IJIAET International Journal of Innovative Analyses and Emerging Technology

| e-ISSN: 2792-4025 | http://openaccessjournals.eu | Volume: 3 Issue: 6

Forecasting Productivity Indicators of Agricultural Products by Considering the Feasibility of Practical Programs

Abdug'aniev Otabek Allajonovich

Doctor of Economics (DSc), Termiz State University, Vice-rector for financial and economic affairs

genius7722@mail.ru

Abstract: The article is devoted to the issue of exponential equalization of the dynamics of agricultural yields, as well as optimization of the adaptation parameters of the Brown and Holt models. Also, in the Surkhandarya region, multivariate forecast indicators of agricultural productivity until 2025 have been developed.

Keywords: practical use, agricultural products, food security, polynomial models, adaptive assessment, population, forecasting.

Introduction

The agricultural sector plays an important role in ensuring food security in the world, satisfying the population's material needs and requirements for agricultural products to a certain extent. According to the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization, "... currently, more than 840 million people in the world do not have the opportunity to eat enough. This means almost one in eight of the world's population. In addition, more than 30 percent of the population of the planet is experiencing the problem of not eating enough, lack of the most basic microelements and vitamins (www.fao.org)». All this shows that statistical analysis of the processes of agricultural production, econometric assessment of the factors affecting it, and development of forecasts of the main indicators are an urgent issue.

Analysis of the relevant literature

Many scientific research works have been carried out in economic sectors on the creation of econometric models of agricultural production processes in the regions and forecasting their prospects. These include C.C. Gulomov, D.S. Allamatova, B.E. among the economists of our country. The works of Mamarakhimov and others can be cited.

In the researches of the scientists of our country, C.C.Gulomov, D.S.Allamatova, the issues of the development of the agricultural sector in the regions were comprehensively studied, and the role of innovation in the development of the agrarian network in the regions and the policy of the state to ensure food security were shown [2].

B. E. Mamarakhimov has also studied the issues of development of the agricultural sector, and in his opinion, ensuring food security in the region is mainly carried out at the expense of the development of its own agricultural production and domestic sales markets, and partly at the expense of importing food products from abroad. feasibility is shown [3].

Foreign scientists P.V. Leshchilovsky, V.G.Gusakov, E.I.Kiveishalar in their research paid special attention to the issues of stimulating the agricultural sector in ensuring food security in the regions [4].

However, in the studies of the above-mentioned scientists, the cultivation of the main types of agricultural products at the regional level, forecasting, and the study of socio-economic problems in

IJIAET International Journal of Innovative Analyses and Emerging Technology

| e-ISSN: 2792-4025 | http://openaccessjournals.eu | Volume: 3 Issue: 6

this area have not been sufficiently studied. From this point of view, the issues of modeling the processes of agricultural production, regional development, state support and future forecasting remain relevant today.

Research methodology

The main goal of the research is to develop scientific and practical proposals and recommendations to satisfy the population of our country with quality agricultural products at the level of demand. Comparison, grouping and economic-statistical methods were widely used in the research process. As a result of the research, multivariate forecasts of productivity indicators of the main types of agricultural products were developed in Surkhandarya region, and scientific and practical proposals were developed for further improvement of this indicator. The developed scientific and practical proposals and recommendations can be used in the development of targeted state programs for the organization of food safety policy in our country and its improvement.

Analysis and results

As we know, the goal of forecasting is to determine the future development of the system based on the study and analysis of the past and present conditions, the laws of change, and to reveal the nature and content of the situation.

Forecasting determines the possible future development path and outcome of events and processes, evaluates the indicators characterizing these events and processes for a more or less long-term perspective.

Forecasting the yield of agricultural products using econometric methods in the conditions of Surkhandarya region is a bit of a problem. Because the hot and dry climatic conditions of the region have a negative effect on the formation of crops. For this reason, the issue of forecasting the volume of production of agricultural products and productivity indicators in the conditions of Surkhandarya region remains more urgent.

Often, it is difficult to decide which function is the most convenient to recommend for the development trend of the series dynamics based on the initial data.

