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THE NEXUS BETWEEN AGRICULTURE AND FARMING ON A TIME-SERIES MODEL: IN THE CASE OF KASHKADARYA REGION

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Introduction

The agricultural economy plays an important role in the world economy and satisfies the material needs and requirements of the population for food products. There are many approaches to the economic study of the volume of agricultural production and changes in it. According to statistics, currently world's agriculture is home to 1 billion of the economically active population. It employs more than a million people , and accounts for about 5 percent of the world's total output. According to the statistical forecast, "by 2050, the world population will reach 9.1 billion. In this case, the world's demand for meat and dairy products is expected to increase by 2 , 5-3 , 0 times compared to today " [6]. This, in turn, increases the demand for agricultural products. In order to achieve the main goal in agriculture, a variety of products are grown, works, services are performed, which are distributed and sold in order to meet demand. These processes, which take place at the level of enterprises, associations, industries (district, region, republic), are carried out on the basis of free market relations.

Today, due to the implementation of a systematic approach to agricultural production through a number of scientific studies on improving the efficiency of agricultural production , improving the system of their economic and statistical indicators, complex economic and statistical analysis through averaging indicators. Extensive research is being conducted on the statistical assessment of the intensive development of agriculture, multi-factor statistical analysis of the volume and quality of agricultural products . One of the priorities in world practice is to improve the methodology of agricultural statistical accounting and reporting system, including the use of methods of systematic statistical analysis, statistical methods for assessing and developing forecasts of factors affecting the development of the main types of agricultural products.

2. Methods

To determine the relationship between agricultural production and farming, we employed a quantitative approach using a multi-crop time series model.

Multi-dimensional econometric models of agricultural products have been implemented to increase the efficiency of agricultural production.

Effective implementation of these tasks will increase the assessment and efficiency of agricultural economic activity in the regions, further improve the system of statistical indicators in agriculture, study and forecast the economic development of the industry in the regions by special statistical methods . requires

Agricultural products represent the total volume of agricultural production in the reporting period, determining the total value of agricultural products grown on farms, dehkan (personal assistant) farms and organizations engaged in agricultural activities.

In the process of theoretical substantiation of the introduction of indicators directly or indirectly describing the efficiency of agricultural production in the model, based on the availability of a database on them and in agreement with the developers of methodological recommendations, this in the study, economic efficiency is characterized by the profitability of agricultural products and agricultural products.

H_0: there is no link between agriculture and farming

H_1: there is a link between agriculture and farming

3. Analysis and estimation results.

This reaserch study carried out an economic analysis of the development of the agricultural sector in Kashkadarya region in 2010-2021. According to the results, it provides an economic and statistical analysis of agricultural production. Continuing in this direction, in our study there are economic aspects of the development of the agricultural sector, for which the following factors are selected:

-The volume of agricultural products, ie the factor influencing this indicator for our model, was selected as an independent variable.

-The amount of agricultural products was selected as a dependent variable.

Table 1 Growth rate of agricultural production and statistics of agricultural production in Kashkadarya region over the years (expressed as a percentage of the previous year)

Year	The village farm products	Agriculture products
2010	107.0	106.9
2011	104.9	101.9
2012	107.1	106.9
2013	107.4	107.7
2014	106.0	105.5
2015	106.1	105.2
2016	106.5	105.0
2017	103.3	99.7
2018	96.5	88.9
2019	101.4	101.7
2020	103.7	105.4
2021	101.9	99.3

Above mentioned table demonstrates regressor and regressand used in our estimation model. Data are obtained from Kashkadarya province statistics management annual publications and State statistics committee of Uzbekistan Republic.

During the period 2010 and 2021 in Kashkadaryo region, we econometrically estimate nexus between village farm products growth and farming products using time series data. Our objective was to prove that there is a positive relationship between farming products and agricultural products employing OLS model. Software stata 16 were used in our estimation.

