ASIA PACIFIC JOURNAL OF MARKETING & MANAGEMENT REVIEW
ISSN: 2319-2836
IMPACT FACTOR: 8.071
Vol 13, Issue 07, 2024

ANALYSIS OF MACRO-ECONOMIC INDICATORS OF THE REPUBLIC OF UZBEKISTAN AND FORECAST ACCORDING TO SCENARIOS

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Annotation: The article deals with the practical application of methods and scenarios of econometric analysis using the interdependence of macroeconomic indicators of the economy of the Republic of Uzbekistan, as well as the science of mathematical statistics and its application to economics, that is, the construction of econometric models and the evaluation of their parameters, the characteristics of economic indicators are described in detail

Keywords: macroeconomic indicators, economic process, structure, econometric model, strategic planning, statistical model.

Introduction:

Currently, a lot of work is being done to expand the database of macroeconomic indicators and to ensure the possibilities of comparing the received data. In the context of globalization in the world, a number of scientific works on improving the calculation of macroeconomic indicators according to international standards and researching the structural structures in the calculation system, including improving the introduction of the econometric evaluation system of macroeconomic indicators and introducing automated information systems for their comparative evaluation and researching ways to create an open data portal done Currently, the introduction of information systems integrated into modern management based on international standards, ensuring the transparency and openness of macroeconomic indicator system data, improving the information base and calculation method of macroeconomic indicators due to the effective use of international standards and principles are considered one of the main scientific directions.

In the "Strategy of actions on the five priority directions of the development of the Republic of Uzbekistan in 2017-2021", such tasks as "Development and liberalization of the economy, ensuring the stability of the national economy, deepening structural changes and increasing the export potential" [1] are defined. Competent execution of these tasks requires international comparison of macroeconomic indicators, complex analysis of their system of indicators, econometric modeling and forecasting.

If we look at the history of researches on improving the structural aspects of economic growth and structural transformation of the economy, we can see that this process has been the focus of world-renowned scientists. Inclusive growth indicators E. Corso [2], scientific and methodological aspects of econometric approaches to their assessment by economists P. Vellala, M. Madala, U. Chhattopadhai [3], CIS on issues of using the system of national accounts in the international comparison of macroeconomic indicators and creating econometric models B.I. Bashkatov[4], V.I. Jerebin[5], V.K. Zaitsev[6], C.M. Zagladina[7], Yu.N. Ivanov[8-9], A. .I. Kocarev[10], G.D. Kulagina[11], M.G. Nazarov[12], A.N. Ponomorenko[13], B.T. Ryabushkin[14], V.N. Calin[15], M.R. Eidelman[16], K.G. Chobanu[17] and others have taken a wide place in scientific research.

ISSN 2319-2836 (online), Published by
ASIA PACIFIC JOURNAL OF MARKETING & MANAGEMENT REVIEW.,
under Volume: 13 Issue: 07 in July-2024
https://www.gejournal.net/index.php/APJMMR

ASIA PACIFIC JOURNAL OF MARKETING & MANAGEMENT REVIEW
ISSN: 2319-2836
IMPACT FACTOR: 8.071
Vol 13, Issue 07, 2024

Also, inclusive growth processes on the basis of macroeconomic policy stability aimed at reducing unemployment, developing trade and increasing labor productivity Ch. Aoyagi and G. Ganelli [18], inclusive growth on the basis of macroeconomic stability, human capital, structural changes, foreign investment and foreign trade freedom supply issues were studied by R. Anand, S. Mishra, Sh. J. Peiris [19]. The problems of employment, labor productivity, and structural changes took a leading place in these studies.

Research methods.

According to the results of the research, high rates of economic growth will continue in the medium-term future in the Republic of Uzbekistan and will allow a better explanation of the requirements of the internal consumer market and the mechanism of connections implemented by the Government.

The main element of econometric research of the economy is the analysis of connections of economic indicators representing the economic process and phenomena and the creation of its econometric model. The difficulty in studying such connections in the economy is that they are not uniformly rigid and are not among functional connections. The reason for this is that it is always a very difficult task to determine all the factors affecting the studied variable and to evaluate their interaction.

Second, many such relationships are accidental, meaning that they contain an accidental constituent along with the primary connections.

Third, researchers have data collected based on limited statistical observations, which are subject to various types of error.

The science of mathematical statistics and its application to economics, that is, creation of econometric models and estimation of their parameters, made it possible to check hypotheses about the characteristics of economic indicators and their connection norms. This, in turn, provides the basis for economic analysis and forecasting, as well as the development and adoption of scientifically based economic decisions.

Econometric modeling is closely related to such disciplines as economics, mathematical statistics and sociology. These connections are related to economic forecasting, strategic planning, economic and social development: statistical models consider the interrelationships of the national economy and the elements of the development of individual sectors of the economy, the dynamics of systems.

