 2010-2022 was 6596.4 billion soums on average in 13 years;

- the smallest volume of foreign trade turnover (export and import, ( $x_2$ -Foreign trade) was equal to 452.4 billion soums, the largest volume was equal to 2037.8 billion soums. The change in 2010-2022 was 1187.4 billion soums on average in 13 years ;

- the smallest volume of industrial production ( $x_3$ -Industrial product) ( $x_1$ -Invest) was equal to 2011.2 billion soums, the largest volume was equal to 22834.4 billion soums. The change in 2010-2022 was 6596.4 billion soums on average in 13 years.

Based on the sequence of econometric analysis, we will study the correlation relationship of the analyzed indicators through the Stata program. "Correlation is a

relationship in which each value of the independent variable  $x$  corresponds to a certain mathematical expectation (average value) of the independent variable. Correlational connection is an "incomplete" connection, which is manifested not in each individual case, but in many cases only in average magnitudes" [3]. According to this, the results of the correlation analysis of the indicators are expressed as follows:

	YGDP	Invest	Foreigntrade	Industrial~t
YGDP	1.0000			
Invest	0.9775	1.0000		
Foreigntrade	0.9564	0.9155	1.0000	
Industrial~t	0.9771	0.9703	0.9556	1.0000

**Figure 2. Correlation table of indicators**  
*[Completed by the author via Stata software]*

According to the theory of econometric analysis, the closer the correlation coefficient is to 1, the stronger the relationship between the outcome and factor indicators. According to the analysis results in Figure 2 above, the correlation coefficient is 0.91-0.97. So, there is a strong connection between the indicators that cause changes in the volume of GNP, which is the final indicator - the volume of investments in fixed capital, foreign trade turnover (exports, imports), changes in the volume of industrial production.

It is desirable to carry out regression analysis on econometric analysis. "Regression analysis consists in determining the analytical form of dependence, in which the change of the resulting factor is conditioned by the influence of one or more factors, and the majority of all other factors affecting the resulting factor are taken as a constant and average value. The purpose of regression analysis is to evaluate the functional dependence of the conditional mean value of the resulting factor on the factor characteristics" [4].

In the course of our research, we analyzed the regression relationship of selected endogenous and exogenous indicators using the Stata electronic econometric analysis program.

Source	SS	df	MS	Number of obs	=	13
Model	3.9207e+09	3	1.3069e+09	F(3, 9)	=	140.70
Residual	83595774.9	9	9288419.43	Prob > F	=	0.0000
				R-squared	=	0.9791
				Adj R-squared	=	0.9722
Total	4.0043e+09	12	333693290	Root MSE	=	3047.7

YGDP	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Invest	1.721268	.6093459	2.82	0.020	.3428315	3.099704
Foreigntrade	11.82442	5.792471	2.04	0.072	-1.279059	24.9279
Industrialproduct	.2516311	.6893578	0.37	0.724	-1.307805	1.811067
_cons	-665.3591	3254.613	-0.20	0.843	-8027.804	6697.086

**Figure 3. Regression analysis results**  
*[Completed by the author via Stata software]*

From the results of regression analysis, we use R-squared - multifactor coefficient of determination to evaluate the quality of multifactor regression models. According to it, the following formula can be used to determine the R-squared coefficient of multifactorial determination:

$$R^2 = 1 - \frac{\sum_{i=1}^n \varepsilon_i^2}{\sum_{i=1}^n (y_i - \bar{y})^2} = \frac{\sum_{i=1}^n (\hat{y}_i - \bar{y})^2}{\sum_{i=1}^n (y_i - \bar{y})^2}$$

According to the theory of multifactor econometric analysis, the coefficient of determination shows the share of the variation of the resulting factor under the influence of the factors. That is, the sign “y” determines what part of the variation is taken into account in the model, and “y” is determined by the influence of the factors included in the model. The closer the coefficient of determination  $R^2$  is to one, the higher the quality of the model.

The results of the above regression analysis show that the R-squared coefficient of determination is 0.97. This coefficient of determination means that endogenous sign, i.e. exogenous signs: the amount of investments in fixed capital ( $x_1$ - Invest), foreign trade turnover (exports, imports, ( $x_2$ -Foreign trade)) have a 97 percent influence on the change in the volume of GDP. Also, the fact that the coefficient is closer to 1 indicates the high quality of the econometric model and the reliability of the analysis.

