QUANTITATIVE EVALUATION OF THE INFLUENCE OF INDIVIDUAL FACTORS ON THE RESULT INDICATORS CHARACTERIZING THE COMPETITIVENESS OF RA AGRICULTURE AND THE INTEGRAL INDICATOR OF THAT COMPETITIVENESS

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Introduction. Competitiveness is one of the most important characteristics of a market economy and an important economic category. The level of competitiveness is influenced by many factors that can contribute or hinder its increase. State policy is of particular importance in increasing the competitiveness of agriculture, which is designed to provide the necessary conditions and a favorable environment for the realization of this goal. The favorable influence of the state policy on the competitiveness of agriculture finds its expression in the improvement of indicators characterizing competitiveness, in qualitative shifts, in the positive trends of changes in the characteristics of the level of competitiveness. However, it is not justified to attribute the mentioned positive changes only to the influence of the state policy, because other factors also affect the competitiveness of agriculture. In this case, a clearer picture of the impact of state policy on the competitiveness of agriculture can be made by quantifying that impact.

The level of competitiveness of agriculture is affected by other factors besides the above-mentioned policies. Certain factors have more or less influence on this or that characteristic of agricultural competitiveness. In this case, the quantitative assessment of the influence of various factors on individual characteristics of agricultural competitiveness is of particular interest. First of all, we are talking about productivity as a characteristic of the competitiveness of a branch, including agriculture, which most comprehensively reflects it, and in this sense, its study acquires particular importance. Therefore, we consider M. Porter's interpretation of competitiveness, according to which "Competitiveness is determined by productivity..." [National Competitiveness Report of Armenia, 2008, 14].

Productivity as a characteristic of the competitiveness of a branch, including agriculture, reflects it more comprehensively and in this sense its study acquires particular importance. The role of productivity is becoming more important as one of the main output indicators characterizing the competitiveness of agriculture. In the case of agriculture, productivity has its own manifestation and is reflected in the index of gross agricultural output per employed person in that branch. Many direct and indirect factors affect the size of the indicated indicator, in particular: the level and structure of agricultural mecha-

nization, population employment, the yield of agricultural crops and the yield of agricultural animals, the level of agricultural commoditization, the index of tariffs for agricultural services, the exchange rate of foreign currency (for example, the US dollar). The impact of many factors on agricultural productivity may or may not be favorable. The size of that effect may also vary. In this case, the assessment of the mentioned amount allows to identify the factors that have more or less influence on agricultural productivity in the given period. Along with the productivity of agriculture, it is of no less interest to evaluate the quantitative impact of various factors on indicators characterizing the competitiveness of its crop and livestock sub-sectors, such as yield (in particular, wheat) and food yield (for example, milk yield of cows) indicators. The gross yield of the given agricultural crop, producer price, agricultural services tariff index, foreign currency exchange rate can be considered as the factors influencing the yield, and the milk producer's price, the price index of livestock vaccinations can be considered as the factors affecting the grain yield. The influence of the mentioned factors on yield and grain yield may be more or less. Identifying the factors that have a greater or lesser impact on the competitiveness of agriculture and its sub-sectors allows to focusing on mitigating specific negative factors and making the most of the opportunities of positively influencing factors.

The identification of the factors influencing the above-mentioned indicators to a greater or lesser degree characterizing the competitiveness of agriculture and its individual sub-sectors is possible as a result of the quantitative assessment of the impact of these factors using regression models and econometric calculations. Although the role of such assessment is becoming more and more important in the economic literature, the evaluation of the quantitative relationship between not all result and factor indicators related to the branch, including the agriculture of our republic, has received the necessary attention. In this case, it refers to the above-mentioned indicators. If we take into account that there is a statistical relationship between not all the result and factor indicators related to the agriculture of our republic, then the discovery of such a relationship becomes more important. At the same time, the development of an integral indicator of the competitiveness of the branch, particularly agriculture, which has not received enough attention in the economic literature, is no less important, which will allow a more complete quantitative understanding of the level of competitiveness and the extent of its change under the influence of various factors. In this context, the quantitative assessment of the impact of individual factors determining the competitiveness of RA agriculture and the development of an integral indicator of the competitiveness of the sector, particularly agriculture, are becoming relevant.

The purpose of the article is to evaluate the quantitative impact of a number of factors with a statistical relationship with them on the individual result indicators characterizing the competitiveness of RA agriculture in the considered period, using a regression model,

and to isolate the factors that have a greater or lesser influence, as well as to propose a methodology for evaluating the integral indicator of the competitiveness of the branch, in particular, agriculture approach. The tasks of the article are to clarify the scope of the factors with which there is a statistical relationship with the individual characteristics of the competitiveness of RA agriculture, to perform a regression analysis characterizing the influence of the mentioned factors for the considered period, as well as to estimate the annual and average annual value of the integral indicator of the competitiveness of RA agriculture.

Methodology. The article uses dialectics, scientific abstraction, comparative analysis, logical, statistical and mathematical methods. The application of the dialectic method is clearly seen when observing the movement of individual indicators in the tables included in the research over a number of years and determining the degree of closeness of the relationship between them using appropriate formulas. The application of the scientific abstraction method applied to the entire research, because the scope of the latter is limited to individual characteristics of agricultural competitiveness and one factor affecting them or a limited number of individual factors, that is, others were not considered. The application of the method of comparative analysis found its expression in the comparative analysis of the impact of budget allocations to agriculture on the individual characteristics of agricultural competitiveness: agricultural production volume index, agricultural productivity, and the level of commercialization, the results of which are reflected in the conclusions of the article. The use of statistical methods was demonstrated in the calculations of correlation and determination coefficients. The application of mathematical methods (referring to the calculation of the mean square) found its expression in the calculations of the integral indicator of the competitiveness of the branch, in particular, of agriculture.

