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ECONOMETRIC RESEARCH OF EXPORTS OF GOODS AND SERVICES IN THE REPUBLIC OF UZBEKISTAN

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Abstract: *In this paper have been made econometric research of exports of goods and services in the republic of Uzbekistan. Authors characterized new promising directions of reforming the foreign trade sector associated with the purposeful liberalization of foreign trade and solving problems in the implementation of imports and exports; emphasizes the importance of combining reforms with an active policy to attract foreign direct investment into the economy of Uzbekistan (primarily in the manufacturing industries). Taking into account foreign experience and the results of empirical research, the author proposes a number of specific measures aimed at further diversifying the geographic and commodity structure of the republic's exports, in particular, increasing the share of non-primary goods in exports. It is argued that with the effective implementation of these and other measures, the country can create new industries and industries that are competitive in the world market, thereby ensuring the diversification of production and export of industrial goods with a high degree of processing.*
Keywords: *GDP, production, exporter, Cobb-Douglas production function, regression model, export, forecasting.*

INTRODUCTION

Goods and services produced in the Republic of Uzbekistan are exported to near and far abroad. The main part of the goods produced in our country are value-added products. At the time of Uzbekistan's independence, raw materials accounted for the bulk of exports. As a producer of oil, natural gas, and gold and as the second largest exporter of cotton, natural resources dominate the country's exports. Uzbekistan's other exports include machines and equipment, and food. Uzbekistan's main export partners are Russia, Turkey, China, Kazakhstan and Bangladesh. [10]

LITERATURE REVIEW

The issues of ensuring, assessing and managing economic and financial security at the macro and micro levels were discussed by scientists of our country – N. Jumaev, D. Rakhmonov, A.Burkhanov [5,6], Eshov M. [7], B.Tursunov [8] and others. The work of the mentioned authors undoubtedly makes a great contribution to the theory of financial security of the enterprise. However, due to the complexity and versatility of the problem of financial security of the enterprise, not all aspects of it have been sufficiently studied in these studies. In order to ensure and assess the financial security of enterprises, to adapt the experience of foreign countries to the conditions of Uzbekistan, to develop a methodology for ensuring the financial security of enterprises adapted to domestic enterprises, there is a need to apply generally accepted management methods and scientific justification.

ANALYSIS AND RESULTS

In the econometric study of the volume of exports of goods and services in the Republic of Uzbekistan, first of all, it is necessary to econometrically study the processes of production of export-oriented products. This is because the basis of exports is domestically produced goods and services.

In exploring these processes, we use the hierarchical multiplicative Cobb-Douglas production function [pp. 1, 118, 2, 145]. The use of this model requires the availability of three different resources: the volume of products exported (billion soums) (lnY), the value of fixed assets of exporting enterprises (billion soums) (lnK) and the number of employees at exporting enterprises (lnL) . (Data on these resources for 2000-2020 are available).

Descriptive statistics on variables-factors involved in the construction of the Cobb-Douglas production function are conducted [3, p. 15]. The results of the descriptive statistics are given in Table 1 below (given that the units of measurement of the variables involved in the production function vary, we convert them all to logarithmic values).

Table 1

Descriptive statistics on factors

	lnY	lnK	lnL
Mean	9.667124	8.173181	8.977099
Median	9.831782	8.610920	9.064609
Maximum	12.00827	10.87103	9.300017
Minimum	6.633755	4.743191	8.404495
Std. Dev.	1.664417	1.963154	0.288150
Skewness	-0.308819	-0.282256	-0.755592
Kurtosis	1.920978	1.757554	2.215383
Jarque-Bera	1.352545	1.629553	2.536892
Probability	0.508509	0.442738	0.281268
Sum	203.0096	171.6368	188.5191
Sum Sq. Dev.	55.40569	77.07948	1.660605
Observations	21	21	21

From the table data it is possible to see the mean value (mean), median (maximum), maximum and minimum values (maximum, minimum) of each factor. In addition, the standard deviation of each factor (std. Dev. (Standard Deviation) – the standard deviation coefficient indicates how much each variable deviates from the mean) is given.