The results obtained. In the research work, we aimed to use an unconventional method based on the current demand (taking into account the impact of the pandemic on the economy) in conducting econometric modeling and forecasting of macroeconomic indicators that ensure the sustainable development of the economy. For this purpose, it is appropriate to see the econometric model of the influence of the gross domestic product of the Republic of Uzbekistan - GDP, total income of the population - AUD, pollutants released into the atmosphere - ECO, investments in fixed capital - AKI and the number of jobs in the economy - IBS. First of all, the correlation between the selected factors and their resulting factor is determined (Table 1).

Table 1

ISSN 2319-2836 (online), Published by
ASIA PACIFIC JOURNAL OF MARKETING & MANAGEMENT REVIEW.,
under Volume: 13 Issue: 07 in July-2024
https://www.gejournal.net/index.php/APJMMR

ASIA PACIFIC JOURNAL OF MARKETING & MANAGEMENT REVIEW
ISSN: 2319-2836
IMPACT FACTOR: 8.071
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Correlation coefficient between the gross domestic product of the Republic of Uzbekistan and selected factors [1]

	YIM	*AUD*	*EKO*	*AKI*	*IBS*
YIM	1				
AUD	0,994268	1			
EKO	0,715102	0,553242	1		
AKI	0,923653	0,719142	0,056988	1	
IBS	0,837416	0,664469	0,560006	0,629314	1

From the data in Table 1, it can be seen that the selected factors with the resulting factor ($r_{YIM,AUD}$=0,9943; $r_{YIM,EKO}$=0,77151; $r_{YIM,AKI}$=0,9237 ва $r_{YIM,IBS}$=0,8374) and it was found that there is no multicollinearity between mutual factors. According to the results, the factors were correctly selected in relation to the resulting factor.

Now it is appropriate to determine this relationship using the currently popular Eviews program, which is a regression equation. Because it is convenient to work in this program and at the same time it shows whether the determined equation is adequate by giving the possibility to check the equation based on several criteria (Table 2).

Table 2

The regression equation between the gross domestic product of the Republic of Uzbekistan and selected factors and its verification by criteria

Dependent Variable: YIM
Method: Least Squares
Date: 05/04/20 Time: 16:56
Sample: 2010 2019
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
			$t_{жад}$=2,262157	
AUD	0,982808	0,300244	3,273364	0.0219
EKO	-17,3884	49,46768	-0,35151	0.0324
AKI	0,729039	0,36063	2,021571	0.0992
IBS	0,059217	0,024881	2,380017	0.0039
C	10459,36	2314,3	4,519449	0.0406

R-squared	0.996006	Mean dependent var	228663.8
Adjusted R-squared	0.992810	S.D. dependent var	141655.6
S.E. of regression	12011.26	Akaike info criterion	21.93193
Sum squared resid	7.21E+08	Schwarz criterion	22.08322

[1]Author's calculation based on the information of the State Statistics Committee of the Republic of Uzbekistan

ISSN 2319-2836 (online), Published by
ASIA PACIFIC JOURNAL OF MARKETING & MANAGEMENT REVIEW.,
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Log likelihood	-104.6596	Hannan-Quinn criter.	21.76596
F-statistic	311.6988	Durbin-Watson stat	2.042282
Prob(F-statistic)	0.000004	$F_{жад}$=5,192168	

Based on the data presented in Table 2, first of all, if we focus on the values of the t-Statistic column to test the significance of the regression equation, when α=0.05 and df=9 $t_{жад}$= 2,2622 from equality $t_{жад} > t_{EKO}$=-0,35151 and $t_{жад} > t_{AKI}$=2,0216 for being $t_{жад} < t_{хис}$ since the condition is not fulfilled, these parameters are irrelevant. To be sure of this, it is also appropriate to check with the MAPE and TIC criteria (Figure 2).