Literature review. A number of economists, including A. Borel, T. Lenskaya [Lenskaya, 2013, 87], K. Saubanov [Saubanov, 2010, 38-53], V. Klyukach [Klyukach, 1998, 208], Bespyatnykh [Bespyatnykh, 2000, 200], O. Koryakina and other authors have identified a more limited or comprehensive range of the mentioned factors. As a result, individual factors were left out of view. We discuss, in particular, the level of commercialization of agriculture, the index of tariffs for agricultural services, the exchange rate of foreign currency (for example, the US dollar), the gross yield of a given crop, the price of a milk producer, the price index of livestock vaccinations, which are not shared by all economists and are considered as factors determining the competitiveness of agriculture. It is also noteworthy that in the economic literature, these factors were mostly considered in the context of contributing to increasing the competitiveness of agriculture. As a result, the issues of quantitative evaluation of the influence of the mentioned factors on the competitiveness of that branch have not been studied in the necessary depth,

especially when it comes to the evaluation of their influence by regression analysis. In other words, the study of the above-mentioned issues is mostly limited by the theoretical judgments related to the regression analysis, and in the context of the competitiveness of RA agriculture, not the necessary attention was paid to the identification of the statistical relationship between all the result and factor indicators.

In the economic literature, not enough attention was paid to the nomination of the integral indicator of the competitiveness of the sector, particularly agriculture. Individual indicators of this competitiveness found in the literature characterize one or another of its aspects and do not provide a comprehensive quantitative picture of its level. Meanwhile, a more complete picture of that level can be made by proposing an integral index by calculating various indicators characterizing different aspects of competitiveness with a specific methodical approach.

Scientific novelty. The statistical relationship between a number of factors determining the competitiveness of RA agriculture in the studied period was revealed and quantitatively evaluated, as well as the factors that had more or less influence on the result indicators characterizing that competitiveness. At the same time, an integral index for assessing the competitiveness of the branch, particularly agriculture, was developed and its annual and average annual value was estimated in the case of RA agriculture. The results of the regression analysis are characterizing the influence of the state policy on the competitiveness of the agriculture of the Republic of Armenia.

Analysis. We used the following approach for the quantitative evaluation of the influence of state policy on a number of indicators determining the competitiveness of agriculture. As the bearer of the state policy, we observed the allocations from the RA state budget to the agricultural sector and, by calculating the correlation and determination coefficients, we assessed their quantitative impact on the value of the gross agricultural product, the agricultural product volume index, and the level of agricultural productivity and productivity. Baseline data for calculations were taken for a long period of time, 15 years (budget data are available since 2007). The baseline data are presented in Table 1.

First, we tried to assess the nature of the relationship between the state budget allocations to agriculture and the value of gross agricultural output. For the econometric analysis of the impact of agricultural budget allocations on the gross agricultural product, agricultural product volume index, agricultural productivity, agricultural commodity level, let's make the following desgnations:

x_t - budget allocations to agriculture, mln drams, in t year,

y_{1t} - gross value of the agricultural products, billion drams in t year,

y_{2t} - the index of the volume of agricultural products, %,

y_{3t} - Productivity of agriculture, thousand AMD/person in t year,

y_{4t} - Level of commercialization in agriculture, %, in t year.

Table 1. Allocations to agriculture from the RA state budget and the indicators determined by them: the value of the gross agricultural product, agricultural productivity, the volume index of agricultural products, the level of commercialization of agriculture.

Years	Budget allocations to the agriculture, million drams	Gross value of the agricultural products, billion drams	The index volume of agricultural product, %	Productivity of agriculture, thousand AMD/person	Level of comercialization in agriculture, %
2007	6700.183	633.9	109.6	1261.5	57.3
2008	10961.888	628.1	101.3	1285.2	54.6
2009	13671.217	552.1	99.5	1123.1	56.2
2010	7171.655	636.7	86.4	1294.9	55.8
2011	5808.389	795.0	113.9	1738.1	56.0
2012	9105.868	841.5	109.5	1924.7	56.1
2013	9337.618	919.1	107.1	2177.4	56.4
2014	9651.395	983.0	106.3	2516.5	56.2
2015	20208.724	945.4	108.4	2641.7	58.6
2016	27087.158	878.5	96.2	2598.3	57.3
2017	10516.520	908.6	97.6	2865.3	56.7
2018	9575.971	892.9	92.8	2675.0	56.5
2019	6235.071	853.3	95.9	2478.4	56.3
2020	9858.199	833.3	103.2	2465.4	57.2
2021	20053.744	934.4	99.1	2702.1	57.0

The closeness of the relationship between the mentioned indicators was evaluated using the correlation coefficient. In the case of a linear relationship, its closeness is measured by pairwise correlation coefficient, which is determined by the following formula:

$$r_{xy} = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}} \quad (1)$$

If the sign of the deviation from the mean matches, then the relationship is direct ($r_{xy} > 0$), if the sign of the deviation does not match, the relationship is inverse ($r_{xy} < 0$): The pairwise correlation coefficient is measured from -1 (in the case of random complete inverse correlation) to 1 (in case of complete direct correlation). In absolute magnitude: $0 \le |r_{xy}| \le 1$. The closer the value of r_{xy} is to unity, the closer the relationship is, and the closer the value of r_{xy} is to 0, the weaker the relationship. When the connection from

$|r_{xy}|$<0.30 is considered weak, the connection of $|r_{xy}|$=0.3÷0.7 is considered strong, and when $|r_{xy}|$>0.7 the connection is considered very strong or close" [Yeliseeva, 2010].

