International Journal of Multicultural and Multireligious Understanding

http://ijmmu.com
editor@ijmmu.com
ISSN 2364-5369
Volume 9, Issue 3
March, 2022
Pages: 505-512

Econometric Factors of Sustainable Development of Fuel and Energy Complex Enterprises of the Republic of Uzbekistan

Gulchekhra Jalgasovna Allaeva

Doctor of Economics, Associate Professor, Acting Professor of the Department of Industrial Economics and Management, Tashkent State Technical University, Uzbekistan

http://dx.doi.org/10.18415/ijmmu.v9i3.3631

Abstract

The article proposes the main econometric factors of the methodology for sustainable development of enterprises of the fuel and energy complex of the Republic of Uzbekistan. Correlation and regression analysis of the proposed econometric factors has been carried out. Based on the results of the analysis, scientifically grounded proposals for the effective and safe sustainable development of the sectors of the energy sector of the national economy are presented.

Keywords: *Econometric Analysis; Statistics; Correlation Analysis; Multivariate Econometric Model; Sustainable Development; Digital Economy; Nuclear Energy; Renewable Energy Sources; Energy Conservation; Energy Efficiency; Fuel and Energy Complex*

Introduction

The degree of development of the economic system is interconnected with the activities of the fuel and energy complex, which determines the economic potential, volume and efficiency of industrial production. Studying processes and phenomena, researchers are faced with the problem of studying not individual indicators, but their totality, the mutual influence on each other and the relationship between each other. Today, the sustainable development of enterprises in the fuel and energy complex is the basis for the effective development of the modern world community. The enterprises of the fuel and energy complex must provide the growing population of the planet with energy resources and the sustainable development of the world economy with an average annual GDP growth rate of 3.5-4%, which will lead to an increase in world energy consumption by 1.3-1.5 times by 2030 [1]. Methods and mechanisms for managing the production and economic activities of enterprises in the fuel and energy complex are constantly being improved, the intensity of systemic transformations in the industry is increasing, the achievements of innovative processes, methods of mathematical statistics, mathematical modeling and forecasting the sustainable development of these enterprises are actively used, which, in turn, stimulates the growth of the competitiveness of the enterprises they produce. products.

Literature Review

Sustainable development of enterprises of the fuel and energy complex combines two opposites: on the one hand, stability as the stability of the state of enterprises in a particular industry, and on the other hand, development, as a process aimed at changing an object in order to improve it [2-5]. Studies devoted to the study of methods of mathematical modeling and forecasting of sustainable development of industrial enterprises are carried out in scientific centers and educational institutions of leading countries of the world, including the World bank (Economic Development Institute), EBRD (European Bank for Reconstruction and Development), ADB (Asian Development Bank) , Economic Development Institute, IEA (World Energy Agency), WEC (World Energy Council), Harvard University, New York University, University of Chicago (USA), University of Manchester, London school of Economics, University of Huddersfield (UK).

Research Methodology

The article used various types of analyzes: heuristic and expert assessment, statistical grouping, correlation, economic and statistical, graphical analysis and other methods.

Analysis and Results

In order to create a model for sustainable development of the fuel and energy complex, it is necessary to use the methods of mathematical statistics, which include multivariate analysis. Among the methods of the latter is the correlation analysis of certain factors. When studying certain phenomena, signs (factors) can be divided into two groups: dependent factors and independent ones. This division is purely arbitrary, since a factor that is dependent in one case can become independent in another. Studying mass phenomena, in particular, economic phenomena, it is necessary to logically classify all the studied characteristics (factors) into independent and dependent ones.

For the correct choice of a suitable production function for sustainable development of fuel and energy enterprises in accordance with the nature of the economic process, it is necessary to study the complex of interrelationships between technological, managerial and a number of other characteristics of the simulated object.