In these types of processes, adaptive forecasting methods are widely used in research due to their relatively convenient algorithm and ease of use on computers. Typically, adaptive models are based on an exponential smoothing model. The exponential smoothing method is used for time series smoothing and forecasting.

The peculiarity of the exponential smoothing method is that each observer in the smoothing procedure uses only the previous level value obtained with a certain weight. The weight of each observation decreases as it moves away from the point in time being smoothed.

The smoothed value of the line observation S_t relative to time t is determined by the following formula:

$$S_t = \alpha y_t + (1 - \alpha)S_{t-1} \quad (1)$$

where α is a smoothing parameter describing the weight of the observation being smoothed, which satisfies the condition $0 < \alpha < 1$.

Using the exponential average in short-term forecasting requires the following expression as a series model:

$$y_t = a_{1,t} + \varepsilon_t \quad (2)$$

where $a_{1,t}$ - is the average level of the variable series over time;

IJIAET International Journal of Innovative Analyses and Emerging Technology
| e-ISSN: 2792-4025 | http://openaccessjournals.eu | Volume: 3 Issue: 6

бунда $a_{1,t}$ - вақт давомида ўзгарувчи қаторнинг ўртача даражаси;

ε_t - non-autocorrelated random deviation with zero mathematical expectation and variance σ^2.

$\hat{y}_\tau(t)$ by t we denote the value of the forecast made one time unit (step) ahead at time.

The concept of exponential averaging can be generalized to the case of a slightly higher order of exponential averaging.

After calculating the exponential averages S_t according to the formula (1), they themselves form a new time series. We define their limits by $S_t^{(1)}$. A superscript indicates that the string is the result of the first alignment. This series can be smoothed again by the following expression similar to formula (1):

$$S_t^{(2)} = \alpha S_t^{(1)} + \beta S_{t-1}^{(2)} \tag{3}$$

The resulting smoothed series $S_t^{(2)}$ is twice smoothed compared to the original series, so it is called the second-order exponential average.

The exponential mean of order *k* is found by the following expression:

$$S_t^{(k)} = \alpha S_t^{(k-1)} + \beta S_{t-1}^{(k)} \tag{4}$$

If the investigated process trend is described by a *p* - degree polynomial, the τ - step forward forecast is made using the following formula:

$$\hat{y}_\tau(t) = \hat{a}_1 + \hat{a}_2\tau + \hat{a}_3\tau^2 + \ldots + \hat{a}_{p+1}\tau^p \tag{5}$$

here $\hat{a}_1 + \hat{a}_2 + \hat{a}_3 + \ldots + \hat{a}_{p+1}$ – parameter estimate.

Based on the basic theorem of R. Brown and R. Mayer's method of exponential smoothing and forecasting, the unknown coefficients of *p* – order polynomial *(p+1)* $S_t^{(k)}$ $(k = 1,2,\ldots,p+1)$ can be represented by a linear combination of exponential averages.

As a result, in forecasting with this method, it is necessary to calculate variable exponential averages from order *1* to *(p+1)*, and then polynomial coefficients are determined through their linear combination. It can then be predicted by this polynomial.

The two-parameter Holt model is an improvement of the Brownian model for a first-order polynomial. According to the Holt model, the τ step forward forecast is expressed by the following formula:

$$\hat{y}_\tau(t) = (\hat{a}_{1,t} + \tau\hat{a}_{2,t}) \tag{6}$$

The coefficient is updated as follows:

$$\hat{a}_{1,t} = \alpha_1 y_1 + (1-\alpha_1)(\hat{a}_{1,t-1} + \hat{a}_{2,t-1}) \tag{7}$$

$$\hat{a}_{2,t} = \alpha_2 + (\alpha_{1t} - \hat{a}_{1,t-1}) + (1+\alpha_2)\hat{a}_{2,t-1}$$

here α_1, α_2- adaptation parameters, $0 < \alpha_1, \alpha_2 < 1$;

$\hat{a}_{1,t}$ and $\hat{a}_{2,t}$ – characteristics of the development trend;

Each adaptation parameter lies in the interval [0;1], the closer the parameter is to one, the more weight is assigned to the last observation.