In our scientific work, our indicators of cointegration dependence examined through three main conditions. In multi-factor time series, the cointegration was performed in the following steps:

we expressed the indicators as a percentage;

time series were checked for stationarity;

a regression model was constructed;

the residue was checked for stationarity.

Also, in the development of these models, five conditions of Gaus Markov were used in conducting diagnostic analysis to determine graphical tables, correlation coefficients and density, regression models, prognosis of the structured model.

As far as our reaserch study is dealing with multi-factor time-series, in the very first step it is essential to check stationarity for the volume of agricultural products using Dickey-fuller test.

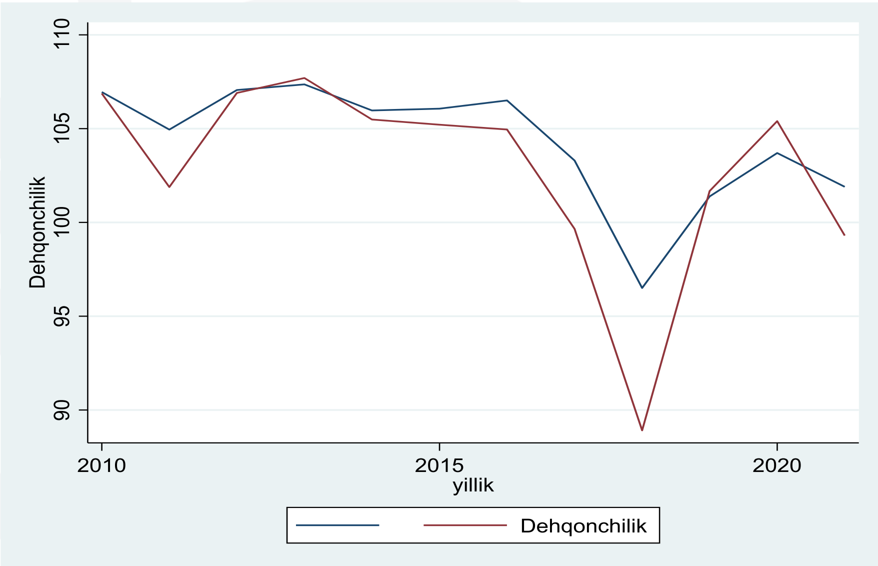

Figure 1. Q Agricultural products and agricultural products graphical method of checking the stationarity

It is clearly seen that village economy products go in the same line with farming products in the province. The data in Figure 1 we can notice same vibration in both variables.

Table 2 Q Agriculture products Dickey-Fuller index on

Dickey-Fuller test for unit root — Number of obs = 8

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-3.866	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.0023

Dickey Fulesr test enables us to detect that there is a stationarity in village farming products. The statistical test value of the Z (t) test had a negative number " -3.866 ", the critical value was 1% "-3.750", the critical value was 5% "-3.000" and the critical value was 10% "-2.630" which indicates the presence of strong stationary, forming a small value as a number took place after three integrations. Also, the MacKinnon value is a small value of r-value = 0.0023, indicating the presence of strong stationary.

Table 3 Agriculture products Dickey-Fuller index on

Dickey-Fuller test for unit root — Number of obs = 8

	Test Statistic	Interpolated Dickey-Fuller 1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.185	-3.750	-3.000	-2.630

MacKinnon approximate p-value for Z(t) = 0.0007

When Dickey-Fuller **test used to check stationarity, our**, the statistical test value of the Z (t) test gave us negative "-4. 185 ", representing a critical value of 1%" -3.750 ", a critical value of 5%" -3.000 "and a critical value of 10%" -2.630 "with a small value as a negative number. Also, MacKinnon showed a strong stationary value with a small value of r-value = 0.0007.

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We can see in Tables 2 and 3 that in this case the selected values were nonstationary, and after three integrations the values of both variables became stationary and the condition of cointegration correlation was satisfied.