We will adhere to the following notation:

i - number of the studied factor, $i \in N$; X_i - studied independent factor; Y is the dependent factor under study. In some situations, Y can be calculated as a function of X_i: $Y = f(X_1, X_2, X_i, ..., X_n)$. In this case, it is said that Y and the set X_i are linked by functional dependence. The function $f(X_1, X_2, ..., X_n)$ must also include a random variable "U": $Y = f(X_1, X_2, X_i, ..., X_n, U)$. Studying the volume of output Y at the enterprise, it is natural to assume that it depends on the costs of various types of resources X_i and write: $Y = f(X_1, X_2, X_i, ..., X_n)$. This relationship is a model that establishes how the variables are related to each other. In the general case, the relationship between the dependent variable Y (effective indicator) and n independent variables can be written: $Y = f(X_1, X_2, X_i, ..., X_n)$.

For a model of sustainable development of enterprises in the fuel and energy complex, initial data on the effective factor and factors that influence it to one degree or another are required. As a sign of the result characterizing the sustainable development of the fuel and energy complex, we took the indicator -

the net volume of production and sales of fuel and energy resources, billion Uzbek sums - (*Yi*), since the financially stable development of the industry's enterprises is largely ensured by these indicators. The presence of a sufficient level of income allows enterprises to carry out activities to improve activities in the production, social and environmental spheres, which ensures the sustainable development of enterprises, the industry and the economy as a whole.

Correlation analysis is required to select indicators of a multivariate econometric model. Among the factors are paired correlation coefficients. The matrix of paired correlation coefficients between factors was determined (table 1).

Tab1e 1. Matrix of paired correlation coefficients between factors*

	LNY	LNX_1	LNX_2
LNY	1.000000		
LNX_1	0.081372	1.000000	
t-Statistics	0.046586		
Probability	0.0000		
LNX_2	0.983313	0.123215	1.000000
t-Statistic	0.011944	1.045698	
Probability	0.0000	0.2975	

**Developed by author*

Table 1 also presents the coefficients for determining the reliability and probability of the correlation coefficients. At the bottom of each correlation coefficient, its value and probability are indicated, calculated as Student's t test. It is established that the calculated probability between the factors does not exceed 0.05. For example, a specific correlation between the financial result from the activities of enterprises (lnY) and manufactured products (lnX2), the coefficients $r_{\ln Y,\ln X2}$ 0. 983313 t 0,011 and prob. 0,0000. This indicates that there is a strong correlation between the two factors, that the particular correlation coefficient is reliable, and that there is a positive correlation between the two factors with an accuracy of 98%.

Let's carry out a correlation analysis to select the factors that will be included in the multivariate econometric model of sustainable development of the fuel and energy complex. That is, there are partial and double correlation coefficients between the factors. The results are presented below (table 2).

In addition, table 2 also contains the double correlation coefficients, which show the density of the relationship between influencing factors (lnXi, lnXj). The most important thing here is that the influencing factors are not closely related to each other. That is, there should be no multicollinearity. The value of the double correlation coefficient between the two influencing factors is 0.7.

If it is small, then multicolarity does not exist. From the data in the table, it can be seen that the relationship between influencing factors does not exceed 0.7. Consequently, there is no multicollinearity among the influencing factors. Table 2 also presents the coefficients for determining the reliability and probability of the correlation coefficients. At the bottom of each correlation coefficient, its value and probability are indicated, calculated as Student's t test. The probability is established that the calculated probability between the factors does not exceed 0.05.

Table 2.Coefficients of specific and double correlation between factors matrix

	LNY	LNX1	LNX2	LNX3	LNX4	LNX5	LNX6	LNX7
LNY	1.000000							
LNX1	0.959460	1.000000						
	14.44294	-----						
	0.0000	-----						
LNX2	-0.873475	-0.705398	1.000000					
	-12.07690	-9.047594	-----					
	0.0000	0.0000	-----					
LNX3	0.889370	0.702631	-0.672051	1.000000				
	8.253248	6.138380	-7.559646	-----				
	0.0000	0.0000	0.0000	-----				
LNX4	0.956756	0.675320	-0.709541	0.631703	1.000000			
	13.95425	18.74084	-9.284707	6.355352	-----			
	0.0000	0.0000	0.0000	0.0000	-----			
LNX5	0.712295	0.623843	-0.674883	0.590690	0.620808	1.000000		
	4.305598	3.386531	-5.200954	3.105828	3.359683	-----		
	0.0004	0.0033	0.0001	0.0061	0.0035	-----		
LNX6	0.850677	0.561339	-0.573736	0.696533	0.614323	0.624114	1.000000	
	13.00327	14.81145	-7.621177	5.589531	9.578443	3.388943	-----	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0033	-----	
LNX7	0.869620	0.562071	-0.696662	0.636777	0.432698	0.668472	0.667075	1.000000
	16.81703	14.96235	-8.592920	6.483772	10.97193	3.813294	16.12223	-----
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0000	-----

