

## ASSESSMENT AND DETERMINATION OF ALTERNATIVE SCENARIOS FOR FORECASTING THE EXPORT POTENTIAL OF UZBEKISTAN BASED ON MULTIFACTOR ECONOMETRIC MODELS

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### Abstract

The article evaluates and identifies alternative scenarios for forecasting the country's export potential based on multifactor econometric models. The scientific views of local and foreign economists on the concept of "export potential" are explored. Endogenous and exogenous factors influencing export potential were identified using many analysis methods, and alternative forecasting scenarios were developed. The implementation of the necessary measures to achieve the forecast indicators of export potential is proposed.

Key words: foreign trade turnover, export potential, export volume, share of small business exports in total exports, investments in fixed capital, main partner countries.

### Introduction

"Uzbekistan - 2030" strategy defines the task of "strengthening the export potential of the national economy and sharply increasing the share of products with high added value in its structure." In particular, to increase the volume of exports by 2 times and 45 bln. USD, increasing the number of exporting enterprises from 6.5 thousand to 15 thousand, increasing the volume of finished and semi-finished products in export by 3.3 times, expanding the export of finished and technological products to European countries within the framework of GSP+ and other systems. In addition, based on the idea of "New Uzbekistan - the country of competitive products", it is planned to provide all-round support to exporters who bring national brands to foreign markets [1].

One of the macroeconomic indicators that determine the level of socio-economic development of any country is the foreign trade turnover, which reflects the country's economic relations with the outside world. Foreign trade turnover reflects the process of the country's exchange of goods and services with the outside world.

The volume of exports and imports in the foreign trade turnover and the structural analysis of these indicators can show the extent to which the country is developing, its dependence on the outside world or the high level of economic independence. Based on the study of the export level of countries and its composition, it is possible to draw clear conclusions about what competitive advantages a particular country has in its region or among the countries of the world in general.

The Republic of Uzbekistan, which is deeply integrated into the world community day by day, is among the countries that are gaining a strong position in the region where it is located and among the countries of the world. During its development until today, our country has been steadily developing foreign trade relations with foreign countries in the framework of foreign economic relations. The multi-factor analysis of the volume and composition of exports in the foreign trade turnover of our country allows to determine the main trends of change in the economic relations with the outside world in the period up to now, as well as the strategic directions that can be implemented in the export in the future period.

### **Literature review**

It is appropriate to conduct an analysis of the concept of "export potential" and determine the features of its formation and development within the region. A.B.Borisov defines the export potential as "the ability of the state to export existing or produced resources and products" [2]. However, according to the new economic and legal dictionary, A.N.Azriliana export potential not only envisages the ability to export, but also defines it as "the ability of the entire national production, industry, individual sectors or enterprises to produce the required amount of competitive products" [3].

Yu.A. Savinov and A.Yu.Migunovs offer the following interpretation of export potential: "export potential is the use of comparative national advantages of the national economy, its individual sectors, branches, enterprises and companies (extensive natural resources, favorable geographical, infrastructure and other factors, high labor productivity, etc.) is the ability to produce goods and services that are competitive in the world market and have new competitive advantages based on scientific and technical achievements" [4].

The management of the effectiveness of the formation and development of the export potential of the country or region embodies a multi-level system of macro-, meso- and microenvironmental tasks aimed at achieving the highest possible result in foreign markets. From the point of view of the country's economy, the definition given by the economist A.A. Maltsev more clearly expresses the content of the concept of export potential. According to this approach, the country's export potential is evaluated based on the quantitative measure of the country's domestic export potential and the definition of its export base, having the consumption capacity of the foreign market[5]. Uzbek researchers I.S.Hotamov, O.O.Rashidova studied issues such as analysis and forecasting of export potential, diversification of export potential [6].

In the studies, due attention is paid to the forecasting of the total export volume based on the analysis of the factors affecting the country's export potential [7]. The method of forming multi-factor econometric models, which allows to identify alternative scenarios, has been studied by many researchers and scientists from a theoretical and practical point of view.

The production functions reflecting the multi-factor connection of the processes are reflected in the modeling of interrelationships such as the volume of the manufactured products of the activity, labor and capital expenditure, return of funds, labor productivity. In general, models in the form of a product (service) production function can be expressed as follows:

$$N = f(F_1, F_2, F_3, \dots, F_n)$$

Here: N - volume of created products (services);

$F_1, F_2, F_3, \dots, F_n$  – factors affecting the result of activity, i.e. the resulting factor.

