

IQTISODIYOT va TARAQQIYOT

Ijtimoiy, iqtisodiy, siyosiy, ilmiy, ommabop jurnal



- 08.00.01 Iqtisodiyot nazariyasi
- 08.00.02 Makroiqtisodiyot
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- 08.00.04 Qishloq xo'jaligi iqtisodiyoti
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- 08.00.17 Turizm va mehmonxona faoliyati



Yashil

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Bosh muharrir:

Sharipov Qo'ng'irotboy Avezimbetovich

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Bosh muharrir o'rinbosari:

Karimov Norboy G'aniyevich

Muharrir:

Qurbonov Sherzod Ismatillayevich

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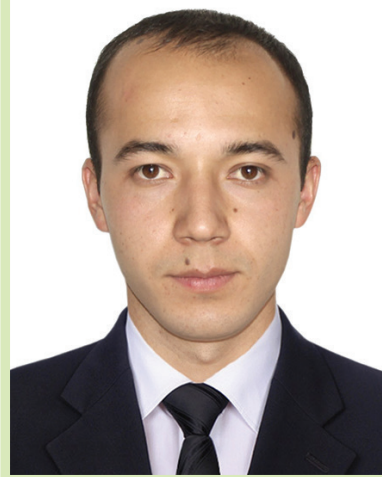


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SIGNIFICANCE AND PROSPECTS OF USING ECONOMIC-MATHEMATICAL MODELS IN ANALYSIS OF OUR COUNTRY'S ECONOMIC GROWTH



Rasulov Jamshid Shokir o'g'li
TSUE, 1st year doctorate student

Abstract: in the article, economic growth is one of the main macroeconomic indicators. Including economic growth, its components, factors affecting it and their analysis based on economic-mathematical models, it is revealed that it is becoming the main focus of the current globalizing economy.

Key words: Economic growth, economic-mathematical models, globalization economy, econometric analysis, economic statistics, forecasting.

Annotatsiya: maqolada iqtisodiy o'sish eng asosiy makroiqtisodiy ko'rsatkichlardan biri ekani ilgari surilgan. Shu jumladan, iqtisodiy o'sish, uning tarkibiy qismlari, unga ta'sir etuvchi faktorlar va ularni iqtisodiy-matematik modellar asosida tahlilini olib borish hozirgi globallashib borayotgan iqtisodiyotning asosiy markazida ekani ochib berilgan.

Kalit so'zlar: Iqtisodiy o'sish, iqtisodi-matematik modellar, globallashuv iqtisodiyoti, ekonometrik tahlil, iqtisodiy statistika-lar, prognozlash.

Аннотация: в статье экономический рост является одним из основных макроэкономических показателей. Включая экономический рост, его составляющие, факторы, влияющие на него и их анализ на основе экономико-математических моделей, выявлено, что он становится основным направлением современной глобализирующейся экономики.

Ключевые слова: экономический рост, экономико-математические модели, экономика глобализации, эконометри-ческий анализ, экономическая статистика, прогнозирование.

I. INTRODUCTION

In today's globalized era, the search for the sources of the country's wealth and ways to continuously increase them is considered as the most important task for the countries. At the same time, it seems that achieving continuous growth is the most difficult task. It seems economic growth refers to the growth of the gross domestic product (GDP) and its value per capita. Therefore, in order to assess the economic potential of the country and the rate of the growth of the economy, it is necessary to evaluate the rate of the growth of the GDP. Currently, there are many shortcomings and uncertainties in the assessment of economic growth, as well as errors in the analysis. These make it somewhat difficult to make accurate conclusions about the state of economic growth and to forecast it. To prevent this, it is becoming a very important task to use foreign experience in analysis and to introduce accurate calculation methods into the accounting system of our country. For example, the Presidential Decree No PL – 4749 "Strategy of Actions for the Further Development of the Republic of Uzbekistan" adopted on February 2, 2017, which caused great economic growth, has achieved effective economic growth in recent years ^[1]. Including, the amount of GDP in our country between 2017–2021 will be 317.4 trillion soums (104.4% compared to last year), 424.7 trillion soums (105.4%), 529.3 trillion soums (105.8%), 602.1 trillion soums (101.6%), 734.5 trillion soums in 2021 (107.4%) and 888.3 (120.9%) trillion soums in 2022 ^[6]. Determining how much each sector contributed to the size of the economy is becoming the main object of economic analysis. In addition, on January 28, 2022, our president approved the "Development Strategy of New Uzbekistan" for 2022-2026. The decision on economic growth for the next 4 years was also included in it ^[2]. Therefore, it is necessary to constantly analyze the results of these reforms. Econometric

analysis is important in economics for several reasons. That is, it transforms data into models for making accurate decisions and conclusions. In addition, in the current globalization era, which sector has a positive and which sector has a negative impact on the economic growth of our country. After the analysis, how much economic growth contributes to prosperity and forecasting future data through it and it leads to accurate and easy calculations based on econometric models.