Skewness is an asymmetry coefficient, which means that if it is zero, it is a normal distribution and the distribution is symmetrical. If this coefficient differs significantly from 0, then the distribution is considered asymmetric (i.e., not symmetrical). If the asymmetry coefficient is greater than 0, i.e., positive, then the normal distribution graph for the factor under study is shifted to the right. If it is less than 0, i.e. negative, it will be pushed to the left by the normal distribution graph for the factor under study. It can be seen that the asymmetry coefficients of all the factors on the processes we are studying are less than zero (Table 1) and that the graphs of the functions are shifted to the left (Figure 1). These shifts mainly reflect changes in the dynamics of the factors being studied. In some years, some factors had a sharp increase, while in others the changes were not significant. Graphs of the normal distribution functions of all factors are shown in Figure 1 below.

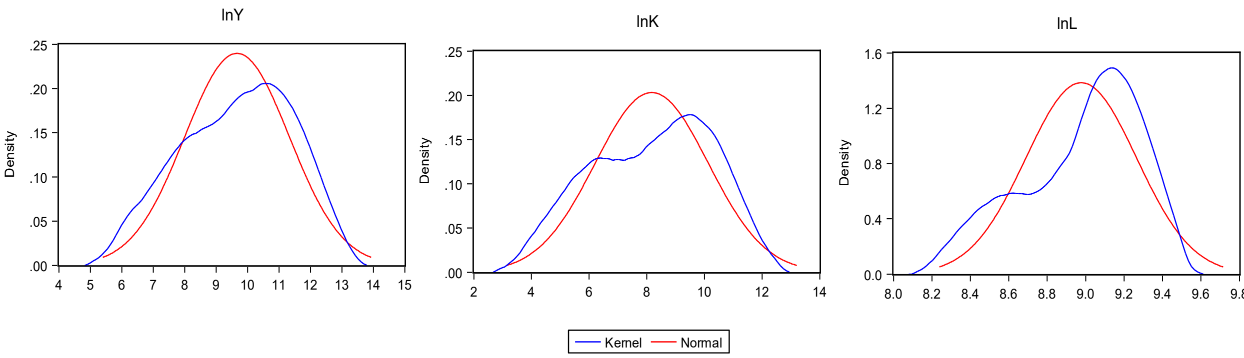


Figure 1. Graphs of normal distribution functions of factors

As can be seen from Figure 1, all factors are subject to the law of normal distribution. Since the excess coefficient of all factors was less than 3, it was thinner than the theoretical graph of the normal distribution.

The normal distribution graph of the resulting factor is shown in Figure 2 below.

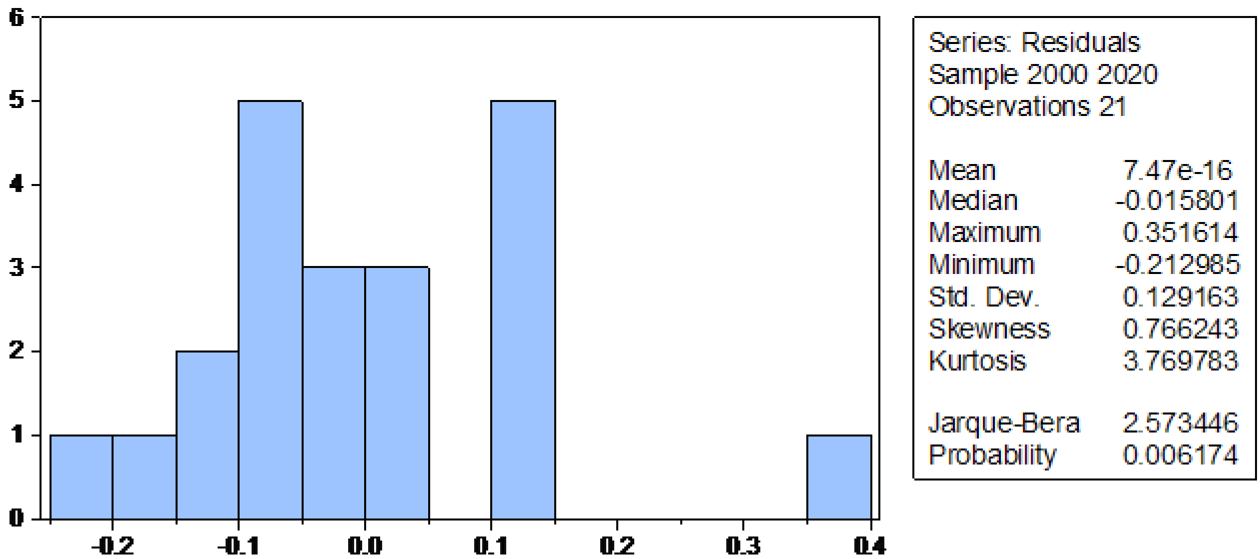


Figure 2. Check that the resulting factor obeys the law of normal distribution

The Jacques-Bera criterion is used for this. This criterion is a statistical criterion that checks the errors of observations with normal distribution moments of the third moment (asymmetry) and the fourth moment (excess) to the normal distribution and and.

