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Econometric Modeling On The Basis Of An Analysis System In Agricultural Sector Management

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ABSTRACT

In modern conditions, when management decisions are made on the basis of statistical, incomplete data analysis, the use of econometric modeling and analysis methods is not only reasonable, but necessary. Econometric models are applied both at the level of enterprise activity and at the level of analysis and planning of economic activity of the whole region and the country as a whole. The goal of the research is to create econometric models to obtain an effective tool for forecasting, analysis, and decision making.

KEYWORDS

Econometric model, analysis, forecasting, efficiency, farming, correlation and regression analysis, level of agricultural potential, modeling,

INTRODUCTION

Econometric methods and models are an integral part of any modern system of economic and management decision support. Today, econometric methods are used to diagnose the state of the enterprise, solve corporate finance and risk management tasks, evaluate the efficiency of investments and innovations, assets and businesses, analyze price dynamics and living standards, evaluate the parameters of economic and mathematical models of logistics [1].

An econometric model represented by a system of equations and inequalities is a mathematical analogue of an object that takes into account all the important aspects and

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features of its performance, according to which we can find the best option for the development of this object. Clearly, the more deeply the essence and content of an object, the interdependence of its elements, and their impact on the activity or the final outcome of an object are considered, the more accurate and acceptable the solution will be.

Econometric methods allow us to answer two main questions: what can happen in the future (forecast, forecasting the development of the economic situation) and how changes in one quantity can affect another - the task of analysis to manage economic processes [5].

The task of forecasting economic indicators is very relevant and is the basis for the development of fundamental economic decisions. Forecasting objectives can be different: crisis forecasting, demand forecasting, business efficiency, sustainability, and more. In systems with sustainable development trends, an econometric forecasting apparatus can be a sufficiently effective means of substantiating forecast data.

Economic processes evolve over time, so the analysis and forecasting of time series, including multidimensional analysis, plays an important role in econometric research. A dynamic range is a sequence of observations that is usually ordered in a timely manner, although it is also possible to order on other parameters. The organization of data in the form of a time sequence is characteristic for the study of the most diverse areas of human activity. These include exchange rates and stocks in the economy, information on daily equipment failures, and more. The sequence of time obtained in the study of different subjects has a different nature, so new processing methods are being developed and are constantly emerging for their study.

The generalized indicators of development dynamics of economic processes are average growth, average growth rate and growth. In fulfilling a number of preconditions, approximate, simple forecasting methods can be used before a more in-depth quantitative and qualitative analysis of these indicators [3]. The simplest method of forecasting using econometric time series models is extrapolation, ie. conveying past trends to the future. However, this requires a detailed analysis of the data of the last few years, as this year's trends may be radically different from previous years.

THE MAIN PART

In forecasting, the level of economic indicators in a often dynamic series consists of four components: trend, seasonal, cyclical, and random components. Depending on the method of combining these components, time series models are divided into additional, multiplicative, or mixed type models.

According to the general methodology of time sequence analysis, the starting point for creating a forecast model is to determine whether it is possible to distinguish a number of structural components and, above all, a trend in its composition. In this regard, it is necessary to determine the following:

- Whether there is a long-term trend over time;
- If the trend is identified, what is its nature;
- What additional dependencies can be observed in the time sequence.

A common way to identify development trends is to use this time sequence, specifically moving moving averages. Moderate motion

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mitigation of random and periodic oscillations makes it possible to identify the current trend in the development of this process.

Analytical alignment of the time sequence can be performed using certain functions of time - the growth curve. The use of the growth curve should be based on the assumption that the trend will remain the same, both during the observation period and in the forecast period. The predicted values of the selected growth curve are calculated by substituting the time values corresponding to the lead period into the curve equation. The forecast thus obtained is called a point forecast. In addition to the point forecast, it is expedient to calculate the range of possible values of the forecast indicator, the intermediate forecast. The confidence interval takes into account the uncertainty associated with the position of the trend (error in calculating the parameters of the curve) and the probability of deviation from this trend [4].

In order to reasonably assess the quality of the model obtained, it is necessary to check the conformity of this model to the actual process and to analyze its accuracy characteristics. Success testing is based on the analysis of a random component and the use of a number of statistical criteria. Accuracy indicators describe the magnitude of random errors obtained using the model. All accuracy indicators can be calculated after the lead period has already ended or when considering the indicator in the retrospective section.

Production planning and forecasting in agriculture as a key technical and economic indicator of efficiency cannot be done without reliable forecasting of productivity dynamics. The probabilistic nature of productivity creates favorable conditions for the use of econometric forecasting methods based on the trend model of the dynamic series [7].