The next step in the main goal of our study is to create a regression and correlation model on the example of Kashkadarya region on the level of impact of agricultural products on agricultural production. The factor influencing agricultural products (Agriculture) is expressed in the form of the following simple regression and correlation econometric formulae:

$$Qishloq\ xo'jaligi_i = \beta_0 + \beta_1 dehqonchilik_i + \varepsilon_i \qquad (1)$$

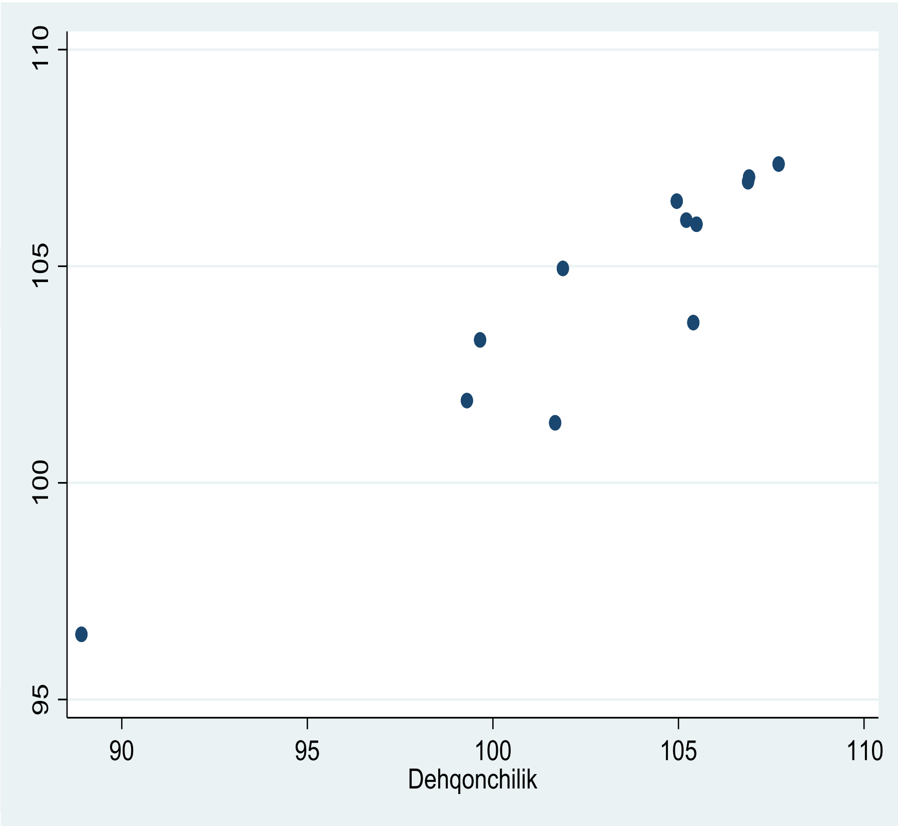

Figure 2. The village economy products and farming products between dependence on the scatter plot graph

Above picture demonstratws the data on village economy products functional issue in the province farming products functional release effect analysis, according scatter plot data enables us to notice link available between those chosen varibales

Table 4 Simple regression and correlation analysis results (Kashkadarya province in the example)

Source	SS	df	MS
Model	98.3872567	1	98.3872567
Residual	13.1527526	10	1.31527526
Total	111.540009	11	10.1400009

Number of obs	=	12
F(1, 10)	=	74.80
Prob > F	=	0.0000
R-squared	=	0.8821
Adj R-squared	=	0.8703
Root MSE	=	1.1469

Qishloqxoj~i	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Dehqonchilik	.5736904	.066331	8.65	0.000	.4258957	.7214851
_cons	45.3115	6.828829	6.64	0.000	30.09592	60.52708