Based on the above results, it is appropriate to create a regression equation (econometric model). "Multivariate regression model parameter estimation can be done in matrix form. The linear multivariate regression equation in matrix form is written in the following form:

$$Y = Xa + \varepsilon.$$

where: Y is a vector of arbitrary variable values with size  $(n \times 1)$ ; X is the matrix of values of independent variables  $X_1, X_2, \dots, X_k$  the dimensionality of the X matrix is equal to  $n \times (k + 1)$ . The first column is unity because  $a_0$  is multiplied by one

in the regression equation;  $\alpha$  is a vector of unknown parameters with size to be estimated  $(k + 1) \times 1$ ;  $\varepsilon$  – is a vector of random deviations of size  $n \cdot 1$ :

$$Y = \begin{pmatrix} y_1 \\ y_2 \\ \dots \\ y_3 \end{pmatrix}; \quad X = \begin{pmatrix} 1 & x_{11} & \dots & x_{1k} \\ 1 & x_{21} & \dots & x_{2k} \\ \dots & \dots & \dots & \dots \\ 1 & x_{n1} & \dots & x_{nk} \end{pmatrix}; \quad Y = \begin{pmatrix} a_1 \\ a_2 \\ \dots \\ a_k \end{pmatrix}$$

The following formula is used to calculate the parameters of the regression equation by the method of least squares:

$$A = (X'X)^{-1} X'Y,$$

where:  $X'$  is the transposed  $X$  matrix;  $(X'X)^{-1}$  is an inverse matrix" [3].

Based on the above, according to the results of the analysis, the following regression equation was created:

$$y = 1.721268 \text{ Invest} + 1182442 \text{ Foreigntrade} + 0.2516311 \text{ Industrial produc} + 665,391$$

We check the reliability of the model through several tests. Fisher's F-test is used to test the significance of a multivariate regression model. It is determined by the following formula:

$$F = \frac{R^2 / k}{(1 - R^2) / (n - k - 1)}$$

If the calculated value of the criterion with degrees of freedom  $\gamma_1 = k$ ,  $\gamma_2 = (n - k - 1)$  at a given level of significance is greater than the value in the table, then the model is considered significant. When the reliability of the model was checked with the f test, it was found that the true value of  $F(3.9)$  is 140.7.

The probability value is 0.0000. According to the property of econometric models, if the probability Prob is less than 0.05, the F-test means that the reliability of the model is correct. Therefore, our model is reliable according to the F-test.

We will also check our model by parameters. For this we use t-test. Assessment of the reliability of each parameter of the multifactor regression model is carried out using the Student's t-test. For any parameter of the model, the  $a_j$  value of the t criterion is calculated according to the following formula:

$$t_{xuc} = \frac{a_j}{S_\varepsilon \sqrt{b_{jj}}}$$

where:  $S_\varepsilon$  is the standard (root mean square) deviation of the regression equation. It is determined by the following formula:

$$S_\varepsilon = \sqrt{\frac{\sum (y - \hat{y}^2)}{n - k - 1}}$$

$b_{jj}$  – diagonal elements of  $(X'X)^{-1}$  matrix.

Its value is -0.20 - 2.82, respectively, according to the parameters. Probability values are equal to 0.02, respectively. Based on the property of econometric models,

a probability Prob of less than 0.05 means that the t-test is valid for model reliability. Therefore, the parameters of this model are also reliable. We tested this model with F-test, t-test.

### **Review the reliability of the constructed econometric model**

We check the reliability of the highly structured econometric model based on Gauss-Markov conditions [5]. The results of the investigation were as follows:

- According to the 1st condition of the Gauss-Markov conditions, the number of observations is required to be greater than the number of parameters. In the results of the analysis carried out during our research, the number of observations is greater than the number of parameters, that is, the number of observations is 13, and the number of parameters is equal to 4. This, in turn, corresponds to condition 1 of the Gauss-Markov conditions for testing the reliability of the constructed econometric model.

- According to the 2nd condition of the Gauss-Markov conditions, the sum of empirical data should be equal to the sum of model data. In this regard, the results show the following, including:

Variable	Obs	Mean	Std. Dev.	Min	Max
model	13	27250.8	18075.59	7054.394	59886.7
YGDP	13	27250.8	18267.27	6585.8	63506.8

**Figure 4. Results of an empirical data set**  
*[Completed by the author via Stata software]*

In the case under consideration, the sum of the empirical data according to the analysis results is equal to the sum of the model data, that is,  $Y=27250.8$  and is mutually equal to the model values. Therefore, the econometric model based on the regression equation based on this condition is reliable.