IJIAET International Journal of Innovative Analyses and Emerging Technology
| e-ISSN: 2792-4025 | http://openaccessjournals.eu | Volume: 3 Issue: 6

It can be seen that the forecast values in this model depend on the past and current levels of the time series, the initial values of the coefficients and and the adaptation parameters α, α_1 and α_2.

Exponential smoothing, Brown and Holt model errors can be obtained as the sum of squared errors *(Sum Square Error -SSE)*:

$$SSE = \sum_{t=1}^{n} \varepsilon_t^2 \quad (8)$$

It can be seen that the adaptation parameters α, α_1, α_2 influence the model error *SSE*. Therefore, in order to find the optimal values of these parameters, it is necessary to solve the following optimization problems.

Exponential smoothing, for first and second order Brownian models:

objective function $SSE(\alpha) \rightarrow min$; (9)

constraint condition $0 \leq \alpha \leq 1$.

For the Holt model:

objective function - $SSE(\alpha_1, \alpha_2) \rightarrow min$; (10)

conditions of limitation $0 \leq \alpha_1 \leq 1$ and $0 \leq \alpha_2 \leq 1$.

optimization problems must be solved.

Using the above, non-linear optimization problems (9) and (10) in calculating the forecast values of agricultural productivity in the Surkhondarya region were solved using the "Poisk Reshenia" application in the Excel electronic processor. It, in turn, led to a decrease in the forecast error. The results of adaptive polynomial models of agricultural yield indicators, optimal values of adaptation parameters and model error calculations are presented in Table 1.

Table 1. Adaptive polynomial models of agricultural yield indicators, optimal values of adaptation parameters and model errors

Product name	According to the first-order Brownian model			According to the second-order Brownian model			According to the Holt model			
	Model equation	Optimal value of adaptation parameter (α)	Model error $SSE(\alpha)$	Model equation	Optimal value of adaptation parameter (α)	Model error $SSE(\alpha)$	Model equation	Optimal value of adaptation parameter α_1	Optimal value of adaptation parameter α_2	Model error $SSE(\alpha_1, \alpha_2)$
Wheat	$y_\tau(t)$=50,33-0,5635τ	0,761	4,397	$y_\tau(t)$=50,058-0,0327τ-0,146τ^2	0,486	2,607	$y_\tau(t)$=50,325-0,497τ	0,473	0,803	3,484
Potatoes	$y_\tau(t)$=232,77+13,3τ	0,511	1364,8	$y_\tau(t)$=235,47+0,781τ+3,034τ^2	0,489	1778,9	$y_\tau(t)$=231,74+11,86τ	0,56	0	1043,1
Vegetable	$y_\tau(t)$=203,92+2,75τ	0,452	642,77	$y_\tau(t)$=201,97-0,3242τ-1,827τ^2	0,474	668,25	$y_\tau(t)$=206,52-4,34τ	0,429	0,608	634,35

Poly crops	$y_\tau(t)=375,41+18,5\tau$	0,524	3446,4	$y_\tau(t)=383,1521+7,307\tau+9,85\tau^2$	0,574	3181,5	$y_\tau(t)=365,42+32,97\tau$	0,532	1	3270,6
Wet fruit	$y_\tau(t)=112,52+4,091\tau$	0,704	480,11	$y_\tau(t)=113,2622+14,762\tau-0,186\tau^2$	0,536	653,39	$y_\tau(t)=111,3+4,19987\tau$	1	0,282	481,11
Grapes	$y_\tau(t)=98,287-2,785\tau$	0,535	1369,4	$y_\tau(t)=85,586+8,19\tau-4,955\tau^2$	0,536	2047,9	$y_\tau(t)=82+1,49\tau$	1	0	1039,9

The analysis of the adequacy and accuracy characteristics of the models presented in Table 2 shows that there is a very strong relationship between the coefficients of determination in all three models, but the second-order Brown model in the yield indicator of wheat and rice crops, the Holt model in the yield of potatoes and vegetables, and the Holt model in the yield of wet fruits and it can be seen that the average absolute error of the first-order Brown model is less than the other two models. Predictive values were found using the adaptive polynomial models defined for the yield indicators of agricultural products in Surkhandarya region (Table 2).