The interdependence between the studied phenomena was presented using a two-dimensional linear regression model:

$$y_t = a_0 + a_1 x_t + e_t \quad (2),$$

$$\widehat{y_t} = a_0 + a_1 x_t \quad (3),$$

where` x_t - is the actual level of the factor attribute, in t year

y_t և $\widehat{y_t}$ - are the actual and theoretical levels of the output characteristic in t year,

e_t - is the effect of factor characteristics and random factors not included in the model,

$a_0; a_1$ - are the parameters of the regression model, which are estimated by the method of least squares [Yeliseeva, 2014, 23-25]. The coefficient of determination and the F criterion of significance of the regression analysis were also calculated among the studied indicators. The coefficient of determination shows how much of the variation in the outcome characteristic is due to the variation in the factor characteristic:

$$R^2 = \frac{\sum(y_i-\bar{y})^2}{\sum(\hat{y}_i-\bar{y})^2} = (r_{xy})^2, \; 0 < R^2 < +1, \quad (4),$$

$$F = \frac{\sum(\hat{y}_i-\bar{y})^2}{df_1} \div \frac{\sum(y_i-\hat{y}_i)^2}{df_2} \quad (5), \text{ where}$$

$\sum(y_i-\bar{y})^2$- is the total variance of the resulting trait,

$\sum(\hat{y}_i-\bar{y})^2$- is the variance due to the regression of the outcome trait,

$\sum(y_i-\hat{y}_i)^2$- is the variance due to the residuals of the outcome trait,

df_1 and df_2 – is the number of degrees of freedom.

The results of calculation of correlation and determination coefficients characterizing the relationship between budget allocations to agriculture and other outcome features are presented in table 2.

From the results of the analysis presented in Table 2, it can be seen that in 2007-2021 Between budget allocations to RA agriculture (X_t) and the volume of gross agricultural output (Y_{1t}), a direct relationship of medium strength was formed ($r_{xy_1} = 0.288$). According to the calculated coefficient of determination, about 8.32% of the fluctuations in the volume of gross agricultural products in the studied years are due to the fluctuations of budget allocations to agriculture ($R^2 = 0.0832$), and the remaining 91.68% are due to the influence of other and random factors. According to the regression coefficient in the constructed regression model, the gross agricultural output increased by 6.46 billion drams in parallel with the increase of one million drams in budget allocations for agriculture in 2007-2021 ($a_1 = 0.00646$). However, the results of the regression analysis showed that the budgetary allocations to agriculture in the studied years did not have a significant impact on the increase in the gross output of agriculture (**F=1.17,** sig.=0.29)). From the results of the analysis presented in Table 2, it can be seen that in 2007-2021 a

weak inverse relationship ($r_{xy_2} = -0.134$) was formed between budget allocations to RA agriculture (x_t) and the volume index of agricultural products ($\mathbf{y}_{2t}$). According to the calculated coefficient of determination, about 1.81% of the fluctuations of the index of agricultural output volume in the studied years are due to the fluctuations of budget allocations to agriculture ($R^2 = 0.0181$), and the remaining 98.19% are due to the influence of other and random factors. According to the regression coefficient, in the built regression model, in 2007-2021, parallel to the increase of budget allocations to agriculture by one million drams, the volume index of agricultural products decreased by 0.16 percentage points (**a_1 = 0.00016**). However, the results of the regression analysis showed that the budgetary allocations to agriculture in the studied years did not have a significant impact on the increase of the volume index of the agricultural products

(**F=0.23**, sig.=0.63).

The analysis has shown that a direct relationship of average strength has been formed between the budget allocations for agriculture (x_t) and the level of agricultural productivity (y_{3t}) in 2007-2021. According to the calculated coefficient of determination, about 14.9% of fluctuations in the level of agricultural productivity in RA in the studied years are due to fluctuations in the budgetary allocations of agriculture (**R2 = 0.149**), and 85.1% are due to the influence of other and random factors. According to the constructed regression model, one million of agricultural budget allocations were made in the studied years. The increase in drams contributed to the increase of agricultural productivity by 0.039 thousand drams/person or 39 drams/person (**a_1 = 0.039**). It should be noted that the relationship formed between budget allocations for agriculture and agricultural productivity is not significant (**F=2.28,** sig.=0.15).

According to the results of the analysis, in 2007-2021 a direct and strong connection has been formed between the budgetary allocations of RA agriculture (**$\mathbf{x_t}$**) and the level of agricultural production (**$\mathbf{y_{4t}}$**). According to the calculated coefficient of determination, 25.8% of the variations in the agricultural product level in the studied years are due to the variations in the budgetary allocations of agriculture (**$\mathbf{R^2}$=0.258**), and the remaining 74.2% are due to random factors not included in the model. According to the constructed regression model, the increase of budget allocations by one million drams in the studied years contributed to the increase of the level of agricultural commercialization by 0.07 percentage points ((**a_1 = 0.00007**). The analysis showed that the relationship formed between the budgetary allocations of agriculture and the level of commercialization in 2007-2021 was significant. (**F=4.58**, sign. = 0.047). In fact, the policy conducted in the field of agriculture had a positive effect on the competitiveness of the sector with the budgetary allocations shown, but this effect was weak.