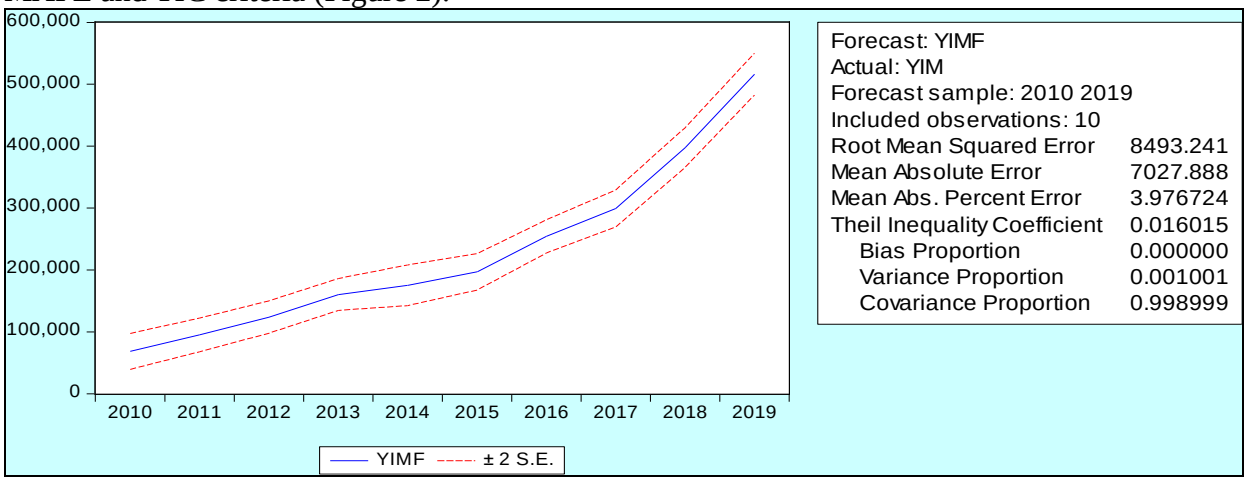

Figure 2.

Mean absolute percentage error *(Mean Absolute Percentage Error-MAPE)* мезонига кўра, $MAPE < 10\%$ - forecast accuracy is high, $10\% < MAPE < 20\%$ - forecast accuracy is good, $20\% < MAPE < 50\%$ - forecast accuracy is satisfactory as well $MAPE > 50\%$ - forecast accuracy is unsatisfactory [2]/ Theil coefficient (TIC) $0 \le TIC \le 1$ varies in the interval. As a result, MAPE=3,976<10 and Theil coefficient (TIC) 0≤TIC=0,016<1 forecast accuracy is higher and all selected parameters are significant.

Now the significance of the regression equation should be checked with Fisher's test. α=0,05; k1=4 and k2=5 when Fжад= 5,192168 is equal to, which is determined from the equality Fhis=311.6988 based on the condition Fjad<Fhis

$$YIM = 0{,}98 * AUD - 17{,}4 * EKO + 0{,}73 * AKI + 0{,}06 * IBS + 10459{,}4 \qquad (1)$$

Since regression equation (1) is significant and DW=2.042282, there is no autocorrelation. So, according to the values and conditions of the main criterion, regression equation (1) is reliable and adequate.

[2] Arzhenovsky S.V., Molchanov I.N. Statistical forecasting methods. Textbook / Growth. state econ. univ. - Rostov-n/D., -2001. pp. 68-70.

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ASIA PACIFIC JOURNAL OF MARKETING & MANAGEMENT REVIEW.,
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https://www.gejournal.net/index.php/APJMMR

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If we give an economic explanation to the regression equation, if we increase the investment volume of the total income of the population in fixed capital and the number of jobs in the economy by 100%, the country's gross domestic product can be increased by 98%, 73% and 6% respectively. however, it should be noted that in the current conditions of the Republic of Uzbekistan, this indicator is of great importance as it allows to increase the volume of the gross domestic product by 17.4 units due to the reduction of the pollutants released into the atmosphere by 1 ton.

The conducted research was conducted on the basis of several scenarios, and in the following scenario, GDP and influencing factors are the result factors: expenditure on final consumption-X1, investment in raw capital-X2, changes in reserves-X3 and export-import balance of goods and services-X4 were selected. The correlation between the resulting factor and influencing factors was examined. The result in this regard is reflected in Table 3 below.

Table 3

Results of correlational binding [3]

Indicators	$Y_{ЯИМ}$	X1	X2	X3	X4
$Y_{ЯИМ}$	1				
X1	0,998817692	1			
X2	0,999537136	0,698	1		
X3	0,869976071	0,772	0,765	1	
X4	0,316028078	0,282425044	0,308676657	0,221475587	1

From the data of Table 3, it can be seen that the volume of gross domestic product is related to all factors other than the export-import balance of goods and services (0.316028), including final consumption (0.998817), investment in working capital (0.99954) and changes in reserves (0 .86997) there is a strong dense bond between them. It should be noted here that the selected factors are in the middle $|r_{x_1,x_2}| < 0{,}8$ multicollinearity was found when the conditions were fulfilled.

Therefore, there is multicollinearity among the selected factor indicators, except for the export-import balance of services. Correlation between final consumption and fixed capital investment is 0.998, correlation between fixed capital investment and changes in reserves is 0.865, and so on. Multicorrelation is defined by the condition r>0.7.

This shows that it is possible to ensure the participation of all factors except the export-import balance of services in the creation of the regression equation representing the already observed process.