Table 2. Surkhandarya region agricultural productivity indicators forecast options for 2023-2025 according to adaptive polynomial models

Product name	According to the first-order Brownian model			According to the second-order Brownian model			According to the Holt model		
	2023	2024	2025	2023	2024	2025	2023	2024	2025
Wheat	49,766	49,203	48,639	49,88	49,41	48,65	49,846	49,376	49,888
Potatoes	246,07	259,37	272,67	239,29	249,17	265,12	243,6	255,46	267,32
Vegetable	206,67	209,42	212,17	199,82	194,01	184,55	202,18	197,84	193,5
Poly crops	393,91	412,41	430,91	400,31	437,17	493,72	398,39	431,36	464,33
Wet fruit	116,61	120,70	124,793	127,84	142,04	155,87	115,50	119,70	123,90
Grapes	95,502	92,727	89,932	88,82	82,15	65,56	83,49	84,98	86,47

Discussion of research results

The results of the analysis show that the obtained forecast values of the production of agricultural products and productivity in the Surkhandarya region show that in 2023-2025, positive trends will not be maintained in the level of providing the population of the region with this product compared to the physiological norm.

Conclusions and suggestions

In conclusion, adaptive methods allow to take into account different information values of sequence levels that have significant properties in short-term forecasting of agricultural production. The adaptation process is repeated for each new point of the examined period, providing a simulation of the development trend in each period.

Based on the above information, we can conclude that in order to further increase the productivity of agricultural products in the Surkhandarya region, it is necessary to restore the productive forces of agricultural land, carry out reclamation activities, scientifically justify the level of use of mineral fertilizers and various additives, and ensure the achievement of high yields.

List of used literature:

1. Decree of the President of the Republic of Uzbekistan dated February 7, 2017 No. PF-4947 "On the strategy of actions for the further development of the Republic of Uzbekistan". http://lex.uz

2. S.S. Gulomov, D.S. Allamatova. "Mintaqalar otiq-ovqat xavfsizligini ta'minlashda innovatsiyalarning roli." // Materials of the republican scientific-practical conference on the problems of modernization and development of innovative management activities in the branches of the agro-industrial complex of the Republic of Uzbekistan (part 1). Tashkent 2016, TDAU. - pp. 24-26.
3. B. E. Mamarakhimov. "O‘zbekistonda oziq-ovqat xavfsizligini ta’minlash va sanoatini rivojlantirish". // Scientific article. Scientific electronic magazine "Economy and innovative technologies". No. 5, September-October, Tashkent 2016. Pages 4-6.
4. I.I. Eliseeva, S.V. Kurysheva, T.V. Kosteeva. Econometrics. -M. : Finance and statistics, 2013. 344 pages.
5. D.N. Saidova, I.B. Rustamova, Sh.A. Tursunov. “Agrar siyosat va oziq-ovkat xavfsizligi”. Study guide. Tashkent 2015. Pages 90-115.
6. Nazarov Sh.Kh., Zokirov S.S., Saydahmedov H.M., Yakubova E.T., Shukurov S.M., Karimov M.M., Khusainova O.Sh., Mominov.T.K. “Surxondaryo viloyatini ijtimoiy-iqtisodiy rivojlanish strategiyasi”, Tashkent 2016. Pages 92-97.
7. П.В.Лещиловский, В.Г.Гусаков, Е.И.Кивейша. Экономика предприятий и отраслей АПК: учебник /.; Минск : БГЭУ, 2012. 318 стр.
8. O.A.Abduganiev, O. Jurayev. “Livestock statistics indicator system specific aspects of construction.” // International Engineering Journal For Research & Development. №5, USA 2020. pages 14-21.
9. www.stat.uz – Official site of the State Statistics Committee of the Republic of Uzbekistan.
10. Official website of the Food and Agriculture Organization of the United Nations. www.fao.org