Figure 1 shows the data on wheat yield in agricultural enterprises of Surkhandarya region for 2009-2019.

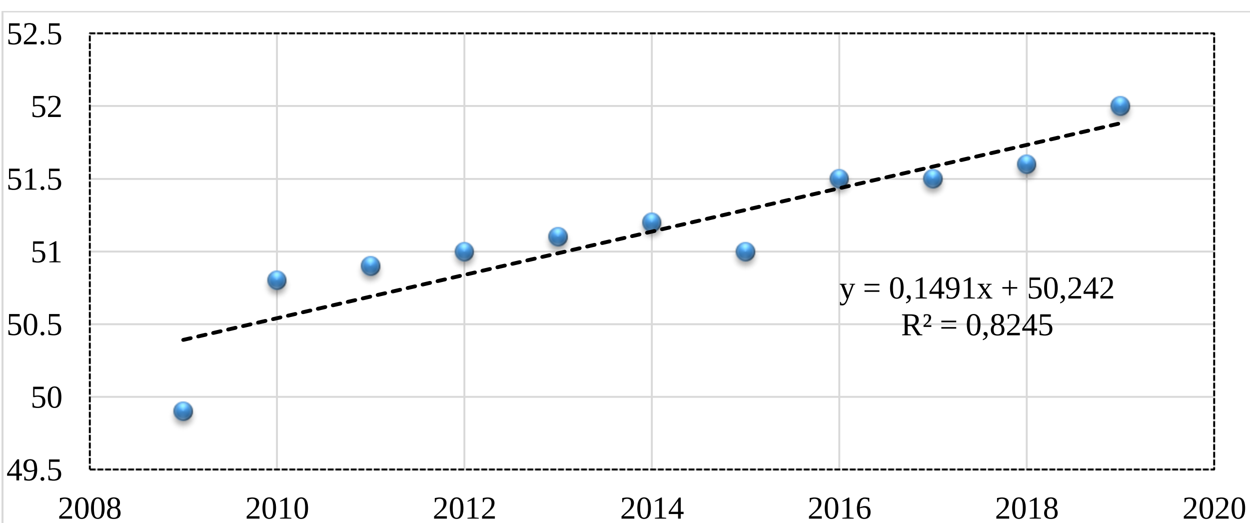

Figure 1. Dynamics of wheat yield in agricultural enterprises of Surkhandarya region

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A graphical view of the dynamic efficiency series shows that from 2009 to 2019, there is an increase in wheat yield in general, but growth is observed as a trend on average. In some years, the levels change, deviating from the main trend, which depends more on the meteorological conditions of the year. Drought in 2015 led to a 10% drop in yields this year compared to 2014 [6].

Extrapolation of a series of dynamics is done in different ways, for example, according to analytical formulas.

By extrapolating t = 12 based on the model equation $\hat{y} = y = 0{,}1491\,t + 50{,}242$ calculated in Figure 1, we can determine the expected yield of wheat in 2020 at agricultural enterprises in Surkhandarya region.

$$\hat{y}_t = 0{,}1491 * 12 + 50{,}242 = 52{,}03$$

In practice, the result of extrapolating the estimated events is usually obtained by intermediate estimates rather than by points.

Table 1

Extrapolation of time dynamics for wheat yield in agricultural enterprises of Surkhandarya region

Years, Collected	№ years	Yield	Square deviation	Ability to work	Striped productivity	Deviation from reality	Turning square
	t	y	t^2	yt	y = 0,1491 t + 50,242	$(y_i - \hat{y}_t)$	$(y_i - \hat{y}_t)^2$
2009	1	49,9	1	49,9	50,391	-0,491	0,241
2010	2	50,8	4	101,6	50,540	0,260	0,067
2011	3	50,9	9	152,7	50,689	0,211	0,044
2012	4	51	16	204,0	50,838	0,162	0,026
2013	5	51,1	25	255,5	50,988	0,113	0,013
2014	6	51,2	36	307,2	51,137	0,063	0,004
2015	7	51	49	357,0	51,286	-0,286	0,082
2016	8	51,5	64	412,0	51,435	0,065	0,004
2017	9	51,5	81	463,5	51,584	-0,084	0,007
2018	10	51,6	100	516,0	51,733	-0,133	0,018
2019	11	52	121	572,0	51,882	0,118	0,014
$\sum$	66	562,5	506	3391,4		-0,003	0,520
2020					52,03		
2020	Forecast interval limit		$51{,}39 \leq$ y prognosis $\leq 52{,}66$				