As a result indicator characterizing competitiveness, we considered the productivity in agriculture and separately evaluated the impact of various factors on that indicator. In particular, we have considered the following factors: the level of agricultural commodification, the tariff index of agricultural services, average annual exchange rate of the US dollar. The following designations have been made:

y_t - is the agricultural productivity in the t year, thousand drams / person,

x_{1t} - is the level of commercialization of agriculture in the t year %,

x_{2t} - is the index of tariffs for agricultural services in the t year,

x_{3t} - is the average annual exchange rate of 1 US dollar in the t year, in drams.

Table 2. The results of the calculation of correlation and determination coefficients characterizing the relationship between budget allocations to agriculture and other outcome features

Indicators	Impact of budgetary allocations for agriculture (x_t)`			
	On the volume of gross agricultural output y_{1t}	On the index of the volume of agricultural output	On the level of productivity of agriculture	The level of commercialization of agriculture
Correlation coefficient	$r_{xy_1} = 0.288$	$r_{xy_2} = -0.134$	$r_{xy_3} = 0.386$	$r_{xy_4} = 0.508$
Coefficient of determination	$R^2 = 0.0832$	$R^2 = 0.0181$	$R^2 = 0.149$	$R^2 = 0.258$
Regression model	$\widehat{y_{1t}} = 739.9 + 0$	$\widehat{y_{2t}} = 103.7 - 0.00016x_t$	$\widehat{y_{3t}} = 1653.5$	$\widehat{y_{4t}} = 55.6 + 0.00007$
Significance of the regression model by F criterion	$F = 1.17$ ***(sig.=0.29)***	$F = 0.23$ ***(sig.=0.63)***	$F = 2.28$ ***(sig.=0.15)***	$F = 4.58$ ***(sig.=0.047)***

The results of the regression analysis characterizing the effect of individual factors determining labor productivity, wheat yield and milk yield of cows in RA agriculture.

In order to assess the specific impact of the mentioned factors on the level of productivity in RA agriculture in 2000-2021, the results of the analysis are presented separately. The analysis shows that in 2000-2021 a non-linear relationship was formed between the level of productivity and commercialization of RA agriculture, which was presented through a stepwise regression model:

$y_t = a \times x_{1t}^b \times e_t$ (6), where:

a, b are the parameters estimated by the method of least squares,

$\mathbf{e_t}$ - are the effects of random factors not included in the model.

The coefficient of elasticity is calculated, which shows by how much a one percent increase in the factor characteristic changes the resulting characteristic: (7) [Ekonometrika, 2007, 86-90].

From the results presented in Figure 1, it can be seen that in the studied years, a strong non-linear relationship was formed between the productivity and commercialization level of RA agriculture (**R = 0.606**). According to the coefficient of determination, around 36.8% of the fluctuations in the agricultural productivity level of RA in the studied years are due to the fluctuations in the level of agricultural commodity ($R^2 = 0.368$), and the remaining 63.2% are due to the influence of other factors not included in the model. As the elasticity coefficient shows, in 2000-2021 a one percent increase in the agricultural commodity level contributed to an increase in the agricultural productivity level by 5.527% (**E = 5.5271%**).

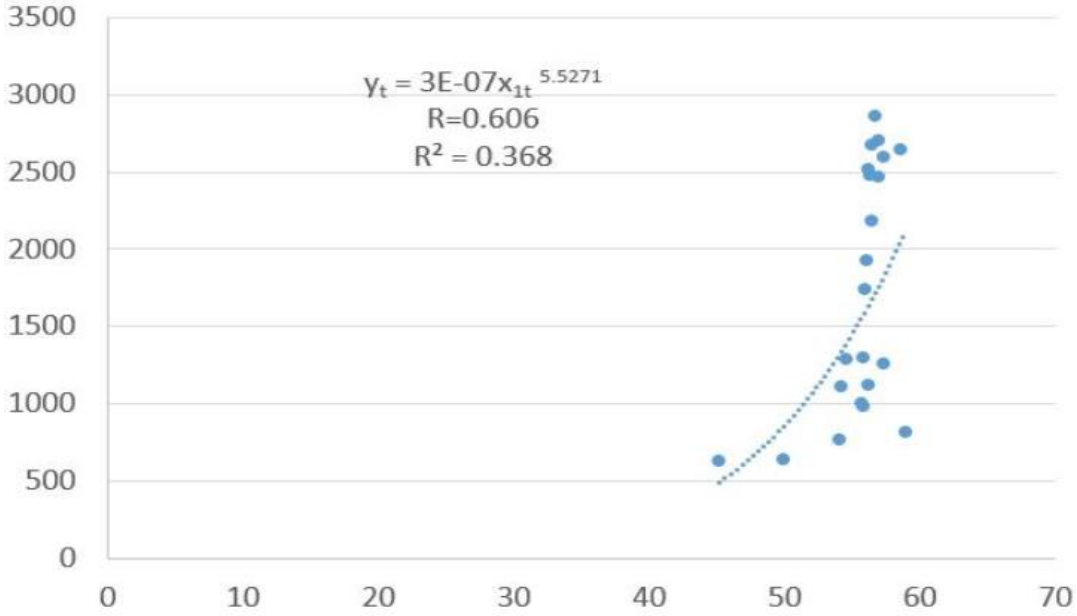

Figure 1. The interdependence of RA agricultural productivity (vertical) and level of commercialization (horizontal) in 2000-2021.