Table 4 represents resression analysis outcomes between farming products as a dependent variable and agricultural products as independent variable. The corrected determination coefficient showed how well it matched the formed model data. This is because the closer the corrected determination coefficient is together, the more likely it is that the agricultural variable, which is considered an independent variable, justifies the effect of the change on the agricultural variable. That is, farming allows for accurate forecasting of crop values. The justified coefficient of determination in the formed model shows that the agricultural yield is 87 the percentage depends on the farming factor, which is a factor formed in the model. The remaining 13 percent is due to other factors not taken into account. The coefficient of the level of impact of the amount of agricultural products (Agriculture), which is a factor influencing agricultural products (Agriculture), is determined at the level of significance of 5%. The probability of a P-value in the coefficient of agricultural output (Agriculture) of the regression model is less than 0.05%, which means that this coefficient affects the change in the volume of agricultural production (Agriculture) . The P-value probability of the Fisher F-statistic in the constructed regression model is less than 0.05, and is equal to the amount of Agricultural Products (Agriculture), which is a dependent variable of the constant and the independent variable . shows that it is a mystery. We perform a diagnostic analysis to determine the prognosis of the constructed model.

We carry out diagnostic analysis of this model under the conditions of Gaus Markov, which is widely used in the world.

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According to Gaus Markov's first condition, the number of observations should be six times greater than the number of indicators. The number of our observations is twenty-four and the number of indicators is two, and we can see that our model successfully passed the first condition of Gaus Markov (see data in Table 1).

According to Gaus Markov's second condition, we can see that the empirical model is equal to the sum of theoretical data, and it is expressed as follows.

Table 5 According to the model Gaus Markov's second condition

Variable	Obs	Mean	Std. Dev.	Min	Max
Qishloqxoj~i	12	104.3039	3.184337	96.50494	107.3588
model	12	104.3039	2.990702	96.32006	107.0971

Concluding from the data in Table 5, our model was more successful than condition 2.

The third condition is that the residues should not be associated with the model. If interconnected, it is called a heteroskedastic state. Three different methods of verification in this regard are the graph method, the correlation table, and the tests, that is, the Vait (White) test, performed by the Breush-Shpogan test.

We first begin with the Breush-Shpogan test.

Table 6 Breush - Shpogan tests result

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of Qishloqxojaligimahsulotlari