It can be clearly seen from Figure 2 that the resulting factor is subject to the normal distribution. This is confirmed by the calculated parameters and criteria, i.e., the Jacques-Bera calculated coefficient is 2.57 and its probability is less than 0.05 (prob = 0.006).

It can be seen that the bonds between the resulting factor (lnY) and the influencing factors (lnK, lnL) are very dense (Fig. 3).

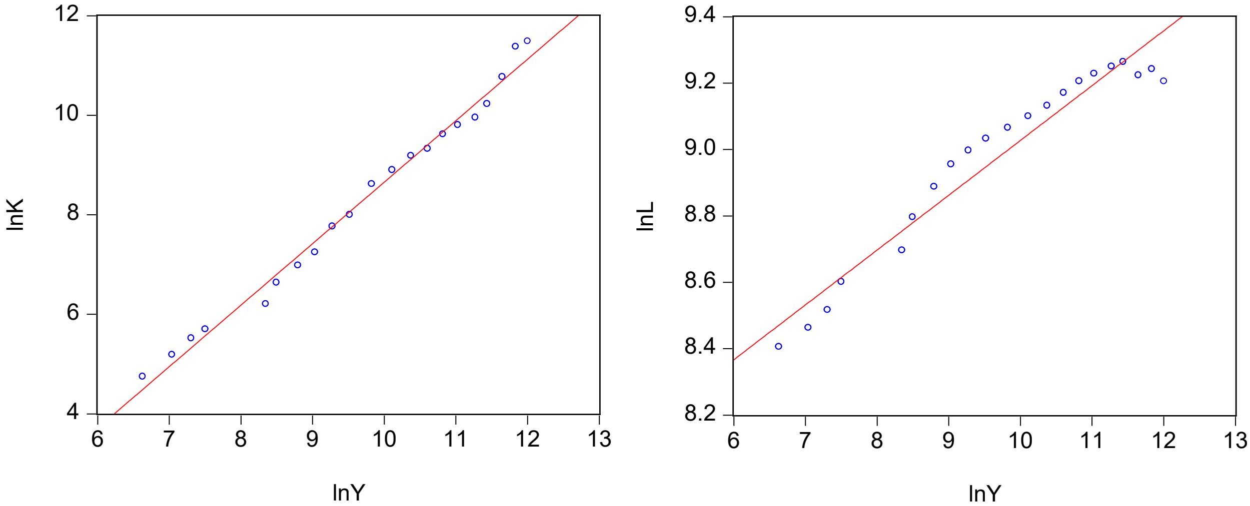


Figure 3. The link densities between the resulting factor and the influencing factors

For the analytical examination of these dense bonds, we calculate the specific and double correlation coefficients between the resulting factor (lnY) and the influencing factors (lnK, lnL) [4, p. 57]. The calculated correlation matrix values are given in Table 2 below.

Table 2

Specific and double correlation coefficients between factors Matrix

Covariance Analysis: Ordinary

Date: 08/17/21 Time: 23:12

Sample: 2000 2020

Included observations: 21

Correlation

t-Statistic

Probability	lnY	lnK	lnL
LNY	1.000000		
LNK	0.996939	1.000000	
	55.58163	-----	
	0.0000	-----	
LNL	0.951220	0.951196	1.000000
	13.43948	13.43590	-----
	0.0000	0.0000	-----

As can be seen from the data in Table 2, there is a strong correlation between the resulting factor (lnY) and the factors influencing it (lnK, lnL). That is, the values of the specific correlation coefficients between the factors are close together. For example, the volume of exports in the country amounted to billions. soums (lnY) and influencing factors – the value of fixed assets of exporting enterprises, bln. soums (lnK) and the number of employees in exporting enterprises, the specific correlation coefficients between people (lnL) are respectively and equal to. This suggests that there are close links between these alms.