To construct the regression equation, it is appropriate to use the Eviews calculator, which is currently the most convenient. According to it, the following regression equation was determined using the dynamic and static indicators of the above-selected indicators for the period 1997-2019:

$$Y_{ЯИМ} = 664{,}02 + 0{,}319 * X_1 + 2{,}86 * X_2 + 0{,}722X_3 \qquad (2)$$

here: $Y_{ЯИМ}$- volume of gross domestic product;

[3]Author's development based on the information of the State Statistics Committee of the Republic of Uzbekistan.

ISSN 2319-2836 (online), Published by
ASIA PACIFIC JOURNAL OF MARKETING & MANAGEMENT REVIEW.,
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Vol 13, Issue 07, 2024

X_1 – final consumer spending;
X_2 – investment in working capital;
X_3 – changes in reserves;

In this case, it is necessary to check the reliability and adequacy of the identified regression equations in accordance with the criteria.

According to the "Akaike", "Schwarz" and "Hannan-Quinn" criteria determined during the evaluation of the model, model (1) can be said to be reliable, however, it is necessary to clarify the misunderstanding according to the criteria of t-statistics presented in Table 3.3. In the table according to the t-criterion of the ctudent distribution $\alpha = 0{,}05$ degree of significance and $df = 21$ the value of the degrees of freedom coni $t_{table} = 2{,}0796$, $t_{X_1} = 1{,}042$ from equality $t_{X_1} < t_{\text{жад}}$ It is necessary to check the significance of the parameter of the equation determined by the criteria of determining the quality of the forecast model.

Table 4

Reliability and adequacy check of regression equation (2). [4]

R- square	0,999641	The dependent variable is the mean	63213,14	t- tactics	
Improved R-squared	0,999552	The dependent variable is the standard deviation	74641,9	X_1	1,042
The standard error of the regression	2057,69	Akaike information criterion	17,77353	X_2	1,975
The sum of the squares of the residuals:	71979240	Schwartz criterion	18,02223	X_3	6,717
Approximation to logarithmic truth	-181,6221	Hanna-Quinn criterion	17,82750	X_4	-
F-ctatictics	8772,368	Darbin-Watcon CT	1,18	C	1,042

Determining the quality of the GDP change forecast model $\text{MAPE} < 10\%$ and $0 \leq \text{TIC} \leq 1$ from being $\text{MAPE} = 6{,}468 < 10\%$, as well as in the present proceeding $\text{TIC} = 0{,}0072$ is equal to, the forecast quality is very high and regression equation (2) is reliable and adequate.

According to the determined model values, one unit change in final consumption expenditure and reserves leads to an additional 0.32 unit decrease and 0.72 unit increase in GDP volume. From this process, the factor that has the potential to increase the GDP more than all other factors is investment in working capital, and it was found that if this factor increases by one unit, the GDP can be increased by an additional 2.9 units.

[4] Author's development based on the information of the State Statistics Committee of the Republic of Uzbekistan

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ASIA PACIFIC JOURNAL OF MARKETING & MANAGEMENT REVIEW.,
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https://www.gejournal.net/index.php/APJMMR

ASIA PACIFIC JOURNAL OF MARKETING & MANAGEMENT REVIEW
ISSN: 2319-2836
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Vol 13, Issue 07, 2024

Now we will carry out the macroeconomic econometric analysis according to the 3rd scenario. in this case, if the change in the volume of gross domestic product - Y_GDP will be observed in relation to households - X1, state management bodies - X2, non-profit organizations serving households - X3, gross savings - X4, we will definitely have a change in a certain way. This ultimately shows the impact of selected factors on GDP.

Table 5

Correlation of GDP with factors [5]

	$Y_{ЯИМ}$	X_1	X_2	X_3	X_4
$Y_{ЯИМ}$	1				
X_1	0,999	1			
X_2	0,998	0,7687976	1		
X_3	0,996	0,7218068	0,6966743	1	
X_4	0,999	0,59828169	0,6533443	0,77484294	1

From the data of Table 5, it can be seen that the factors affecting GDP were chosen correctly. According to him:

$$Y_{ЯИМ\,1} = 712.107 + 2{,}772 * X_1 - 7{,}211 * X_2 - 9{,}325 * X_3 + 3{,}003 * X_4 \quad (3)$$

the normalized regression equation was calculated.

where: X1 – households;

X2–state management bodies;

X3–non-profit (social) organizations providing services to households;

X4–gross savings.

Summary

It is appropriate to distinguish the following groups among the indicators of scientific activity that reflect the most important descriptions of the activity of this area of the economy, for which econometric analysis at the macroeconomic level can be extremely important:

- indicators of scientific activity results;
- indicators of the costs of scientific activity;
- indicators of using the results of scientific activity.

In general, the methodology of econometric analysis provides further improvement of the information base of macroeconomic analysis and forecasting. The use of its principles allows to further detail the indicators included in the information base of macroeconomic analysis and forecasting, to ensure their complexity, to increase their quality, and also to provide wider opportunities for choosing the most suitable analytical devices and models.

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