**Developed by author*

This indicates that there is a strong correlation between the two factors, that is, the particular correlation coefficient is reliable and that there is a positive correlation between the two factors with an accuracy of 95%.

Consequently, the correlation coefficients between the factors included in the multivariate econometric model satisfy the probability requirements calculated by the Student's t test. Based on these factors, it will be possible to create a multivariate econometric model that determines the volume of production.

Based on the above considerations, the following factors were chosen to create a multivariate econometric model for sustainable development of production activities in the oil and gas sector (quarterly data for 2010-2020): result - sales volume, billion Uzbek sums. - (Y), influencing factors - the number of consumers of fuel and energy resources, pref. - (X1), cost of production, billion Uzbek sums, - (X2), number of deposits, km2.units. - (X3), share of renewable energy sources, million Uzbek sums. - (X4), total transactions through POS terminals, billion Uzbek sums. units - (X5), modernization of OPF units (X6), transportation costs, million Uzbek sums (X7).

In econometric modeling of indicators in the fuel and energy complex, first of all, factors influencing the given industry and its development are identified and presented in the form of time series. Descriptive statistics are carried out on the basis of these time series prior to the development of an econometric model. That is, for each variable, the values of indicators such as mean values, indicators of fashion and median, standard deviations, indicators of asymmetry and excess, Jacques-Bera[6] statistics and probabilities are calculated:

- Net sales of fuel and energy resources (FER), billion Uzbek sums - (Y)
- Investments in fixed assets, billion Uzbek sums (X1);
- Cost of goods sold, billion Uzbek sums (X2);

According to the initial data for these indicators, the coefficient of variation does not exceed the standard value, therefore, these factors can be included in the study. The calculation of the pairwise correlation coefficient between the factors of investment in fixed assets, billion Uzbek sums (X1i) and net sales of products (FER), billion Uzbek sums - (Ui) is presented in Table 3.

Table 3. Calculated data for determining the coefficient of pair correlation with the factor of sales in the fuel and energy complex

Years	X_{1i} млрдсум	Y_i млрдсум.	X_{1i}*Yi	$(X_{1i}-\bar{X}_{1i})^2$	$(Yi-\bar{y})^2$
1	2	3	4	5	6
2003	32,019	47,056	0,023	12,3963	19,807
2004	20,044	40,024	0,001	11,7497	31,2084
2005	24,012	40,093	0,1767	2,6497	30,1669
2006	21,141	30,254	0,9906	0,1385	34,0991
2007	24,043	30,031	0,0217	7,9963	31,5444
2008	14,140	20,049	0,2450	2,1674	30,6522
2009	9,1244	10,023	0,0092	9,7830	30,9408
2010	11,781	16,851	8,9186	5,7274	16,016
2011	14,453	20,231	0,8085	0,0008	28,6701
2012	11,402	13,546	6,3386	0,3274	16,3171
2013	27,743	40,423	0,4125	11,7497	31,1972
2014	42,044	50,614	1,4122	1,5074	38,4331
2015	42,782	54,102	0,1326	4,9630	32,3470
2016	50,147	60,356	0,0578	11,7497	31,1972
2017	63,758	75,081	0,1053	4,9630	32,1086
2018	56,745	70,095	0,2565	0,6852	32,2674
2019	32,745	40,014	0,0140	6,3897	31,3538
2020	42,852	45,881	2,7002	0,4519	23,7318

**Developed by author*

The average value of the variable is found as follows:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \qquad (1)$$

where n is the number of observations.