Thus, the model representing the interdependence of the resulting indicator and the factors affecting it, that is, the production function, can be represented by a regression equation.

It is emphasized that there is a linear relationship between the resulting factor and the factors that affect it when creating economic-mathematical models. This assumption is determined by the ratio of the resulting indicator and the proportional coefficient of interfactor correlation, as well as the coefficient of direct expenditure on the activity. In the linear programming models used in the analysis of the production function, the volume of the produced products (services) and the consumption of resources are directly proportional.

For practical situations, the use of linear production functions allows the application of mathematical models that are practical and easy to structure.

Economic growth has a linear relationship between the consumption of raw materials and fixed assets, while the relationship between the consumption of labor and fixed capital is a complex linear relationship.

Creation of economic-mathematical models of the analysis of changes in economic processes and the use of new methods provide a deeper and more accurate study of the relationships between growth and its factors.

The non-linear representation of the economic growth function for specific situations is as follows:

$$N = a_0 \cdot F_1^{a_1} \cdot F_2^{a_2} \cdot F_3^{a_3} \cdot \dots \cdot F_n^{a_n}$$

Using this function, we can determine the effect of each factor on the resulting factor. The rate of change of the output factor comes in two forms, the absolute rate of growth and the relative rate of growth.

The absolute rate of growth of the indicator for each factor of the resulting indicator is determined by taking a special derivative of the non-linear form of growth with respect to a factor. For example, for the first factor:

$$\frac{\partial N}{\partial F_1} = a_0 \cdot a_1 \cdot F_1^{a_1-1} \cdot F_2^{a_2} \cdot F_3^{a_3} \cdot \dots \cdot F_n^{a_n}$$

It is known that the change of the resulting factor is directly related to all its factors. The ratio of private derivatives obtained by the factor is a specific normative indicator in the exchange of these factors.

In addition to the absolute rate of change of the output factor in economic growth models, the relative rate is also of great economic importance. The relative rate of change of the output factor in economic growth models is a quantity that indicates the percentage change in the output factor indicator when any indicator of growth changes by 1 percent.

The main goal of using the specified economic-mathematical modeling methods and their production functions is to correctly organize the optimal operation of socio-economic processes in the conditions of available resources.

Taking into account the wide use of multifactor production functions and functions derived from them in the multifactor analysis of socio-economic development processes, we define econometric models of the total export volume in the form of a production function based on the multifactor connection. The identified models will help to determine the target forecast indicators for the medium and long term based on the determination of the management directions

of the factors affecting the total volume of export and the volume of its components at the macro level, as well as to determine the measures necessary to achieve these indicators.

**Research methodology**

The main rules and principles of dialectics formed the methodological basis of the research. In studying the problems of forecasting the country's export potential, the method of econometric modeling of mutual cooperation and foreign trade was relied on, that is, the method of collecting, processing and analyzing data on economic indicators. Logical analysis, synthesis, generalization, induction and deduction, systematic approach to economic events and processes were used to draw conclusions from the data.

**Analysis and results**

Based on the above considerations, a multi-factor analysis of the export volume and its components, which is a component of the foreign trade turnover of the Republic of Uzbekistan, was carried out during the research.

Determining the level of importance of factors is the main task in the implementation of multifactorial analysis and is called the specification stage of modeling. The stage of extracting factor indicators participating in the model is one of the main stages in the formation of multi-factor models. It is necessary to formulate the content of the studied process, to be more precise, the factors that have the main influence on the change of the result index using accurate analysis methods.

Many analysis methods can be used in this process, including dozens of analysis methods such as SWOT-analysis, PEST or PESTLE-analysis. However, all of these methods of analysis should go to a precise mathematical expectation of the factors related to the process being studied as a result of the analysis, and the influencing factors should be distinguished depending on the quantitative level of this mathematical expectation.

In the course of our research, we chose the SWOT analysis method to analyze the country's export volume and its composition based on multi-factor models. As we know, SWOT-analysis allows to evaluate the situation of the research object in these four aspects based on the four main aspects of the research object - STRENGTHS, WEAKNESSES, OPPORTUNITIES and THREATS.

