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ECONOMETRIC ANALYSIS OF THE DYNAMICS OF AGRICULTURAL PRODUCTION IN UZBEKISTAN

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Abstract

In this article In Uzbekistan village farm products work to release volume in 2009–2024 dynamics timely row information based on timely the train economic -mathematical modeling through the trend determination for the purpose of striped and exponential trend models developed . Received results village farm products work to release in volume stable growth trend the existence showed .

Keywords: Agriculture, time series, dynamic analysis, economic growth, trend model, exponential model, econometric analysis, forecasting.

Introduction

Agriculture is one of the most important sectors of the economy, playing an important role in providing the country's population with food products, supplying raw materials for industrial sectors, and increasing export potential. In particular, the sustainable development of the agricultural sector is of great importance in ensuring economic growth in the national economy, increasing employment, and the socio-economic development of rural areas. Therefore, analyzing and assessing trends in the volume of agricultural production over time is one of the urgent issues.

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In recent years, Uzbekistan has been implementing a number of institutional and economic reforms aimed at modernizing agriculture, effectively using resources, and diversifying the agricultural sector. These processes are contributing to the sustainable growth of agricultural production. In this regard, a scientific analysis of dynamic changes in the agricultural sector, identification of existing trends, and forecasting future development directions is of great scientific and practical importance.

Time series analysis is widely used in the analysis of economic processes. Time series analysis allows you to determine how a certain economic indicator changes over time, assess its trend, and develop forecasts for the future. When these methods are used in conjunction with economic and mathematical modeling, it becomes possible to analyze economic processes more accurately.

This study analyzed the dynamics of agricultural production in Uzbekistan for 2009–2024 based on statistical data. The study calculated the absolute incremental growth rate, growth rates, and overall trend of the series. In addition, linear and exponential trend models were used to identify trends through economic and mathematical modeling of the time series.

The purpose of the research is to analyze the dynamics of the volume of production of agricultural products, to identify its main trends and to evaluate them based on econometric models. To achieve this goal, the tasks of analyzing time series data, building trend models and drawing economic conclusions based on them were defined.

The results of the study are of significant scientific and practical importance in identifying development trends in the agricultural sector, assessing economic growth factors, and developing forecasts for the coming years.

Methodology. This study used statistical and econometric analysis methods to assess the dynamics of agricultural production in Uzbekistan. The information base of the study is official statistical data on agricultural production for 2009–2024. Data for this period allow us to track long-term trends and development

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dynamics in the agricultural sector. The study used the time series method to analyze the characteristics of changes in agricultural production over time.

In the analysis of time series data, the main dynamic indicators of the series were calculated. In particular, absolute additional growth, growth rates and average annual growth indicators were determined. Through these indicators, the trends of changes in the volume of agricultural production over time and the general direction of development were evaluated. Also, trend analysis methods were used in order to reduce random fluctuations in the series and show the general trend more clearly.

In order to analyze economic processes in more depth, linear and exponential trend models were built to estimate the trend in agricultural production volumes. To estimate the parameters of the exponential model, the model was logarithmized, transformed into a simple linear regression, and the parameters were determined using the least squares method. The obtained models allow for an economic and mathematical assessment of the dynamics of agricultural production volumes and the development of forecasts for the future.

Literature review. The issues of analyzing the dynamics of agricultural production and its assessment based on econometric models have been widely studied in economic literature. In particular, the scientific work by A. Abdullaev and B. Bekmurodov entitled “Economic Foundations of the Development of the Agrarian Economy and Agriculture” (2021) analyzed the main economic trends in the development of the agricultural sector. The authors assessed the dynamics of changes in the volume of agricultural production using statistical and econometric methods and substantiated the role of the agricultural sector in the national economy and its development prospects.

S. T. Yuldashev and N. X. Karimov's research "Methods of economic analysis and forecasting of the agricultural sector" (2020) covers the analysis of economic processes in the agricultural sector based on the time series method. Using trend models, dynamic indicators and economic forecasting methods, the authors show

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the possibility of estimating long-term trends in the volume of agricultural production.