The average is determined by the ratio of the total number of observations in the time series to the number of observations. Since the units of measurement of the variables are different, and to better explain the interpretation of the multivariate econometric model, we logarithm the values of all factors. For this, a special econometric modeling program was used - EViews 10. Descriptive statistics by factors (Table 4.).

Table 4. Descriptive statistics by factors*

	LNY	LNX_1	LNX_2
Mean	0,345033	1,35108	1,387276
Median	0,398742	1,36971	1,377242
Maximum	0,232229	1,37550	1,397017
Minimum	0,577948	1,38006	1,350995
Std. Dev.	0,370198	1,38480	1,364023
Skewness	0,000146	1,39500	1,350003
Kurtosis	0.258934	1.36978	1,357936
Jarque-Bera	0,412378	1.35474	1,350321
Probability	0,456123	1.38324	1,381246
Sum	210,9243	8,26105	7,876556
Sum Std. Dev.	124,254	15,879	18,45579
Observations	118	118	118

**Developed by author*

From the data in the table, you can see the average value (mean value), median value (maximum), maximum and minimum values (maximum, minimum) of each factor. In addition, the standard deviation of each factor is given (std. Dev. (Standard deviation) - the standard deviation coefficient indicates how much each variable deviate from the mean).

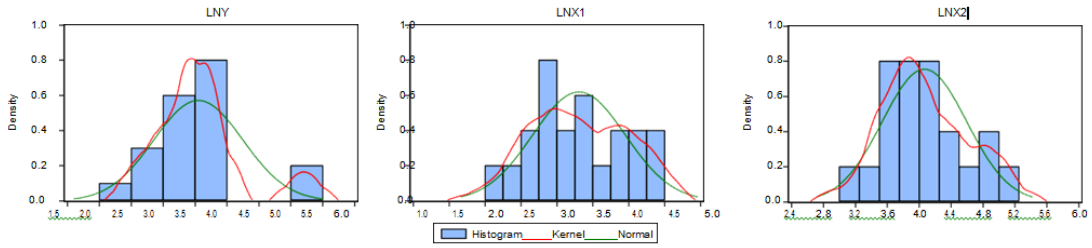

Figure 1. Graph of normal distribution functions of factors*

**Developed by author*

Figure 1 shows that almost all factors obey the law of normal distribution. Because the exceedance ratio of some factors is greater than the theoretical normal distribution plot (lnY, lnX1 and lnX2). In some years, some factors increased sharply, while in others the changes were insignificant. In general, all studied factors obey the law of normal distribution. The graph of the normal distribution of the resulting factor is shown below (Fig. 2). For this, the Jacques-Bera mezzanine is used. This test is a statistical test that checks the observation errors for the moment (skewness) observed with the moments of the normal distribution and the fourth moment (kurtosis) for the normal distribution, and S = 0.09 and K = 2.15.

The degree of freedom of this statistic is divided by χ^2 - the square of two degrees of freedom, because S - the asymmetry coefficient and K - the excess coefficient is the asymptotic norm, therefore, its squares are also the asymptotic norm.

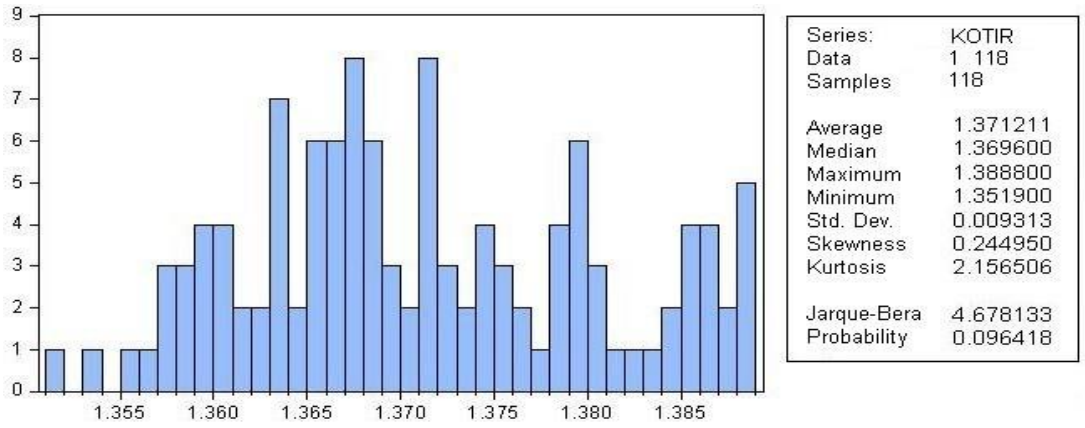

Figure 2. Checking the obtained multiplier to obey the law of normal distribution*