In the course of the factor analysis of the volume and structure of the export of the Republic of Uzbekistan, we selected the following 3 main resulting factors as endogenous factors influencing the factor analysis, which allow factor analysis of the general state of export and the opportunities within the existing situation (Table 1):

**Table 1. Indicators of factors affecting the export volume and indicators of its components in the economy of the Republic of Uzbekistan**

Endogenous factors	Exogenous factors
The total volume of exports	X <sub>11</sub> is the average price parity in domestic and foreign markets (export price index).
	X <sub>12</sub> – capitalized investments.
	X <sub>13</sub> – share of small business in export.

	X <sub>14</sub> – the share of the 5 largest export destinations in total exports.
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*\*Developed by the author based on the results of the SWOT analysis*

1. Total export volume of the country.

In order to isolate the exogenous factors from the selected result factors, the factors that can affect the change of the result factors were placed in each section of the SWOT-analysis matrix, and the influence of each factor on the endogenous factor was determined based on the conclusions of experts in the range of 0-5. The results of the analysis conducted separately for each endogenous factor revealed that the factors with the highest influence on the change of all three outcome factors are economic factors, and the exogenous factors for each outcome factor were separated in the order of the level of influence.

Extraction of exogenous factors for the result factors indicated above in terms of the volume and composition of the export of the Republic of Uzbekistan was carried out on the basis of SWOT analysis. As a result of this analysis, the indicators of factors influencing the change of all three endogenous factors were extracted.

Selected influencing factors were examined for their degree of association with the outcome factor based on several tests and criteria (correlation coefficient, Granger causality test, extended Dickey-Fuller test and Phillips-Perron test). The sum of the effects of the isolated influencing factors has a share of more than 50% in the total influence of the factors influencing the change in the total export volume, and these factors are of great importance in the formation of the total export volume.

The indicators of the total export volume of our country and the factors affecting its change for the period of 2001-2022, presented in Table 2 below, were extracted from the open data system of the Statistical Agency under the President of the Republic of Uzbekistan, and the indicators of each result and factor affecting it were recorded in separate tables. Correlation tests of the factor indicators included in the multifactorial model based on the extracted statistical data, at the same time, the quality of the constructed models and the predictive indicators were determined in the sequence in the table (Table 2).

**Table 2. Indicators of the total export volume and factors influencing its change**

Years	Total export volume, thousand US dollars (Y)	Average price parity in domestic and foreign markets (X <sub>11</sub> )	The volume of investments in fixed capital, bln. soum (X <sub>12</sub> )	Share of small business in export, % (X <sub>13</sub> )	The share of the 5 largest export destinations in total exports, % (X <sub>14</sub> )
2001	2170422,40	1,10	1320,90	9,30	36,45
2002	2988419,70	1,11	1526,60	7,50	19,95
2003	3725011,60	1,14	1978,10	7,30	21,23
2004	4853025,20	1,13	2629,00	7,30	26,18
2005	5408797,30	1,11	3165,20	6,00	35,01
2006	6389833,10	1,07	4041,00	11,20	46,64
2007	8991474,80	1,08	5903,50	14,80	46,46
2008	11493260,20	1,10	9555,90	12,40	29,38

2009	11771281,60	1,12	12531,90	14,60	32,31
2010	13023390,00	1,14	16463,70	13,70	52,22
2011	15021321,00	1,15	19500,00	18,80	55,82
2012	13599659,00	1,15	24455,30	14,00	67,74
2013	14322656,30	1,16	30490,10	26,20	60,31
2014	13545748,20	1,14	37646,20	27,00	61,18
2015	12507382,20	1,14	44810,40	27,00	56,23
2016	12094646,30	1,17	51232,00	26,00	45,86
2017	12553738,70	1,19	72155,20	22,00	49,06
2018	13990745,40	1,18	124231,30	27,20	54,03
2019	17458687,70	1,14	195927,34	27,00	47,77
2020	15102281,20	1,14	210195,10	20,50	40,46
2021	16662804,40	1,11	239552,60	20,00	49,69
2022	19293710,30	1,08	266240,00	29,60	49,21

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*\*Developed by the author based on the data of the Statistical Agency under the President of the Republic of Uzbekistan.*

Based on the connection of the main endogenous and exogenous variables, the above time series data were analyzed using the EViews10 program in order to determine the trends of the total export volume of our country.

Due to the fact that the indicators of the resulting and influencing factors separated in the above table are not of the same measurement unit, that is, the factor indicators are not homogeneous, we can determine the main trend model in the form of a linear logarithmic relationship.

To do this, first of all, we can convert all factor indicators to natural logarithmic indicators (Table 3).