II. LITERATURE REVIEW

First of all, since our topic is related to an economic growth, we will work on the concepts of economic growth and development based on the information given in foreign literatures. A number of research works of foreign scientists have been devoted to the problems of economic growth and the analysis of its factors. They paid great attention to the issue of the stability of the growth rates of countries' economies in market conditions.

First of all, according to the opinion of scientists of our country, including Z. Jumayev, economic growth means a long-term increase in the level of potential production corresponding to the conditions of full employment, inflation, or in other words, the growth of real and potential GDP [3].

According to the famous economist R. Solow, an economic growth mainly consists of 2 components: saving and investment. An increase in savings and investments increases the amount of fixed capital and, therefore, increases the amount of output and national income provided by employment ^[4].

According to Nobel laureate Paul Romer, an economic growth occurs when people accumulate and distribute resources in efficient ways. According to the recipe, we mix cheap ingredients. And the food we make has limited ingredients and turns out to be unexpectedly bad. If economic growth were to be achieved only in one way, we would end up with material shortages and unprecedented levels of pollution and chaos [5].

Another economist A. Lewis in his model considered the labor force reserve as a basis for economic growth. According to him, this model is suitable for countries with "high population density, capital shortage, and limited natural resources". He included countries like India, Pakistan and Egypt [6].

III. RESEARCH METHODOLOGY

Systematic approach, statistics, mathematical modeling, economic analysis, comparison, scientific abstraction and other methods were used in the article. We also analyzed the relationships between the factors based on the multifactor regression equation and analyzed the predictions of our model using Microsoft Excel and Stata programs.

IV. ANALYSIS AND DISCUSSION OF RESULTS

An economic growth represents a long-term expansion of the potential production level corresponding to the conditions of full employment. Economic growth means an increase in aggregate supply, or in other words, an increase in the size of real and potential GDP. As a result of the study of the issue of economic growth, a solution to the problem of effective use of limited resources, which confronts the real production system, is found. Therefore, the study and analysis of economic growth factors and their effectiveness is one of the most urgent problems facing the society.

One of the main tasks of economic-mathematics is to provide it with the tools to build a model based on the given data. The regression modeling technique is very helpful for building a model in this case. The regression model can be linear or curved. Depending on this, we can conduct straight line or curve analysis. In this article, we have selected four factors that affect the main indicator in the analysis of the economic growth of our country and through these models, we performed our analysis through correlation and regression models. At the same time, the multifactor regression equation is as follows:

$$y = a + b_1 \times x_1 + b_2 \times x_2 + b_p x_p + \varepsilon$$

The main goal of multifactor regression is to build multivariate models by studying the effects of each of the factors on the modeled indicator separately and their combined effects.

The system of normal equations for this regression equation is:

$$\left\{ \begin{array}{l} \sum y = n * a + b_1 \sum x_1 + b_2 \sum x_2 + \dots + b_p * \sum x_p \\ \sum y * x_1 = a * \sum x_1 + b_1 * \sum x_1^2 + b_2 * \sum x_1 * x_2 + \dots + b_p * \sum x_p * x_1 \\ \dots\dots\dots \\ \sum y * x_n = a * \sum x_p + b_1 * \sum x_1 * x_p + b_2 * \sum x_2 * p + \dots + b_p * \sum x_p^2 \end{array} \right.$$



Solving the system by the method of determinants, its parameters can be found as follows:

$$a = \frac{\Delta a}{\Delta}, b_1 = \frac{\Delta b_1}{\Delta}, b_p = \frac{\Delta b_p}{\Delta}.$$

In the work of this article, we took 4 factors affecting the economic growth of our country. They are inflation, the volume of exports, investments in fixed capital and the quantity of produced consumer goods. We analyzed the relationship between these factors and our main indicator and whether they have a positive or negative effect on the formation of GDP using econometric models. We used correlation and regression models, which are widely used in econometrics, as our main analysis models. We divided our analysis into 3 parts. First, we conducted correlation analysis, then regression analysis, and finally forecasting. Now we will start our analysis part.