         chi2(1)      =     0.03
         Prob > chi2  =   0.8595
```

The p-value of the Breush-Shpogan test is greater than 0.05, which is called the homoscopic state according to this test criterion, and shows that the residues are not associated with the model. The zero hypothesis shows that the heteroskedastics of the remains do not exist and accept the alternative hypothesis. That is, the remnants of the structured model have a homoskedastic vibration.

In our next step, in addition to this test, we will also review the results of the Vait (White) test mentioned above. Like the Breush-Shpogan test above, this test requires that the p value be greater than 0.05.

Table 7 Vait (White) test result

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Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroskedasticity	1.64	2	0.4406
Skewness	6.96	1	0.0083
Kurtosis	0.17	1	0.6794
Total	8.77	4	0.0670

According to the data in Table 7, the p value of the Vait (White) test is greater than 0.05, which rejects the heteroskedastic state according to the law of this test and allows us to accept the alternative hypothesis 1.
The next fourth condition to test our model is that the remnants of the model should not be cross-linked. There are 3 different ways to check the fourth condition, the graph, the autocorrelation table, the Durbin-Watson test, and the Breush-Godfree test.
As can be seen from Figure 3 below, the residues do not have a normal distribution i.e. the structured model residues do not meet the vibration normalization requirement. However, in our next step, we will also consider the results of test methods to verify the normal distribution of residues.

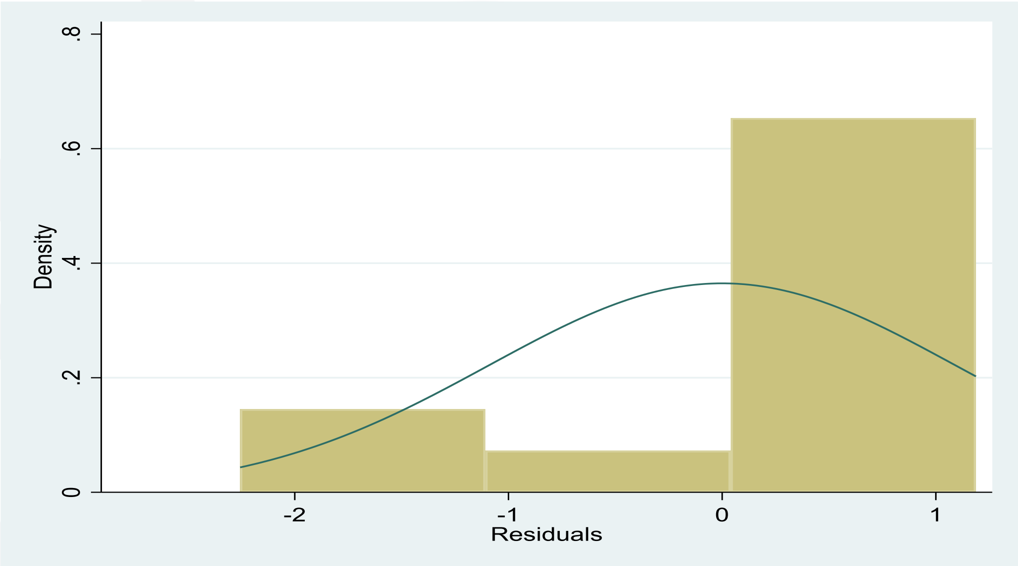

Figure 3 Normal distribution of residues test

with the Durbin- Watson test. According to the criteria of this test, the value of the Durbin- Watson test is from 0 to 4. If the test result on the model is around 2, it means that there is no autocorrelation. If the result is 0 to 1.5 or higher than 2, it means that there is an autocorrelation. When we ran our model from this test, the result was .8427575 and our model showed that the brackets were connected.

In our next step, we will also test the presence of autocorrelation problems in the residues in the constructed model using the Breush-Godfree test (Table 8).

8 – table Breush-Godfree avtokorrel atsi yasi tests result

Breusch-Godfrey LM test for autocorrelation

lags(*p*)	chi2	df	Prob > chi2
1	3.956	1	0.0467

H0: no serial correlation

Based on the results of the Breush-Godfrey test, we can say that there is an autocorrelation between the residues. This is because the R-square probability level is less than 0.05, accepting the hypothesis that the residuals have autocorrelation. According to Gaus Markov's fifth condition, the Shapiro-Wilk test value was 0.80, and given that this value is also less than r>0.05, we can see that this condition is not met, and we tested our model in 5 conditions of Gaus Markov (9 -jadval).

9 – table Shapiro-Vilk test result

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
qoldiq	12	0.80233	3.303	2.328	0.00996

According to these test tests, we conclude that our model successfully passed the 3 conditions of Gaus Markov, but did not pass the fourth and fifth conditions. For prognosis based on the above diagnostic results, this condition is considered unsatisfactory and requires that other factors be considered to improve this outcome.

4.Conclusion

Dimensional research methods using scientific analysis gave us following outcomes.

1. The coefficient of determination determined t in the model shows that the agricultural product 87% depends on the farming factor, which is a factor formed in the model. The remaining 13 percent is due to other factors not taken into account. The coefficient of the level of impact of the amount of agricultural products (Agriculture), which is a factor influencing agricultural products (Agriculture), is

determined at the level of significance of 5%. The probability of a P-value in the coefficient of agricultural output (Agriculture) of the regression model is less than 0.05%, which means that this coefficient affects the change in the volume of agricultural production (Agriculture) .

2. The next step, which was the main goal of our study, was to develop a regression and correlation model on the example of Kashkadarya region in terms of the level of impact of agricultural products on agricultural production.

3. According to Gaus Markov's second condition, the empirical model showed equality to the sum of theoretical data, and our second condition gave positive results.

4. All tests employed in this study confirm positive results and our model found to be reliable.

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