**Table 3. Total export volume and logarithmic value of factor indicators influencing its change**

<i>LnY</i>	<i>LnX<sub>11</sub></i>	<i>LnX<sub>12</sub></i>	<i>LnX<sub>13</sub></i>	<i>LnX<sub>14</sub></i>
14,59	0,10	7,19	2,23	3,60
14,91	0,10	7,33	2,01	2,99
15,13	0,13	7,59	1,99	3,06
15,40	0,12	7,87	1,99	3,27
15,50	0,10	8,06	1,79	3,56
15,67	0,07	8,30	2,42	3,84
16,01	0,08	8,68	2,69	3,84
16,26	0,10	9,16	2,52	3,38
16,28	0,11	9,44	2,68	3,48
16,38	0,13	9,71	2,62	3,96
16,52	0,14	9,88	2,93	4,02
16,43	0,14	10,10	2,64	4,22
16,48	0,15	10,33	3,27	4,10
16,42	0,13	10,54	3,30	4,11

16,34	0,13	10,71	3,30	4,03
16,31	0,16	10,84	3,26	3,83
16,35	0,17	11,19	3,09	3,89
16,45	0,17	11,73	3,30	3,99
16,68	0,13	12,19	3,30	3,87
16,53	0,13	12,26	3,02	3,70
16,63	0,10	12,39	3,00	3,91
16,78	0,08	12,49	3,39	3,90

\* *Developed based on author's calculations*

Using EViews10 software package, the parameters identified during the regression analysis and the importance of the model were evaluated by the main evaluation indicators calculated by the program. A linear logarithmic model of the trend is formed by extracting the coefficients of the regression model to determine the observed situation from the results of the regression analysis.

The parameters identified during the regression analysis using the EViews10 software package and the importance of the model were calculated using the main evaluation indicators developed in the program (Table 4).

A multi-factor econometric model of changes in the country's total export volume and its influencing factors was created using the identified data. According to it, a regression equation representing this process was created.

$$\ln Y = -0.578 \cdot \ln X_1 + 0,244 \cdot \ln X_2 + 0,073 \cdot \ln X_3 + 0,449 \cdot \ln X_4 + 11,864 \quad (1)$$

If the determined linear logarithmic model is potentiated, a non-linear econometric model representing the total export volume is derived:

**Table 4. Characteristics of connection of selected factors and the main indicators of the quality of the constructed factor model on the total export volume**

Dependent Variable:  $\ln Y_t$

Method: Least Squares

Date: 02/18/24 Time: 17:19

Sample: 2001 2022

Included observations: 22

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Average price parity in domestic and foreign markets, $\ln X_{11}$	-1,578189	2.444654	-0.236511	0.8159
The volume of investments in fixed capital, $\ln X_{12}$	0,243631	0.075109	3.243688	0.0048
Share of small business in exports, $\ln X_{13}$	0,072737	0.297401	0.244575	0.8097
Share of the top 5 export destinations in total exports, $\ln X_{14}$	0,448864	0.275735	1.627879	0.1219
The general effect of random factors, e	11,86433	0.775298	15.30293	0.0000

R-squared	0.825011	Mean dependent var	16.09318
Adjusted R-squared	0.783837	S.D. dependent var	0.613300
S.E. of regression	0.285144	Akaike info criterion	0.525070
Sum squared resid	1.382219	Schwarz criterion	0.773034
Log likelihood	0.775769	Hannan-Quinn criter.	0.583483
F-statistic	20.03721	Durbin-Watson stat	1.721253
Prob(F-statistic)	0.000003		

*\*Computationally developed by the author in EViews10 software.*

$$Y_{y3} = \frac{X_2^{0,244} \cdot X_3^{0,073} \cdot X_4^{0,449} \cdot e^{11,864}}{X_1^{0,578}} \quad (2)$$

Based on the trend models determined using the software package, a list of prospective indicators of changes in the total export volume of our country in 2023-2027 and the most convenient models for their calculation was presented (Table 5).