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Knowing the limits of the forecasted value of wheat yield in agricultural enterprises of Surkhandarya region: $\hat{y}_t$ = 52,03, we determine the probability limits of the interval by the following formula:

$$52{,}03 - 2{,}2010 * 0{,}288 \leq y \text{ prognosis} \leq 52{,}03 + 2{,}2010 * 0{,}288$$
$$51{,}39 \leq y \text{ prognosis} \leq 52{,}66$$

Therefore, with a probability of 0.95, in 2020, the yield of wheat in agricultural enterprises of Surkhandarya region may be less than 51.39 quintals and not more than 52.66 quintals.

A prognosis based on the extrapolation of time series of the process under study can usually be effective over a short-term forecast period. One of the promising directions in the development of short-term forecasting is related to adaptive methods. These methods allow the creation of self-correcting models that respond quickly to changing conditions. Adaptive methods take into account the different informational significance of sequences, the "aging" of information. All of these make effective use of them in predicting unstable series with a changing trend.

Correlation and regression analysis of the use of resources of Surkhandarya district
In many cases, linear multivariate regression models are used as econometric models, which include several factors and allow the assessment of the place and role of each factor in the formation of the economic indicator under study. Linear models have very simple mathematical apparatus and significantly reduce the risk of prediction errors compared to nonlinear models. Using the regression model, it is possible to obtain a quantitative assessment of quality indicators of production results (technologies, skills of workers, labor organization, types of management, etc.).

It should be noted that the multivariate regression model requires the use of a forecast for the planned period of all factors in this model, which reduces the presence of errors and the overall computational efficiency of the predictions. In forecasting based on such a model, stability or at least a small variability in the factors and conditions of the process under study should be performed. Currently, the rapidly changing factors are cost indicators - the cost of fixed assets, material and monetary costs, and so on. If the "external environment" of the ongoing process changes significantly, the previous regression model loses its relevance [9].

Often, in the selection of factors, they are based on a principle: the more the complex of factors is studied, the more accurate the results of the analysis. However, it should be borne in mind that if this set of factors is considered as a mechanical sum, the conclusions may be erroneous without taking into account their interaction, without distinguishing and defining the main ones.

Professor A. I. Weinstein stressed the need for careful logical and qualitative analysis in the selection of factors: "... with a careful, careful approach to factors, when creating a model of interdependence, you can limit the minimum number of indicators included in the model and achieve satisfactory results for forecasting." Theoretically, the regression model allows any factors to be taken into account, but in practice this is not necessary [10].

The purpose of a comprehensive assessment of the resources of agricultural enterprises in Surkhandarya region is to identify the system of correlation between individual factors and the final performance of enterprises, to identify errors in planning and management, to find ways to improve the performance of individual enterprises and industry in general [7].

In 2014, three factors were taken into account in the study of the gross output of agricultural enterprises in Surkhandarya region:

1) x1 – cost of labor resources of enterprises, million soums;
2) x2 - cost of material and technical resources of the enterprises, million soums;
3) x3 - cadastral value of lands of enterprises, million soums.

The indicator obtained (y) is the gross output at current prices for the year.

The calculated coefficients allow us to construct a multi-regression equation of the form.

$$y = 1.303\,x1 + 0.560\,x2 + 0.121\,x3 - 45991.01$$

Analysis of multiple regression equations shows that an increase in each factor leads to an increase in gross product cost (all regression coefficients are positive).

The practical value of a built production function can only be assessed after its statistical reliability has been assessed. The statistical features of the equation were as follows: the value of the criterion F is 17.7, the value of the multi-correlation coefficient is 0.91, and the total detection coefficient is 0.83. That is, an 83% change in the factors included in the equation explains the change in the effective indicator, and only 17% corresponds to the factors not taken into account.

The study shows that the direct link between the gross output of agricultural enterprises in Surkhandarya region and the cadastral value of their lands shows the need to improve land use by agricultural organizations in the region, and this is a priority for state land management. In the process of land management, measures will be taken to eliminate territorial shortcomings in agricultural land use, improve the ecological situation in the region, improve the organization of land use and protection and regulate the territory of agricultural organizations of Surkhandarya region, as well as improve its ecological status.

CONCLUSIONS AND SUGGESTIONS

Economic methods are now one of the tools for solving problems of analysis and forecasting of economic systems. A well-constructed econometric model allows predicting and monitoring the economic situation based on a reliable analysis of existing economic data, as well as developing future development options.

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