In Table 2, the numbers below each correlation coefficient are the value of the Student's t-criterion used to verify the reliability of the correlation coefficient. If we look at the data in Table 2, then the Student's t-test values below each correlation coefficient are large numbers (41.30973; 17.33151; 13.49136) that are greater than the Student's table value. This suggests that a close link between these factors is reliable.

Now we calculate the parameters of the production function. To do this, we use the least squares method in EViews. The results of the calculations are presented in Table 3 below.

Table 3
Calculated parameters of the production function
Dependent Variable: Y
Method: Least Squares
Date: 08/17/21 Time: 00:31
Sample: 2000 2020
Included observations: 21

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNK	0.820371	0.050254	16.32462	0.0000
LNL	0.184926	0.055548	3.329121	0.0093
C	1.304336	2.799609	0.465899	0.6469
R-squared	0.993978	Mean dependent var		9.667124
Adjusted R-squared	0.993309	S.D. dependent var		1.664417
S.E. of regression	0.136149	Akaike info criterion		-1.018563
Sum squared resid	0.333660	Schwarz criterion		-0.869345
Log likelihood	13.69491	Hannan-Quinn criter.		-0.986179
F-statistic	1485.487	Durbin-Watson stat		1.827585
Prob(F-statistic)	0.000000			

Using the data in Table 3, we present the analytical expression of the volume of products produced for export on the additive production function of Cobb-Douglas:

$$\ln \hat{Y} = 1{,}3043 + 0{,}8204 \ln K + 0{,}1849 \ln L \quad (1)$$
$$(2{,}7996) \quad (0.0502) \quad (0{,}0555)$$

where the standard error values of each factor are in parentheses.

We make the calculated (1) Cobb-Douglas production function multiplicative. To do this, we potentiate function (1). As a result, the level multiplicative Cobb-Douglas production function will have the following appearance:

$$Y = 3{,}6851 \cdot K^{0{,}8204} \cdot L^{0{,}1849} \quad (2)$$

(2) The multiplicative Cobb-Douglas production function shows that if the value of fixed assets (K) of exporting enterprises increases by one percent, then the volume of products produced for export increases by an average of 0.8204 percent. If the number of employees in exporting enterprises increases by an average of one percent, the volume of exports will increase by an average of 0.1849 percent.

So, in conclusion, it is necessary to attract the main production assets, technological lines, based on more innovations in the production of products for export to foreign countries. That is, the capital capacity of products exported in the Republic of Uzbekistan should be high. On the one hand, this requires an increase in the number of innovative enterprises in the country. On the other hand, the products manufactured by innovative enterprises fully meet international ISO standards and can be exported to any country.

(2) From the multiplicative Cobb-Douglas production function, it can be said that the labor capacity of the products produced for export is low. This shows that if we take into account that a one percent increase in the number of employees in exporting enterprises leads to an average increase in exports of 0.1849 percent, it is necessary to use highly qualified managers in these enterprises, workers who perform specific operations.

In addition, the function can be seen in the function that the country's exporters are more than 1 in the scale of the use of the resources used $\alpha + \beta = 0.8204 + 0.1849 = 1.0053$ in the manufacture of products. That is, it is equal. This involves the Republic of the Republic with more efficiency than the potential of exporters enterprises.

To check the quality of the constructed multiplicative Cobb-Douglas production function (2), we check the determination coefficient. The coefficient of determination indicates the percentage of the resulting factor that is included in the model. The calculated determination coefficient (R2 – R-squared) is 0.9939. This shows that 99.39% of the volume of products produced by exporting enterprises in Uzbekistan depends on the value of fixed assets of exporting enterprises and the number of employees at exporting enterprises. The remaining 0.0061 percent is the effect of factors not taken into account.

The fact that the standard errors of factors (2) in the multiplicative Cobb-Douglas production function also take small values indicates that the statistical significance of the model is high.

Fisher's F-criterion is used to examine the statistical significance of the Cobb-Douglas production function (2) or its adequacy (conformity) to the process under study [2, p. 89]. The value of Fisher's calculated F-criterion is compared to its value in the table. If Fhisob> Fjadval, then the multifactor econometric model (2) is called statistically significant, and the resulting indicator can be used to forecast the volume of exports (lnY) produced in the country for future periods.