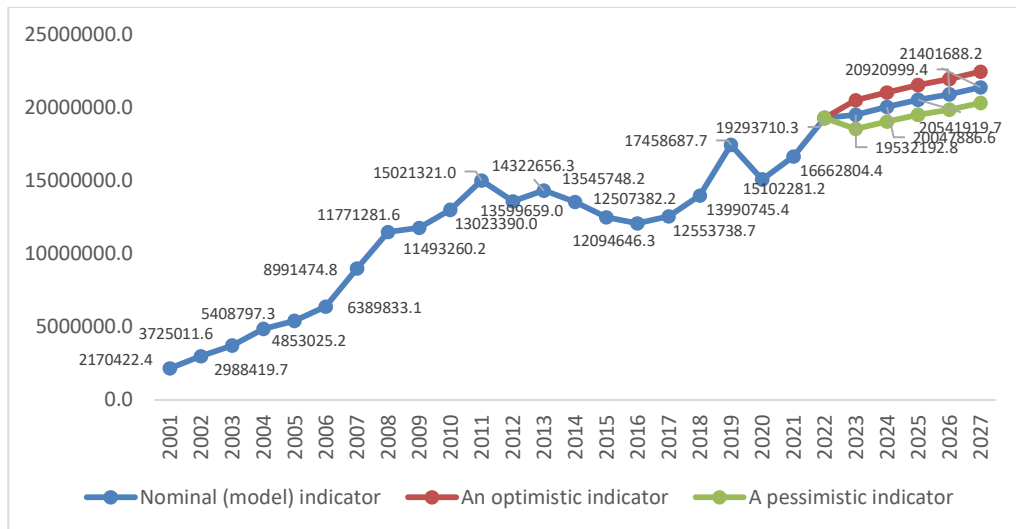
**Table 5. Trend models of total export volume and factors affecting it and forecast indicators for 2023-2027**

Indicators and their factor models	Forecast indicators				
	2023	2024	2025	2026	2027
Total export volume, thousand US dollars $Y_{y3} = \frac{X_2^{0,244} \cdot X_3^{0,073} \cdot X_4^{0,449} \cdot e^{11,864}}{X_1^{0,578}}$	19532192,8	20047886,6	20541919,7	20920999,4	21401688,2
Average price parity in domestic and foreign markets $x_{11} = 0,0018 \cdot t + 1,109$	1,15	1,15	1,15	1,16	1,16
The volume of investments in fixed capital, bln. Soum $x_{12} = 11109,78 \cdot t - 65237,4$	190287,5	201397,3	212507,1	223616,9	234726,7
The share of small business in exports, % $x_{13} = 1,059 \cdot t + 5,519$	29,9	30,9	32,0	33,1	34,1
Share of the top 5 export destinations in total exports, % $x_{14} = 1,197 \cdot t + 30,92$	58,4	59,6	60,8	62,0	63,2

*\* Developed by the author based on research results.*

Using a multifactor econometric model, the values of changes in the total export volume in the long term, i.e. in 2001-2027, were expressed graphically





(Figure1).

**Figure 1. Changes in the total export volume of the country in 2001-2027, thousand US dollars (forecast indicators for 2023-2027)**

*\* Developed based on author's research.*

On the basis of the above factor connections, a development scenario based on the influence of factors on the total export volume was developed, which is considered as the result indicator of the indicators that have a high level of influence on the total export volume. Using the identified trends allows to optimize the level of impacts on the total export volume.

The trend models determined on the basis of multi-factor connection allow to predict the change of the main indicators of the field activity in the future period, taking into account the errors in certain places under the influence of selected factors. In the course of research, changes in the total export volume under the influence of 4 main factors are used to determine forecast values for the next period.

Using the model in practice without evaluating the importance of the econometric model and the quality of its parameters determined on the basis of the above calculations can lead to the occurrence of large errors. Taking this into account, we evaluate the model of the change of the total export volume for its importance and the quality of the model parameters.

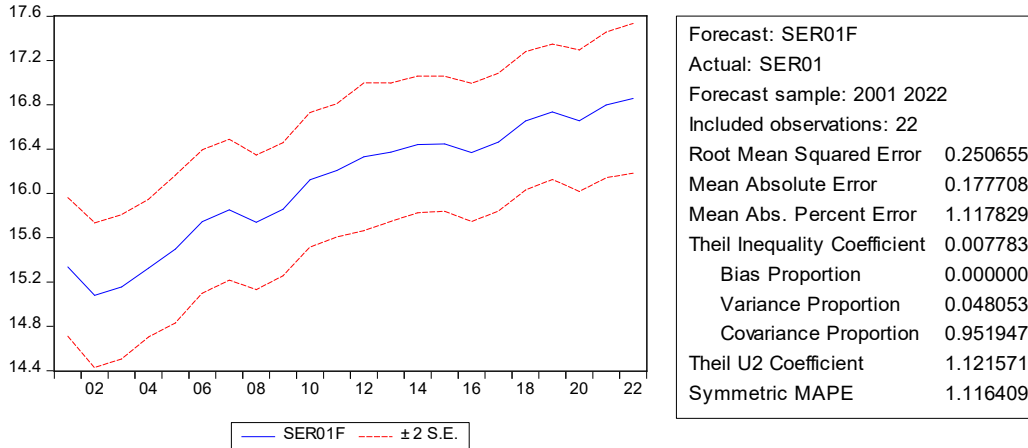
The analysis carried out on the basis of the software package shows that the correlation of the resulting factor with the influencing factors is equal to  $r=0.9083$ , and the coefficient of determination is equal to  $R_2=0.825$ . This shows that the influencing factors and the resulting factor have a high correlation and the residuals, as the difference between the calculated indicators and the real indicators, are also densely connected.

