INDUSTRY IN SURKHANDARYA REGION BASED ON OPTIMAL MODELS

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Abstract: This article analyzes the development factors of the industrial sector of Surkhandarya region based on economic and mathematical modeling. The study used statistical data for 2010–2024, and selected the volume of products produced in the regional industry as the resulting factor, and the volume of investments in fixed capital and the number of operating enterprises as the influencing factors. As a result of the expression of the data in logarithmic form, a multifactor econometric model was constructed and evaluated using the least squares method. The results of the study indicate the need to improve investment policy and stimulate the activities of enterprises to ensure the sustainable development of the industrial sector in the region.

Keywords: Surkhandarya region, industrial development, econometric model, investments, number of enterprises, economic analysis, production volume, OLS method.

Аннотация: В данной статье анализируются факторы развития промышленного сектора Сурхандарьинской области на основе экономико-математического моделирования. В исследовании использованы статистические данные за 2010–2024 годы. В качестве результирующего фактора выбран объём продукции, произведённой в промышленности региона, а в качестве влияющих – объём инвестиций в основной капитал и количество действующих предприятий. В результате логарифмирования данных построена многофакторная

эконометрическая модель, оценка которой выполнена методом наименьших квадратов. Результаты исследования свидетельствуют о необходимости совершенствования инвестиционной политики и стимулирования деятельности предприятий для обеспечения устойчивого развития промышленного сектора региона.

Ключевые слова: Сурхандарьинская область, развитие промышленности, эконометрическая модель, инвестиции, количество предприятий, экономический анализ, объём производства, метод наименьших квадратов**.**

The development of regional industry depends on the total volume of products produced in the industrial sector , investments in fixed capital, and the number of enterprises operating in the industrial sector. The number of enterprises and a number of other factors influence it.

Based on the above considerations, to build a multi-factor econometric model of the regional industrial sector, the following indicators covering the period 2010-2024 , that is, 15 years, were selected as the resulting and influencing factors : resulting factor - the total volume of products produced in the regional industrial sector (billion soums) - (Y), investments attracted to fixed capital (billion soums) - (X_1), the number of enterprises operating in the industrial sector number of enterprises — (X_2) .

Since the units of measurement of the variables are different and to better explain the interpretation of the multifactor econometric model, we take the natural logarithm of all factor values. Below, we will discuss the special methods for implementing the econometric analysis methods that we will consider in our study. We use econometric modeling, statistical, and forecasting programs — EViews 9 , Gretl.

The table data shows the mean, median, maximum and minimum values (Maximum , minimum), as well as the deviation of each factor from the mean (Std . Dev (Standard Deviation)). In addition, the table shows a symmetry indicating whether the theoretical distribution curve of each factor is located to the right (S>0) or to the left (S<0) of the normal distribution curve . coefficient (Skewness — S) and the coefficient of kurtosis (K), which indicates whether the theoretical distribution curve of each factor is higher (K>0) or lower (K<0) than the normal distribution curve, as well as the Jarque - Bera test (Jarque-Bera) values, which are used to confirm the conformity of each factor to the normal distribution, are presented.

Table 1

Statistical description of factors[1]

[1]References used Author's version

	LN(Y)	LN(X_1)	LN(X_2)
Mean	7.845315	8.142780	7.458975
Median (median)	7.730711	7.922333	7.255409
Maximum	9.076283	9.795680	8.481359
Minimum (minimum)	6.628570	6.485093	6.638568
Std. Dev. (standard deviation)	0.801201	1.163099	0.599243
Skewness — S (Asymmetry Coefficient)	0.088023	0.026289	0.594269
Kurtosis — K (Excess Coefficient)	1.743278	1.446432	2.144631
Jarque-Bera (Jarque - Bera criterion)	0.939367	1.409531	1.250829
Probability	0.625200	0.494224	0.535040
Sum (total)	109.8344	113.9989	104.4256
Sum Sq. Dev. (sum of standard deviations)	8.344994	17.58640	4.668205
Observations (number of observations)	14	14	14

Whether or not the factors follow a normal distribution is examined using the symmetry coefficient α , the ex- cess coefficient α and the Jarka - Bera criterion . If we pay attention to the numerical values in the table , the symmetry coefficient α , the ex- cess coefficient α and the Jarka - Bera criterion α The indicators of the criterion have small values, so it is possible to estimate that the known factors are close to a normal distribution. On the contrary, symmetry , excess and Jarka - Bera Large values of the criterion indicate that the factors deviate significantly from the normal distribution.