An inverse relationship was formed between the agricultural productivity of the Republic of Armenia and the agricultural services tariff index in 2000-2021, which was presented through a two-dimensional linear regression model:

$$y_t = a_0 + a_1 x_{2t} + e_t \quad (8)$$

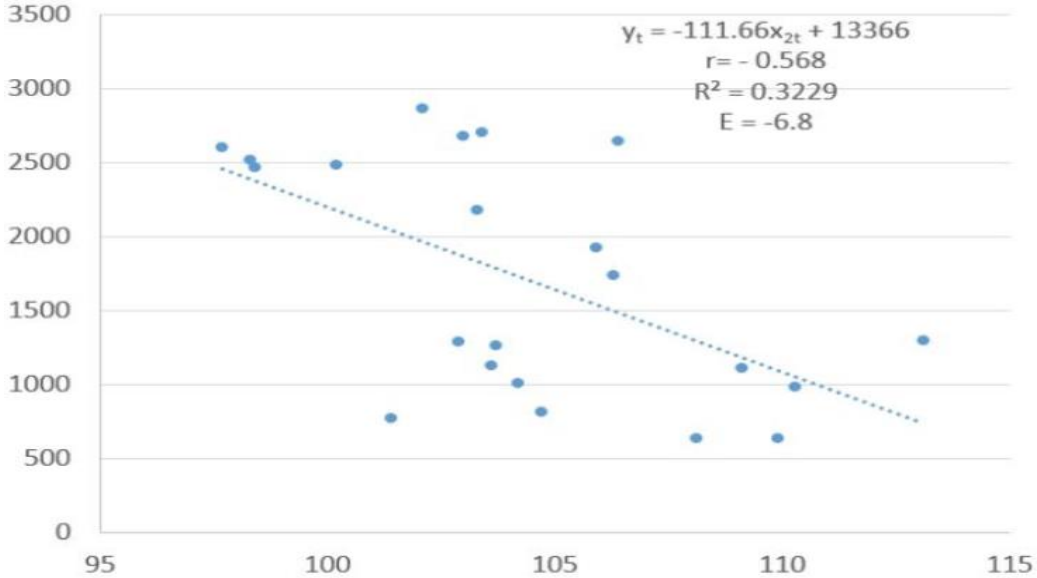

Figure 2. The interdependence of RA agricultural productivity (vertical axis) and agricultural services tariff index (horizontal axis) in 2000-2021

The results of the analysis presented in Figure 2 showed that in the studied years, a strong inverse relationship was formed between the agricultural productivity of the Republic of Armenia and the tariff index of agricultural services. (**r = -0.568**). According to the calculated coefficient of determination, around 32.29% of the fluctuations in the level of agricultural productivity in the studied years are caused by the fluctuations of the price index of agricultural services ($R^2 = 0.3229$), and the remaining 67.71% are caused by other random factors not included in the model. According to the constructed regression model, 2000-2021. an increase in the price index of agricultural services by one percentage point leads to a decrease in agricultural productivity by 111.66 thousand drams/person ($a_1 = -111.66$). In the same period, a one percent increase in the price index of agricultural services leads to a 6.8% drop in agricultural productivity.

The analyzes showed that in 2000-2021 A non-linear relationship was formed between the productivity of RA agriculture and the average annual exchange rate of 1 US dollar, which was presented through a parabolic regression model:

$y_{3t} = a + bx_t + cx_t^2 + e_t$ (9) where: **a,b, c** are the parameters estimated by the least squares method,

e_t - are the effects of random factors not included in the model.

The coefficient of elasticity is calculated, which shows by how much a one percent increase in the factor characteristic changes the resulting characteristic:

$$E = \frac{(b+2\times c\times \bar{x})\times \bar{x}}{a+b\times \bar{x}+c\times \bar{x}^2} \quad (10)$$ [Ekonomietrica, 2007, 90].