- According to the 3rd condition of the Gauss-Markov conditions, the residuals must not be associated with factor signs. If the residuals and the factor signs are correlated, the case is called "heteroskedasticity". If the residuals and the factor signs are not related to each other, the state of homoscedasticity is called or homogeneity. Compliance with these conditions can be determined by various methods: graph, correlation table or tests. We check compliance with this condition using the "White test Breusch Pagan" test. The results of the analysis and the reliability of the constructed model were initially checked on the basis of the Breusch-Pagan (White test) test, according to the Gauss-Markov conditions, and the following results were obtained:

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance

Variables: fitted values of YGDP

chi2(1) = 0.33

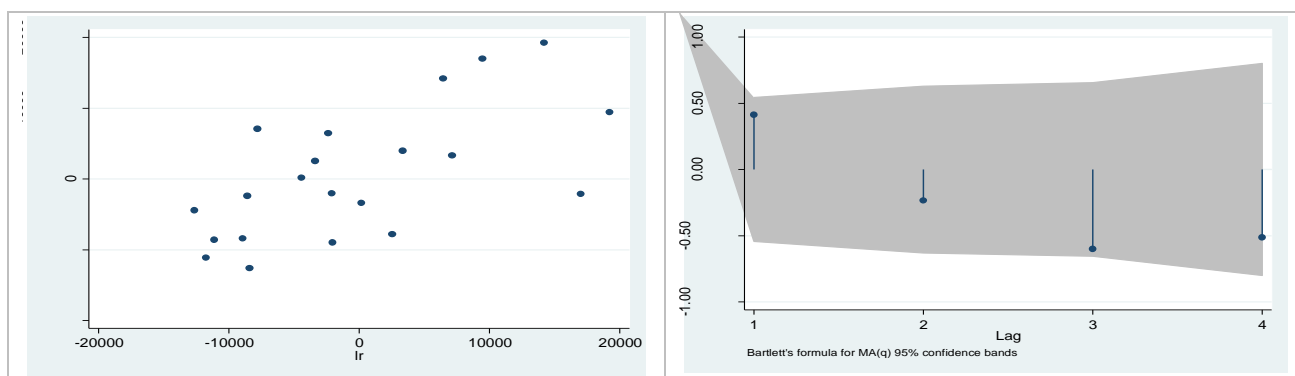
Prob > chi2 = 0.5654

**Figure 5. Breusch-Pagan (White test) test results**

*[Completed by the author using Stata software]*

According to the test results,  $p > 0.05$  is greater. In this case, we reject the alternative hypothesis ( $H_1$ ) and accept the main hypothesis ( $H_0$ ). The results of this conditional check show the reliability of the constructed model.

- The rule of the 4th rule of the Gauss-Markov chain implies that the residuals are not connected. According to this rule, the remains must be in good condition. In this regard, the autocoupling in the residual layer is tested. These examiners are determined by 3 methods: graphic and autocoupling method, Durbin Watson test.



**Figure 6. Condition 3 of Gauss-Markov conditions, graphical method and autocoupling analysis result**

*[Compiled by the author of the Stata introduction]*

According to the 4th column of the Gauss-Markov square, the residual is relatively flat on the map. Also, the fact that the caddy lap is located in a trust sister means that autocoupling is relatively absent in the caddy lap sister.

- According to the 5th condition of the Gauss-Markov conditions, the factors must be uncorrelated. In this case, it is appropriate to conduct a VIF test.

Variable	VIF	1/VIF
Industrial~t	32.73	0.030551
Invest	17.57	0.056904
Foreigntrade	11.83	0.084545
Mean VIF	20.71	

**Figure 7. VIF test results**

*[Compiled by the author of the Stata introduction]*

According to the results of the VIF test, the factors are not strongly correlated, that is, there is no multicollinearity between the factors. That is, condition 5 of the Gauss-Markov conditions is also satisfied.

- According to the 6th term of the Gauss-Markov conditions, the non-normal distribution of the residual of the test white is determined. Depending on the condition, the non-normal distribution of the residuals is checked by means of a graph or the Shapiro-Wilk W and Skewness/Kurtosis test. According to the results of the "Shapiro-Wilk W and Skewness/Kurtosis" test based on the Gauss-Markov model, the  $H_0$  hypothesis is rejected and the  $H_1$  hypothesis is accepted.