To select factors for a multifactor econometric model, it is necessary to conduct a correlation analysis. For this, pairwise correlation coefficients between factors are calculated . According to the results of the correlation analysis, there are strong connections between the resulting factor (LnY) and the influencing factors (LnX $_1$, LnX $_2$), that is, the value of the pairwise correlation coefficients is greater than 0.8.

Results of matrix analysis of pairwise correlation coefficients $ln(x_i)$ $(i = \overline{1,2})$ and$ln(x_j)$ $(j = \overline{1,2})$ the factors can be considered collinear not. Because, if $r_{\ln(x_i),\ln(x_j)} < 0{,}8andX'X$ If the matrix determinant is not close to zero , then this indicates the absence of multicollinearity. Thus , the pairwise correlation coefficients between the factors have taken numerical values less than 0.8. Thus, the correlation coefficients between the factors included in the multifactor econometric model meet the requirements for the calculated value of the t- Student criterion and the probability . Based on these factors, it will be possible to build a multifactor econometric model of the total volume of output produced in the regional industrial sector and the factors affecting it.

In the next step, we construct a multifactor econometric model. In general, a multifactor econometric model looks like this:

$$\ln(Y) = \ln(\alpha_0) + \alpha_1 * \ln(X_1) + \alpha_2 * \ln(X_2) + \cdots + \alpha_n * \ln(X_n) + \varepsilon \quad \textbf{(1)}$$

Here, Y – the resulting factor, X_i –the influencing factors ($i = \overline{1,n}$), ε –random error.

The unknown in the multifactor econometric model (1)$\alpha_0, \alpha_1, \alpha_2, \dots, \alpha_n$ The “least squares method” is used to determine the parameters.

the unknown parameters of the multifactor econometric model are presented in Table 2 below .

2 - table

Calculation results of multifactor econometric model parameters

Variable (Variable)	Coefficient (Coefficient)	Std. Error (Standard error)	t-Statistic (t- Statistic)	Prob. (Probability)
LNX1	0.402653	0.046551	8.649702	0.0000
LNX2	0.579374	0.090353	6.412324	0.0000
S	0.245064	0.363691	0.673825	0.5143
R-squared (R- squared)	0. 8 91567	Mean dependent variable (Mean value of the dependent variable)		7.845315
Adjusted R-squared (smoothed R- squared)	0. 88 0033	SD dependent var (Standard deviation of the dependent variable)		0.801201
SE of regression (Standard error of regression)	0.079987	Akaike information criterion (Akaike Information Criterion)		-2.026496
Sum squared remainder (Residuals are sum of squares)	0.070377	Schwarz criterion (Schwarz criterion)		-1.889555
Log likelihood (Logarithmic approximation to reality)	17.18547	Hannan-Quinn criterion (Hannan - Quinn criterion)		-2.039173
F-statistic (F- statistic)	646.6648			
Test(F-statistic)	0.000000			

(Probability (F- statistic))			

in Table 2 –, we construct a multifactor econometric model :

$$\ln(Y) = 0{,}245064 + 0{,}579374 * \ln(X_1) + 0{,}402653 * \ln(X_2) \quad (3.3.2)$$

The calculated multifactor econometric model shows that a 1% increase in the volume of investments in fixed capital increases the total volume of output produced in the industrial sector by 0 , leading to an increase of 58 percent. Sh like him, operating in the industrial sector A 1 percent increase in the number of enterprises can lead to a 0.4 percent increase in the total volume of products produced in the industrial sector .

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