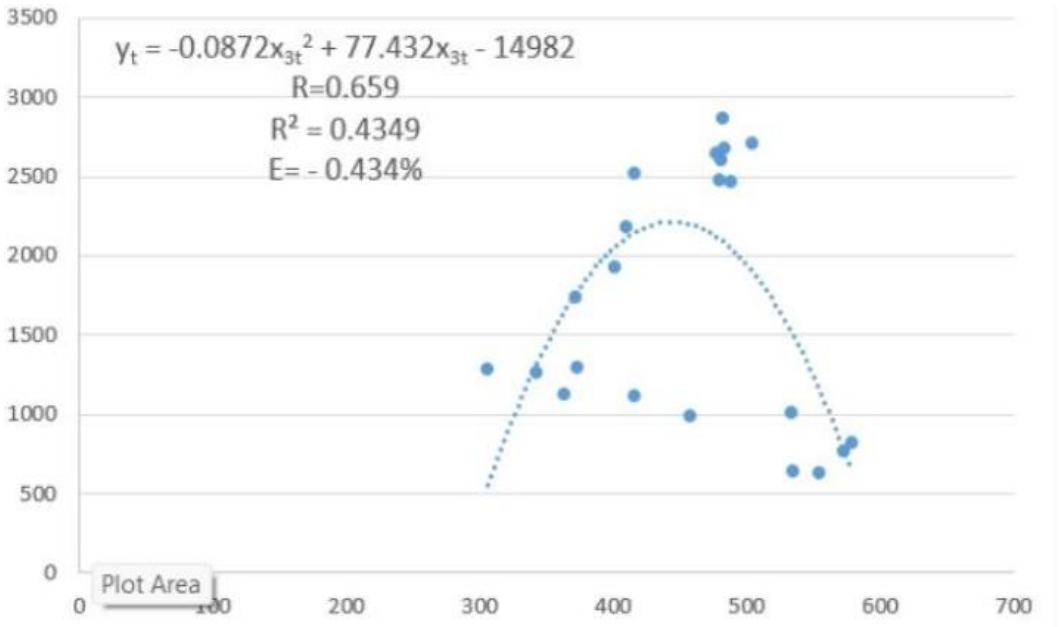

Figure 3. Interdependence of RA agricultural productivity (vertical axis) and the average annual exchange rate (horizontal axis) of one US dollar in 2000-2021

The results of the analysis presented in Figure 3 showed that in the studied years, a strong relationship was formed between the average annual exchange rate of 1 US dollar and the productivity of RA agriculture ($R = 0.659$). According to the coefficient of determination, 2000-2021 About 43.49% of the fluctuations in the level of agricultural productivity in the Republic of Armenia are due to the fluctuations of the average annual exchange rate of 1 US dollar, and the remaining 56.51% are due to the influence of random factors not included in the model. A one percent increase in the calculated elasticity coefficient, the average annual exchange rate of 1 US dollar in the years of study, led to a 0.434% decrease in the level of agricultural productivity in RA. We consider the impact of a number of factors on productivity, the most important indicator of competitiveness.

The application of the regression model provides an opportunity to assess the impact of various factors on agricultural productivity. In order to apply that model, we considered many factors that can logically affect the productivity of agriculture. Our econometric calculations show that not all factors and the productivity index have a statistical relationship. The calculations were made with data covering a long period of time (2000-2021). Calculation indicators of productivity in agriculture and the range of factors affecting them are presented in table 3.

Table 3. Agricultural productivity in RA and individual indicators (factors) affecting it in 2000-2021

Years	Gross agricultural output per employed person (productivity), thousand AMD	Sowing areas of agricult. crops, thousand ha	Gross production of crops, bln drams	Gross output, animal husbandry, bln drams	Tariff index of agricultural services comp. to previous year, %
2000	630.5	303.2	136.2	145.3	109.9
2001	634.0	317.1	208.0	143.0	108.1
2002	766.2	305.6	226.6	151.0	101.4
2003	814.5	314.6	228.7	181.4	104.7
2004	1005.0	322.8	283.9	220.2	104.2
2005	982.9	331.8	288.0	205.0	110.3
2006	1110.2	310.2	356.2	199.7	109.1
2007	1261.5	306.0	429.9	204.0	103.7
2008	1285.2	304.5	405.9	222.2	102.9
2009	1123.1	300.0	346.4	209.3	103.6
2010	1294.9	283.6	302.7	244.0	113.1
2011	1738.1	286.7	465.1	329.9	106.3
2012	1924.7	304.2	516.0	325.5	105.9
2013	2177.4	318.1	572.8	346.3	103.3
2014	2516.5	332.8	605.7	387.8	98.3
2015	2641.7	353.4	550.0	395.4	106.4
2016	2598.3	294.5	486.7	391.8	97.7
2017	2865.3	242.3	469.3	439.3	102.1
2018	2675.0	277.9	415.8	477.1	103.0
2019	2478.4	227.9	410.9	442.4	100.2
2020	2465.4	222.8	399.5	433.8	98.4
2021	2702.1	227.2	469.1	519,2	103,4

The following calculations have been made:

y_t - agricultural productivity in the t year, thousand drams/person,

x_{1t} - sowed areas of agricultural crops in the t year, thousand hectares,

x_{2t} - the gross product of plant breeding in the t year, bln. AMD,

x_{3t} - the gross product of animal husbandry in the t year, billion drams,

x_{4t} - is the index of tariffs for agricultural services in the t year, %.

The influence of the mentioned factors on the level of agricultural productivity of RA in 2000-2021 is presented using a multivariate linear regression model:

$y_t = a_0 + a_1x_{1t} + a_2x_{2t} + a_3x_{3t} + a_4x_{4t} + e_t$ (11) where

$y_t; x_{1t}; x_{2t}; x_{3t}; x_{4t}$ are the actual levels of outcome and factor attributes in t year

$a_0; a_1; a_2; a_3; a_4$ - parameters estimated by the method of least squares,

e_t - is the effect of random factors not included in the model.

In multivariate analysis, partial elasticity coefficients are calculated, which show how much a one percent increase in a factor attribute changes the outcome attribute:

$E_k = a_k \times \frac{\overline{x_k}}{y}$ (12) [Ekonometrica, 2014, 39-53].

Below the results of the regression analysis between the studied phenomena are presented in the table.