R. Kadyrov and D. In Rakhimov's scientific work "Econometric modeling of economic processes" (2022), the methods of using econometric models in the analysis of economic indicators are widely covered. The authors have scientifically substantiated the issues of evaluating the changes in the volume of agricultural production over time through linear and exponential trend models and developing economic forecasts based on these models.

Also J. A. Ergashev and Sh. R. Makhmudov's research entitled "Statistical and Econometric Analysis Methods in Agricultural Economy" (2023) highlights the importance of using economic-mathematical methods in assessing the development of the agrarian sector. The authors scientifically justified the importance of time series analysis, trend models and forecasting methods in the analysis of the dynamics of the production volume of agricultural products.

Analysis and results .

A time series is a sequence of statistical data that describes the change in an economic indicator over time. Here, the unit of time is " year", and the indicator is "agricultural output (trillion soums)". Thus, Table 1 below presents calculations for econometric analysis based on data on the volume of agricultural output in Uzbekistan for 2009-2024 .

The dynamics of agricultural production in Uzbekistan for 2009–2024 was analyzed based on time series data. Analysis of statistical data shows that during this period, the volume of agricultural production had a consistent growth trend. In particular, while in 2009 the volume of agricultural production amounted to 148.87 trillion soums, by 2024 this figure had reached 444.6 trillion soums. This indicates a significant increase in the volume of production in the agricultural sector during the analyzed period.

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Table 1 In Uzbekistan in 2009-2024 volume of agricultural products, (tril. soum)

year	Volume of agricultural products (Y), trillion soums	Absolute incremental growth (chained) D Y t =Y t −Y t−1	Average growth speed (chained , %)	t	t 2	LnY	t·LnY
2009	148.87	-	-	1	1	5.0031	5.0031
2010	149.88	1.01	100.7	2	4	5.0098	10.0196
2011	154.89	5.01	103.3	3	9	5.0427	15.1281
2012	157.24	2.35	101.5	4	16	5.0578	20.2312
2013	156.11	-1.13	99.3	5	25	5.0506	25,253
2014	169.36	13.25	108.5	6	36	5,132	30,792
2015	170.26	0.9	100.5	7	49	5.1373	35.9611
2016	176.11	5.85	103.4	8	64	5.1711	41.3688
2017	183.19	7.08	104	9	81	5.2105	46.8945
2018	195.1	11.91	106.5	10	100	5.2735	52,735
2019	224.3	29.2	115	11	121	5,413	59,543
2020	261.9	37.6	116.8	12	144	5,568	66,816
2021	317	55.1	121	13	169	5.7589	74.8657
2022	364.5	47.5	115	14	196	5.8985	82,579
2023	426.3	61.8	117	15	225	6.0551	90.8265
2024	444.6	18.3	104.3	16	256	6.0972	97.5552
				136	1496	85.8791	755.5718

1. Absolute incremental growth (chained) figures based on the data in the table above

$\Delta Y_t = Y_t - Y_{t-1}$

is calculated using the formula. These calculations show, for example, that additional growth indicators of +18.3 trillion soums were achieved in 2024, while the largest absolute additional growth is expected in 2023 (+61.8 trillion soums).

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2. And the growth rate (chained, %).

$$T_t = \frac{Y_t}{Y_{t-1}} \cdot 100\ \%$$

is calculated using the formula.

It can be seen that, for example, the growth rate in 2024 will be 4.3%, the highest growth rate in the observed years. In 2021, it was 21.04%.

3. Average annual growth rate (geometric)

$$\bar{T} = \sqrt[15]{\frac{Y_{2024}}{Y_{2009}}} - 1 = \sqrt[15]{\frac{444.6}{148.87}} - 1 \approx 7.5$$

Thus, in 2009–2024, the volume of agricultural production grew by an average of 7.5% .