Table 1: Economic indicators of our country between 2000 and 2022

YEARS	GDP (bln soums)- Y	Inflation (%)	Export rate (bln soums)	Investments in fixed capital (billion soums)	Quantity of consumer goods (billion soums)
T	Y				
2000	3255.6	28.2	3264.7	744.5	833.2
2001	4925.3	26.6	3170.4	1320.9	1221.4
2002	7450.2	21.6	2988.4	1526.6	1670.4
2003	9844.0	3.8	3725.0	1978.1	1923.1
2004	12261.0	3.7	4853.0	2629.0	2247.8
2005	15923.4	7.8	5408.8	3165.2	2771.0
2006	21124.9	6.8	6389.8	4041.0	3865.0
2007	28190.0	6.8	8991.5	5903.5	5089.9
2008	38969.8	7.8	11493.3	9555.9	6930.4
2009	49375.6	7.4	11771.3	12531.9	8291.6
2010	74042.0	7.3	13023.4	16463.7	13683.8
2011	96949.6	7.6	15021.3	19500.0	18336.4
2012	120242.0	7.0	13599.6	24455.3	21527.8
2013	144548.3	6.8	14322.7	30490.1	28614.1
2014	177153.9	6.1	13545.7	37646.2	33868.5
2015	210183.1	5.6	12507.6	44810.4	42085.5
2016	242495.5	5.7	12094.6	51232.0	48253.8
2017	302536.8	14.4	12533.7	72155.2	59690.4
2018	406648.5	14.3	13990.7	124231.1	83512.6
2019	529391.4	15.2	17458.7	195927.3	110321.0
2020	602193.0	11.1	45102.3	210195.1	129348.6
2021	734578.7	10.0	16610.6	244962.6	152042.8
2022	888341.7	11.2	21297.3	345154.9	231458.5

The above table contains the data of the 4 factors we mentioned for 22 years between 2000-2022. Since the above indicators are given in different units (one is in %, the other is in numbers), it is not possible to analyze them uniformly. Therefore, in order to analyze them separately and to bring them to a homogeneous indicator, we will natural logarithm them through a mathematical method and the indicators will take the following form.



Table 2.

T	lnY	ln	ln	ln	ln
2000	8.088132	3.339322	8.090923	6.612713	6.725274
2001	8.502140	3.280911	8.061613	7.186069	7.107753
2002	8.915996	3.072693	8.002493	7.330798	7.420818
2003	9.194617	1.335001	8.222822	7.589892	7.561694
2004	9.414179	1.308333	8.487352	7.874359	7.717707
2005	9.675545	2.054124	8.595783	8.059972	7.926964
2006	9.958208	1.916923	8.762458	8.304247	8.259717
2007	10.246723	1.916923	9.104035	8.683301	8.535013
2008	10.570542	2.054124	9.349520	9.164914	8.843673
2009	10.807212	2.001480	9.373420	9.436033	9.022998
2010	11.212388	1.987874	9.474503	9.708913	9.523968
2011	11.481947	2.028148	9.617224	9.878170	9.816643
2012	11.697262	1.945910	9.517796	10.104602	9.977100
2013	11.881369	1.916923	9.569601	10.325157	10.261655
2014	12.084774	1.808289	9.513824	10.535987	10.430241
2015	12.255734	1.722767	9.434092	10.710196	10.647459
2016	12.398738	1.740466	9.400514	10.844120	10.784230
2017	12.619958	2.667228	9.436176	11.186575	10.996926
2018	12.915704	2.660260	9.546148	11.729899	11.332753
2019	13.179483	2.721295	9.767593	12.185499	11.611150
2020	13.308333	2.406945	10.716689	12.255791	11.770266
2021	13.507052	2.302585	9.717796	12.408861	11.931917
2022	13.69711	2.415914	9.966336	12.75175	12.35216

Using the Microsoft Excel program, we expressed the data in numerical form. Now let's start analyzing them. First of all, we make the following table to find the correlation coefficient to determine how much each factor affects GDP.

The result of these correlation calculations is as follows:

1. $r_{yx1} = -0.10$. In this case, a natural state was revealed. The rate of inflation between 2000 and 2022 is inversely related to the growth of the country's gross domestic product. It can be said that this factor pushed back the economic growth.
2. $r_{yx2} = 0.91$. In this case, economic growth was significantly affected by the volume of exports, and the relationship is correct and dense from an econometric point of view.
3. $r_{yx3} = 0.99$. In this case, investments in fixed capital are closely related to economic growth.
4. $r_{yx4} = 0.99$. The volume of consumer goods produced in 2000-2021 is closely related to our main indicator.

In addition, according to Table 3rd, we can determine the relationships between other factors. That is. That is, inflation has an inverse relationship with all other indicators. In the same way, we can determine the mutual correlation of other factors based on the data of Table 3.



Table 3.