Table 4. 2000-2021 The results of the regression analysis between the agricultural productivity of RA, agricultural crops, gross crop production, gross livestock production and agricultural services tariff index

Indicators	**Results**
Multiple correlation coefficient	$R = 0.987$
The coefficient of multiple determination	$R^2 = 0.973$
The regression model	$\widehat{y_t} = 418.8 + 1.327x_{1t} + 1.103x_{2t} + 5.618x_{3t} - 11.$
Coefficient of partial elasticity	$E_1 = 0.228,$ $E_2 = 0.251,$ $E_3 = 0.985,$ $E_4 = -0.709$
Significance of regression coefficients	$a_1(p - value = 0.360),$ $a_2(p - value = 0.03),$ $a_3(p - value = 3.56E - 08),$ $a_4(p - value = 0.235)$
Significance of the model	$F = 155.2(signif. = 3.84E - 13)$

According to the results of the analysis presented in Table 4, a close relationship was formed between the indicators we are studying (**R = 0.987**). According to the calculated coefficient of determination, 2000-2021. About 97.3% of the fluctuations in the level of agricultural productivity of RA are due to the joint fluctuations of the factors included in the model (**R^2 = 0.973**), and the remaining 2.7% are the effects of other and random factors. The performed regression analysis can be considered significant

($F = 155.2 (signif. = 3.84E - 13)$).

According to the constructed multivariate regression model, 2000-2021. Along with the increase of agricultural crops by one thousand hectares, the level of agricultural productivity increased by 1.327 thousand. drams/person (**a_1 = 1.327**), the increase of the gross product of plant breeding by 1 billion drams contributed to the productivity of agriculture to the increase of 1.103 thousand dram/person (**a_2 = 1.103**), and in addition to the increase of the gross output of animal husbandry by 1 billion drams, the productivity level of agriculture increased by 5.618 thousand drams/person (**a_3 = 5.618**). In the studied years, the increase of agricultural services index by 1 percentage point led to the level of agricultural productivity of 11,651 thousand drams/person reduction (**a_4 = 11.651**.

Table 5. Wheat yield in RA and individual indicators (factors) affecting it in 2000-2021.

years	wheat yield, t/ha	wheat exporter's price per 1 kg for last year, drams	gross wheat yield, thousand ton	Agricultural services tariff index compared to the previous year, %	USD exchange rate, AMD
2000	16.6	95	177.8	109.9	555.08
2001	22.3	88	241.7	108.1	535.06
2002	23.9	92	284.7	101.4	573.35
2003	17.2	79	216.7	104.7	578.77
2004	23.4	107	291.6	104.2	533.45
2005	20.3	111	258.4	110.3	457.69
2006	14.6	82	146.5	109.1	416.04
2007	25.8	88	254.2	103.7	342.08
2008	24.3	104	225.7	102.9	305.97
2009	22.4	121	198.1	103.6	363.28
2010	21.2	96	183.5	113.1	373.66
2011	28.8	121	224.1	106.3	372.5
2012	26.5	139	243.1	105.9	401.76
2013	30.8	158	311.6	103.3	409.63
2014	31.8	162	338.2	98.3	415.92
2015	31.3	142	362.7	106.4	477.92
2016	30.7	118	350.4	97.7	480.49
2017	21.8	111	176.4	102.1	482.72
2018	28.2	114	187.5	103	482.99
2019	19.6	113	112.6	100.2	480.45
2020	22.5	126	132	98.4	489.01
2021	16.8	130	97.2	103.4	503.77

The calculated partial elasticity coefficients showed that in 2000-2021. Along with the one percent increase in the cultivated areas of agricultural crops, the level of agricultural productivity increased by 0.228% (**E_1 = 0.228**), the one percent increase in the gross output of crop production contributed to the increase in agricultural productivity by 0.251% (**E_2 = 0.251**), and the level of agricultural productivity paralleled with the one percent increase in the gross output of livestock breeding increased by 0.985% (**E_3 = 0.985**). In the studied years, a one percent increase in the tariff index of agricultural services led to a reduction in the level of agricultural productivity by 0.709% (**E_4 = -0.709**).

We also consider it necessary to address the quantitative impact of various factors on such indicators that characterize the competitiveness in the crop and animal husbandry branches of agriculture, such as yield and grain yield indicators. We consider the yield of wheat as the most important crop. Baseline data on wheat yield and factors influencing it are presented in Table 5.

The following designations were made for factors affecting wheat yield:

y_t - wheat yield level, c/ha, in t year,

x_{1t-1} - price of one kg of wheat offered by wheat producers, drams, in t-1 year,

x_{2t} - gross wheat production, thousand. tons, in t year,

x_{3t} - is the tariff index of agricultural services, %, in t year,

x_{4t} - The average annual exchange rate of 1 US dollar, AMD, in t year.

The influence of the mentioned factors on the level of wheat yield in the Republic of Armenia in 2000-2021 is presented using a multivariate linear regression model (table 6).