4. Trend Equation (Linear)

$$\widehat{Y}_t = 89.28 + 18.93t$$

From this trend equation, it can be concluded that there is an average annual growth trend of 18.93 trillion soums.

When calculating the trend equation in time series, we number the time, that is, if we say 2009 is t=1, then t=1,2,3,…,16, because there are 16 observations in the period 2009–2024.

$\sum$ t = 1 + 2 + 3 + ... + 16 b is the sum of arithmetic progression , i.e.

$$\sum t = \frac{n(n+1)}{2} = 136$$

5. Trend equation (Exponential model)

$$Y_t = ae^{bt}$$

Here: Y t — agricultural volume; t —time (2009=1, …, 2024=16); a —initial level; b —growth rate coefficient; e —base of natural logarithm.

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We logarithmize the exponential model above, since the exponential model in this form is not directly estimable.

$$lnY_t = lna + bt$$

We introduce the following definitions:

A = ln a

The model then looks like a simple linear regression:

$$lnY_t = A + bt$$

In the next step, we calculate the necessary sums from the auxiliary table:

$\sum t = 136; \sum lnY = 85{,}87915; \sum t^2 = 1496; \sum tlnY = 755{,}57237; n = 16.$

Then the regression coefficient in the regression equation is and Calculating the free number based on the formula, we write the result:

$$b = \frac{n\sum tlnY - (\sum t)(\sum lnY)}{n\sum t^2 - (\sum t)^2} = 0{,}0749$$

$$A = \frac{\sum lnY - b\sum t}{n} = 4{,}7327$$

From this, that is, we find a smaller than A:

$$a = e^A = e^{4{,}7327} = 113{,}63$$

Then the daily exponential model looks like :

$$Y_t = 113{,}63e^{0{,}0749t}$$

So, Exponential in the trend equation $b = 0{,}0749$is the average annual growth rate$e^{0{,}0749} - 1 = 7{,}78\ \%$ while forming

In summary, agricultural volume averaged exponential growth of 7.8% has a tendency.

According to the results of the dynamic analysis, the volume of agricultural production has been steadily growing over the years, and the growth rates have accelerated, especially in 2019-2023. This is explained by the ongoing economic reforms in the agricultural sector, modernization of the agricultural sector, introduction of new technologies, and measures aimed at increasing production efficiency.

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In order to determine the general trend of the series, linear and exponential trend models were built. The calculation results showed that the volume of agricultural production is steadily growing over time. The built econometric models confirmed the existence of a long-term growth trend in the volume of production in the agricultural sector. The results also indicate that the agricultural sector occupies an important place in the national economy and its sustainable development is one of the important factors in ensuring the country's economic growth.

Conclusions and suggestions

The results of the study showed that the volume of agricultural production in Uzbekistan has a stable growth trend over the period 2009–2024. Dynamic and econometric analyses based on time series data confirmed that the volume of production in the agricultural sector is increasing year by year. The constructed linear and exponential trend models made it possible to identify the long-term development trend of the volume of agricultural production.

Based on the research results, the following conclusions and suggestions can be made:

There is a steady growth trend in the volume of agricultural production. It was found that the volume of agricultural production increased year by year during 2009–2024. This indicates that the economic reforms and modernization measures implemented in the agricultural sector are yielding positive results.

Trend models confirmed the long-term growth trend of agricultural production. Linear and exponential models constructed during the econometric analysis showed that agricultural production volumes increased over time. This means that the positive trend in the development of the agricultural sector is likely to continue in the coming years.

In order to increase the efficiency of agricultural production, it is necessary to widely introduce innovative technologies. Wide use of modern agrotechnologies,

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digital management systems and resource-saving technologies in agriculture will further increase production efficiency.

Wide use of economic-mathematical analysis methods in the development of the agricultural sector is desirable. Regular assessment of the dynamics of agricultural production based on time series analysis and econometric models will be important in improving the effectiveness of agricultural policy and developing long-term economic forecasts.

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