**Developed by author*

Figure 2 clearly shows that the resulting coefficient obeys a normal distribution. This is confirmed by design parameters and criteria, i.e., the calculated Jacques-Bera coefficient is 4.68, and its probability is less than 0.09.

Conclusion and Recommendations

The studies carried out made it possible to determine that specific correlation coefficients represent a close relationship between the resulting factor and the factors influencing it. Therefore, these correlation coefficients indicate that there is a strong correlation between the outcome factor (volume of e-commerce services, lnY) and influencing factors, that is, the value of specific correlation coefficients is greater than 0.7. There is also a direct relationship between the studied factors of sustainable development of the fuel and energy complex of the Republic of Uzbekistan, and the lack of autocorrelation in the resulting residuals of factors also suggests that the multivariate econometric model described above can be used in forecasting. Thus, the analysis of the econometric factors of sustainable development of enterprises of the fuel and energy complex of the Republic of Uzbekistan revealed that the primary factors affecting the sustainable development of enterprises in the fuel and energy complex are the volume of extracted and produced fuel and energy resources and the volume of sales of products of enterprises of the fuel and energy complex. Also, a direct relationship was determined between the financial result and such factors as the volume of production of fuel resources, the number of deposits, the number of consumers of fuel and energy resources, an increase in the share of alternative energy sources in the total energy balance of the republic, etc., which is confirmed by the multiple correlation coefficient, which is 0.9328.

References

1. Decree of the President of the Republic of Uzbekistan No. DP (Decree of President)-4947 dated February 7, 2017 "On the strategy of actions for the further development of the Republic of Uzbekistan."

2. No. DP-5544 dated September 21, 2018 "On the strategy of innovative development of the Republic of Uzbekistan for 2019-2021"

3. Allaeva G.J. Prospects for sustainable development of enterprises of the fuel and energy complex of the Republic of Uzbekistan. //Monograph. - Tashkent, "Fan va texnologiyalar", 2021.p 160.

4. Allaeva G.J. Sustainable development of enterprises of the fuel and energy complex of the Republic of Uzbekistan in the digital economy. Sanoat itisodiyoti va management. Republic of ilmiy-amaliy anjumanni materialari - T: 2021 j., 29 april. B. 368-372

5. Allaeva G.J., Makhkamova M.A. Advanced technologies in the electric power industry are the basis of energy conservation and energy security in Uzbekistan. // Spec. issue of the magazine "Problems of energy and resource saving". Toshkent, 2019. B. 208-212.

6. Akhmedov T.M., Muinov D.A., Shoakhmedov Sh.Sh. Industrial strategy in Uzbekistan: aspects of problems and formation / Ed. Muinova D.A. - T.: TsEEP, 2005. P. 120.

7. Makhkamova M.A., Allaeva G.J. Relationship between Sustainable Development of Branches of Fuel and Energy Complex and Growth GDP. International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8, Issue-2S11, September 2019 (SCOPUS indx).

8. Dudarev A.S. Factors of Sustainable Economic Development /A.S. Dudarev // Entrepreneur. - 2013. - No. 8. P. 56-59.

9. Khodiev B.Yu., Makhmudov N.M. Milliy iқtisodietning etakchi tarmoқlarini barқaror rivozhlantirish omillari va tendentialari. - T: Iқthisodiet, 2018 . p 344.

10. Batov G.Kh., Sheozhev M.A. Economic assessment of factors ensuring sustainable development of industrial enterprises in the region // News of the Kabardino-Balkarian Scientific Center of the Russian Academy of Sciences. 2015. No. 52. P. 12-19.

Copyrights