	Ln Y	Ln	Ln	Ln	Ln
Ln Y	1				
Ln	-0.101848057	1			
Ln	0.911703341	-0.1784898	1		
Ln	0.99553638	-0.043307	0.91860253	1	
Ln	0.99793888	-0.0534196	0.90181	0.9967236	1

To conclude, from the 4 factors that we have selected, other factors besides inflation actively and effectively participated in ensuring economic growth.

We now analyze our econometric analysis through regression.

$$y = a + b_1 \times x_1 + b_2 \times x_2 + b_p x_p + \varepsilon$$

We find the coefficients of this regression equation using Excel:

Table 4: The calculated regression coefficients

	Coefficients
Y-main factor	1.55952631232816
Ln	-0.145453677507085
Ln	0.0911579390204514
Ln	0.137657776868852
Ln	0.810891661555008

Now, based on the table, we can create the regression model of our choice, and it will look like this. Since we brought our indicators to a homogeneous scale, the basic formula will look like this:

$$Y = a + b_1 \times \ln x_1 + b_2 \times \ln x_2 + b_p \ln x_p + \varepsilon$$

Our regression model is as follows:

$$Y = 1.55 - 0.14 \times \ln x_1 + 0.09 \times \ln x_2 + 0.13 \times \ln x_3 + 0.81 \times \ln x_4$$

Through this model, we can find out how much our main factor Y changes when any of the factors we chose above change by 1 unit. In this way, we created our model through a regression model and 4 factors that affect the economic growth of our country and the relationship between them. We learned about the differences. We also created a regression equation based on the factors we selected.

Based on this constructed table (4), the regression equation for each of our factors is as follows. Since our calculations are in Excel, I will present them in the appendices. Since we brought the indicator to a homogeneous scale, our regression equation will be as follows:

$$Y = a_0 + a_1 \times \ln t$$

1. Our first factor, which is inflation, is the time regression equation as follows:

$$Y = 11.927220073 - 0.339344787734257 \times \ln t$$

2. Now we construct our regression equation using the second factor (export volume):

$$Y = 58.4648845625943 + 8.90812471020232 \times \ln t$$



3. Our third factor is the amount of investments in fixed capital and the regression equation for our main factor is as follows:

$$Y = 100.965132829663 + 54.9071393798416 \times Int$$

4. The regression equation of the fourth factor on the volume of consumer goods is as follows.

$$Y = 130.127758422959 + 65.2771672258976 \times Int$$

As is self-evident, our fourth factor also has a positive effect. Now we have made the calculations until 2025 through our regression equations, and we have shown them in the table below, and we have put the future years in the t values.

Table 5: Prediction table

YEARS	GDP (BLN SOUMS)-Y	Inflation (%)-X1	Export rate (bln soums)	Investments in fixed capital (bln soums)	Quantity of consumer goods (bln soums)
t	Y				
2000	3255.6	28.2	3264.7	744.5	833.2
2001	4925.3	26.6	3170.4	1320.9	1221.4
2002	7450.2	21.6	2988.4	1526.6	1670.4
2003	9844.0	3.8	3725.0	1978.1	1923.1
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2005	15923.4	7.8	5408.8	3165.2	2771.0
2006	21124.9	6.8	6389.8	4041.0	3865.0
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2022	888341.7	11.2	21297.3	345154.9	231458.5
2023	910840.2	8.074	31082.2	452341.5	297541.2
2024	977724.2	8.011	34141.2	592814.7	382490.8
2025	1075496.6	7.948	37501.3	776911.2	491694.1



To summarize, the gross domestic product of our country is expected to reach 1075496.6 billion soums by 2025. In addition, the rate of inflation will reach 7.948% and become positive. Export volume is expected to reach 37501.3 billion soums. Investments in fixed capital are expected to repeat the same trend and reach 776,911.2 billion soums. The price of consumer goods is expected to reach 491,694.1 billion soums, and its growth is expected to be a forecast model based on our model.

V. SUMMARY

Our conclusion from this article is that first of all, working with econometric models in macro-level research leads to the most effective results. First of all, we proved the concept of economic growth, which is the basis of our topic, with sufficient examples and definitions in the introduction and literature section of this article. We fully studied the data of national and foreign scientists about economic growth and its econometric definition, which shed light on our topic, and sufficiently interpreted them.

In the analysis part, based on our chosen model, we closely analyzed the indicators of our country for the last 22 years and gave conclusions to it, and reached a clear model and result. Also, descriptive population gross income; fund; the volume of investments in fixed capital and other macroeconomic indicators were forecast using econometric models and the ways of their use were shown.

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Yashil

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