The significance and quality of the parameters of the constructed econometric model are evaluated using the values of the indicators presented in the table. Fisher's criterion value for the endogenous factor in the identified model is 20.04, and its significance is 0.000003. It can be seen that the constructed trend model can be applied in practice in terms of significance.

The Darbin-Watson (DW) criterion, which allows determining the presence of autocorrelation or multicollinearity in the constructed econometric model, is equal to 1.72, and considering that the optimal limit is around 2.0, it is seen that there is partial autocorrelation in the model. However, this level of autocorrelation is not significantly different from the optimal limit.

Using the EViews10 software package, we form the trend of changes in the volume of exports, which is the main indicator for increasing the country's export potential, within  $\pm 2$  statistical error limits, and evaluate the indicators that represent the importance of this trend (Fig. 2).

The indicators presented in Figure 2 reflect the relevance and adequacy of the constructed model. In particular, the Teil inequality coefficient is 0.0077, the Teil U2 coefficient is 1.12, the bias ratio is 0, the variance ratio is 0.048, the covariance ratio is 0.9519, and the symmetric MAPE is 1.1164, which indicates that the constructed model is in the required range. In particular, considering that the limit for symmetric MAPE is up to 10, it can be seen that the degree of approximation error is smaller than the specified limit, that is, MAPE:  $1.1164 < 10$ .



**Figure 2. Changes in the volume of total exports from 2001 to 2022 within  $\pm 2$  statistical error limits**

*\* Developed by the author based on Eviews 10 software.*

Based on the above analytical data and the assessment of the values of the indicators, the following trend model, which is considered the most important in the development of the country's total export and the influence of factors on it, can be used in the process of developing scenarios based on the strategies for developing the export level of the national economy in the future.

The model and forecast indicators developed on the basis of the Eviews 10 program serve as a basis for the formation of alternative scenarios in the direction of developing plans and strategies for the development of the country's total export volume in the next medium term.

### Conclusions and recommendations

Based on the evaluation of the country's export potential based on multi-factor models and the results of the analysis of target indicators based on alternative scenarios, the following conclusions were summarized:

1. The law of change (trend model) of the country's export volume can be determined in the form of a non-linear model based on multi-factor econometric analysis.
2. According to the conclusions of the leading experts, 5 important exogenous factors are the main factors affecting the change in the total volume of the country's exports today: the average price parity in the domestic and foreign markets, the volume of capital investments, the share of small businesses in exports, the total of the 5 most export-directed countries its share in

exports was determined. A change (increase or decrease) in the indicators of this factor leads to a significant change in the endogenous variable.

3. Due to the non-homogeneous factor indicators in the trend model, which represents the influence of the factors influencing the final factor (total export volume of the country), the model form was chosen as a non-linear model.

Based on the above conclusions and (2) - connection, it is advisable to organize activities in the following directions in order to increase the total export volume of our country:

- in the process of developing the country's investment programs, the establishment of export-oriented enterprises in the territory of special economic zones (small industrial zones, free economic zones, etc.) leads to the operation of enterprises on the basis of stable energy supply and coordination of the average price parity in domestic and foreign markets;

- the projects implemented on the basis of the investment program will be able to sustainably increase the volume indicators with the specified deadlines and full implementation and the increase in the volume of investments directly connected to the increase in the total volume of exports;

- with the development of small business in our country and the increase of its share in exports, it allows to rapidly increase the total export volume;

The use of the results of the above analyzes and the recommendations on increasing the volume of the country's total export in the proposed practice based on them will create an opportunity to increase the competitiveness of the national economy in the future.

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