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
r	13	0.87397	2.220	1.562	0.05912

Skewness/Kurtosis tests for Normality

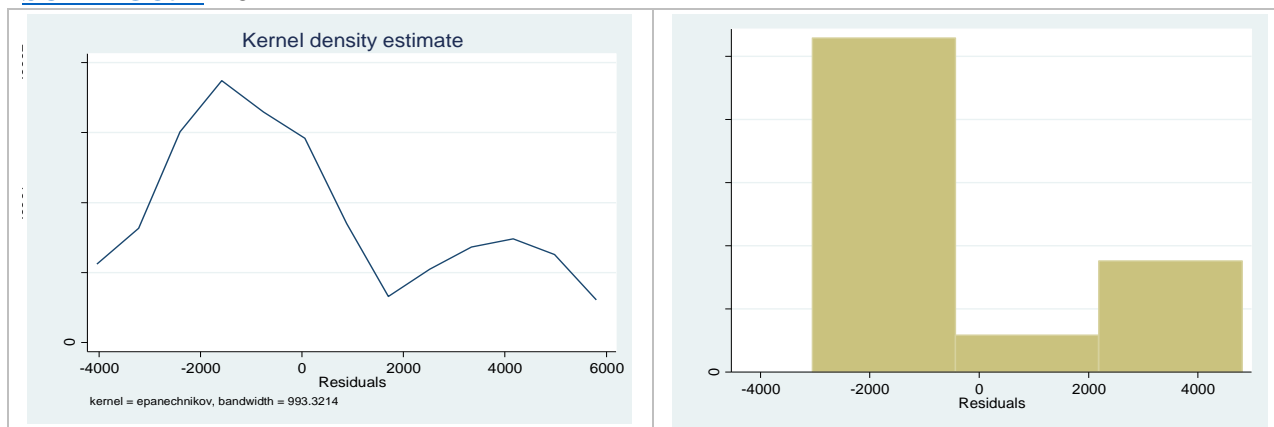
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
r	13	0.1927	0.7124	2.13	0.3453

**Figure 8. Results of Shapiro-Wilk W and Skewness/Kurtosis test for Gauss-Markov model**

*[Compiled by the author of the Stata introduction]*

The Shapiro-Wilk W and Skewness/Kurtosis test assumes that the probability of p is greater than 0.05 when testing the condition of a skewed distribution of the residual. In this case, the p probability is 0.3, and  $p > 0.05$ , that is, the requirements of this condition are also met, and the reliability quality of the model is high.





**Figure 9. Condition 3 of the Gauss-Markov conditions, the result of the analysis by the graphical method**

*[Compiled by the author of the Stata introduction]*

Since the results of the 6th column of the Gauss-Markov network by the graphic method are not distributed optimally, the graphic representation is not symmetrical. In this case, we reject the hypothesis  $H_0$  and accept the hypothesis  $H_1$ .

### Conclusion

Based on the results of the econometric analysis of factors affecting the investment environment and its attractiveness in the economic development of the regions, the following conclusions were formed:

- The selected factors that reflect the economic development of Samarkand region, such as investments in fixed capital, foreign trade turnover, industrial production volume are among the factors that have a strong influence on the change in the volume of GDP:

- An increase in the volume of investments in fixed capital in Samarkand region by 1 unit, that is, by 1 billion soums, has a positive effect on the increase of the region's GNP by 1.7 billion soums;

- Regarding the effect of foreign trade turnover, the increase of the foreign trade turnover of the region, that is, the volume of export and import by 1 billion soums, has a positive effect on the increase of the volume of GNP in this region by 11.8 billion soums. It can be said that the region has a high potential for economic growth by attracting foreign direct investment as a result of improving the investment environment in this area;

- By increasing the volume of production of industrial products in the region by 1 billion soums, the volume of GDP can reach 0.2 billion soums. The result of the analysis means that it is necessary to create a favorable investment environment for industrial production. In this regard, it is appropriate to use the ICOR coefficient to evaluate the effectiveness of investments in the industrial production sector. Through this, there will be opportunities to ensure the effectiveness of investments made in this direction. State support for reinvestment activities of industrial enterprises in order to increase the importance of industrial production in the region for economic

growth will have a positive effect. It is possible to apply the practice of exemption from taxes in the amount of reinvestment to enterprises producing industrial products, which are leaders in the implementation of reinvestment activities.

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