Hence, we find the table value of the F-criterion to verify the statistical significance of the model (2). To do this, we calculate α the values according to the degrees of freedom $k_1 = m$ and $k_2 = n - m - 1$ as well as the degree of significance. The table $k_1 = 2$ and $k_2 = 21 - 2 - 1 = 18$ value of the F-criterion is equal to, depending on the degree of significance and the degree of freedom and. The calculated value of the F-criterion is Fhisob = 1485,487 and since the condition Fcalc > Ftable is fulfilled (2) the multifactor econometric model can be considered statistically significant and can be used to forecast the volume of exports (lnY) in the future.

The Student's t-criterion is used to check the reliability of the calculated parameters (regression coefficients) of the calculated Cobb-Douglas production function (2). By comparing the calculated (tcal) and (ttabl) values of the student's t-criterion, we accept or reject the H0 hypothesis. To do this, we find the table value of the t-criterion based on the selected reliability probability (α) and degree of freedom $\text{d.f.} = n - m - 1$ conditions. Here – the number of observations, – the number of factors.

When there is a probability of reliability and a degree of freedom, the table value of the t-criterion is equal to.

From the calculations performed, it can be seen that the calculated values of the t-criterion on the free limit are accurately smaller than the table value (Table 3). In the Cobb-Douglas production function (2), the value of fixed assets (lnK) of exporting enterprises and the number of employees (lnL) in exporting enterprises are reliable, and their values on the calculated t-criterion are greater than the table value.

We use the Darbin-Watson (DW) criterion to test autocorrelation in the resultant factor residues on the calculated Cobb-Douglas production function (2) [2, p. 95].

The calculated DW value is compared with the DWL and DWU in the table. If DW is less than <DWL, the residue is said to have autocorrelation. If DWcal> is greater than DWU, it is said that there is no autocorrelation in the residuals. The lower limit value of the Darbin-Watson criterion is DWL = 1.13 and the upper limit value is DWU = 1.54. DWhisob = 1.8275. So, since DWisob> DWU, there is no autocorrelation in the balance of the resulting factor (volume of products produced for export in the country (lnY)).

The absence of autocorrelation in the resulting factor residue also suggests that the above (2) multiplicative Cobb-Douglas production function can be used in forecasting.

(2) The actual (Actual), calculated (Fitted) values of the Cobb-Douglas production function and the differences between them (Residual) are shown in Figure 4 below.

Figure 4. Graph of actual (Actual), calculated (Fitted) values of volumes of products produced for export in the Republic of Uzbekistan (lnY) and differences between them (Residual)

As can be seen from Figure 4 (2) the graph of the calculated value of the volume of products produced for export in the Republic of Uzbekistan by the multiplicative Cobb-Douglas production function is very close to the graph of its actual values, the differences between them are small. This is another proof that the (2) multiplicative Cobb-Douglas production function can be used to forecast the volume of products exported in the Republic of Uzbekistan for future periods.

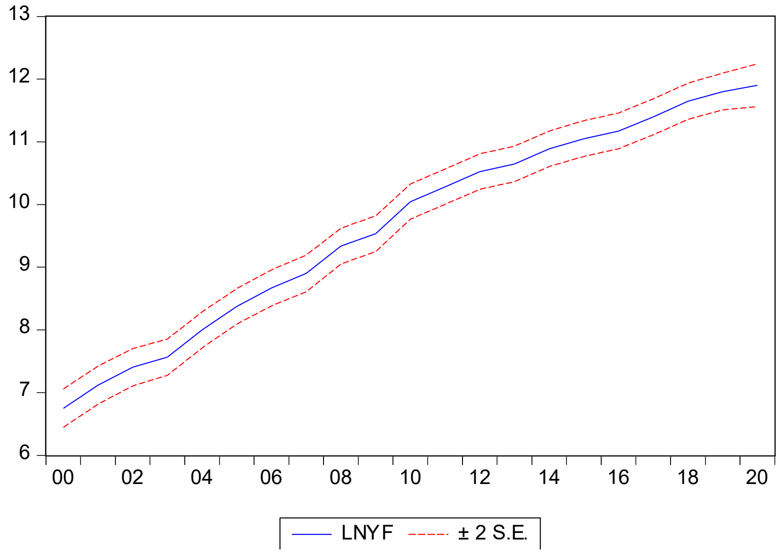
From the calculated (2) Cobb-Douglas production function, it is necessary to calculate the coefficient MARE (Mean absolute percent error) in forecasting the performance for future periods. If the value of the calculated MARE coefficient is less than 15.0 percent, the model can be used to predict the outcome factor, otherwise it cannot be used. The MAPE coefficient is found using the following formula [3, p. 28]:

$$MAPE = \frac{1}{n}\sum_{i=1}^{n}\frac{|y_i - \hat{y}_i|}{y_i}\cdot 100\% \quad (3)$$

here – the actual values of the resulting factor, – the calculated values of the resulting factor.

The value of the MARE coefficient in terms of the volume of products exported in the Republic of Uzbekistan is 1,096% (Figure 5).

This is less than 15.0 percent (MAPE = 1,096), which is 1,096 percent. Therefore, (2) the Cobb-Douglas production function can be used to forecast the volume of products produced for export in the country.



Forecast: LNYF	
Actual: LNY	
Forecast sample: 2000 2020	
Included observations: 21	
Root Mean Squared Error	0.126050
Mean Absolute Error	0.099357
Mean Abs. Percent Error	1.096572
Theil Inequality Coefficient	0.006430
Bias Proportion	0.000000
Variance Proportion	0.001510
Covariance Proportion	0.998490

Fig.5. MAPE coefficient on the calculated model

In short, according to various criteria for the production function of the number of exporters in the Republic of Uzbekistan (LNA) and exporters in the Republic of Uzbekistan (LNL) checked. Full responses to the terms of all criteria.

The developed multiplogat Kobb-Douglas Production function also allows us to predict these factors for future periods.

CONCLUSIONS

Thus, based on the analysis and taking into account the experience of foreign countries in increasing non-resource exports with a high degree of technological effectiveness, we have developed the following measures and recommendations that should be paid attention to when carrying out structural reforms in the republic.

First, the responsible ministries and departments are encouraged to develop a methodology for assessing the level of manufacturability of goods based on international classifications. This will make it possible:

• trace the structure of traded goods by manufacturability;

• rationally optimize import volumes based on its manufacturability and import substitution capabilities (it is necessary to take into account the country's comparative advantages and the availability of the corresponding factors of production for import substitution of a particular product);

• carry out the selection of promising projects for import substitution with the necessary manufacturability;

• to encourage the production of a certain manufacturability by providing various benefits, thereby stimulating private investment in R&D and commercialization of new and promising developments;

• evaluate the effectiveness of structural and technological reforms;

• to qualitatively increase the share of industry in GDP up to 40% by 2030 due to the establishment of production facilities of a certain manufacturability;

• to carry out a qualitative diversification of production and export by increasing the share of manufactures of a certain technological effectiveness;

• assess the technological quality of the participation of local enterprises in global production chains, etc.

Secondly, the state should create favorable conditions for participants in innovative activities. To do this, Uzbekistan needs to continue to build capacity in the following important areas:

• increasing public spending on education and revising the criteria for its effectiveness.

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EMPIRICAL ANALYSIS OF THE DEVELOPMENT OF INNOVATIVE ACTIVITIES IN UZBEKISTAN

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Abstract*. The article is devoted to the analysis of innovative activity and factors influencing it in the republic. It is aimed at analyzing the relationship between innovation, the relationship between business entities engaged in this activity, and the funds spent on it using the econometric module. The data of the Republic of Karakalpakstan, regions and the city of Tashkent for the last 5 years were used.*

Key words*: innovative activity, economic growth, econometric analysis.*

Introduction. As an important part of the innovation process, economists have traditionally seen knowledge dissemination as a key factor in stimulating economic growth. This statement is also supported by several economic relations. First, innovative activity makes products competitive and allows them to reach more markets. In this sense, the division of labor, an important element of the wealth of nations, depends on the expansion of markets, which in turn depends on many innovative processes. Second, modern theoretical approaches emphasize the relevance of innovation by clearly introducing factors that stimulate innovation. In this case, events in the real economy, in addition to quantitative indicators, emphasize which qualitative variables should be taken into account. If the economic environment rejects or fails to take advantage of innovations, innovation activity will cease. Therefore, society will need to create a social environment that influences