Table 6. 2000-2021 The results of the regression analysis between the level of wheat yield in RA, the price per kg of wheat by producers in previous year, the gross output of wheat, tariff index of agricultural services, the average annual exchange rate of 1 USD

Indicators	Results
Multiple correlation coefficient	$R = 0.903$
Coefficient of multiple determination	$R^2 = 0.816$
The regression model	$\hat{y}_t = 43.04 + 0.066x_{1t-1} + 0.04x_{2t} - 0.28x_{3t} - 0.015x_{4t}$
Coefficient of partial elasticity	$E_1 = 0.316,$ $E_2 = 0.4,$ $E_3 = -1.235,$ $E_4 = -0.301$
Significance of regression coefficients	$a_1(p - value = 0.02),$ $a_2(p - value = 3.84E - 05),$ $a_3(p - value = 0.07),$ $a_4(p - value = 0.04)$
Significance of the model	$F = 18.88(signif. = 4.41E - 06)$

According to the results of the analysis presented in Table 6, a close relationship was formed between the indicators we are studying ($R = 0.903$). According to the calculated coefficient of determination about 81.6% of the variations in the wheat yield level in RA 2000-2021 are due to the joint variations of the factors included in the model ($R^2 = 0.816$), and the remaining 18.4% are the effects of other and random factors. The performed regression analysis can be considered significant

$(F = 18.88(signif. = 4.41E - 06))$.

According to the constructed multivariate regression model the increase in the price of wheat in 2000-2021per kg offered by wheat producers in the previous year by one dram contributed to the increase of the wheat yield level by 0.066 t/ha in the given year

($a_1 = 0.066$), the gross wheat harvest was thousand. The increase in tons contributed to the increase of the wheat yield level by 0.04 c/ha ($a_2 = 0.04$), and the increase of one percentage point of the agricultural services tariff index led to the reduction of the wheat yield level by 0.28 c/ha ($a_3 = -0.28$).

In the studied years, the increase of the average annual exchange rate of 1 US dollar by one dram led to the reduction of the wheat yield level by 0.301 t/ha

($a_4 = -0.301$).

The calculated partial elasticity coefficients showed that in 2000-2021 in parallel with a one percent increase in the price of wheat per kg offered by wheat producers in the previous year, the level of wheat yield increased by 0.316% in the following year

($E_1 = 0.316$), a one percent increase in the total wheat harvest contributed to an increase in the level of wheat yield by 0.41% ($E_2 = 0.4$), and agricultural parallel to the one percent increase in the service price index, the level of wheat yield decreased by 1.235% ($E_3 = -1.235$). In the studied years, a one percent increase in the average annual exchange rate of the US dollar led to a 0.301 percent reduction in wheat yield ($E_4 = -0.301$).

Also, we have tried to quantitatively evaluate the influence of the most important index defining the competitiveness of livestock breeding, the factors affecting the average annual milk yield of cows. The econometric calculations show that there is a statistical relationship between not all the considered logical factors and the average annual milk yield of cows. The values of the average annual milk yield of cows and factors statistically related to it are presented in table 7. The agricultural services tariff index is also included in the mentioned factors (presented in table 5).

y_t - the average annual milk yield of one cow in the t year, kg,

x_{1t} - average annual sale price of one liter of milk producers in t year, drams,

x_{2t} - the index of livestock vaccination rates in the t year compared to the previous year,%,

x_{3t} - is the index of tariffs for agricultural services compared to the previous year, % in t year.

Table 7. Average milk yield of cows in RA and individual factors (indicators) affecting it in 2000-2021.

Dates	Average milk yield of cows, kg	Average annual selling price of 1 liter of milk producers	AMD Village: animal vaccination price index, %
2000	1668	103	71.7
2001	1685	102	126.8
2002	1708	98	123.7
2003	1728	101	95.5
2004	1772	100	85.8
2005	1877	101	98.9
2006	1890	107	116.2
2007	1957	112	102.2
2008	1992	115	105.6
2009	2027	105	129.3
2010	2035	114	97.1
2011	2035	163	130.5
2012	2036	143	87.7
2013	2054	145	209.2
2014	2102	162	140.1
2015	2144	146	98.8
2016	2192	137	92.1
2017	2260	145	98.5
2018	2310	152	96.2
2019	2365	144	93
2020	2398	148	90.9
2021	2435	155	94.8

The results of the regression analysis between the average annual milk yield of one cow in RA in 2000-2021, the average annual price of 1 liter of milk producers, the index of livestock vaccination rates, index of agricultural services rates are presented in table 8.

According to the results of the analysis presented in the table, a close connection has been formed between the indicators we study (**R = 0.858**). According to the calculated coefficient of determination, 2000-2021. About 73.7% of the variation in the average annual milk yield of one cow in RA is caused by the joint variation of the factors included in the model ($\mathbf{R^2 = 0.737}$), and the remaining 26.3% is the effect of other and random factors. The performed regression analysis can be considered significant

($\boldsymbol{F = 16.8(signif. = 1.87E - 05)}$).

According to the constructed multivariate regression model, in parallel with the increase in the average annual price of one liter of milk producers by one dram in 2000-2021, the average annual milk yield level of cows increased by 7.811 kg ($\mathbf{a_1 = 7.811}$), in parallel with the increase in the index of livestock vaccination rates by one percentage point, the average annual milk yield level of cows decreased by 1.598 kg ($\mathbf{a_2 = -1.598}$) . In the studied years, the average annual milk yield level of cows decreased by 11,182 kg in parallel with the increase of the tariff index of agricultural services by one percentage point in RA ($\mathbf{a_3 = -11.182}$).

Table 8. The results of regression analysis between the average annual milk yield of 1 cow in 2000-2021, the average annual selling price of 1 liter of milk producers, the tariff index of livestock vaccinations, the tariff index of agricultural services

Indicators	Results
Multiple correlation coefficient	$R = 0.858$
Coefficient of multiple determination	$R^2 = 0.737$
The regression model	$\hat{y}_t = 2387.5 + 7.811x_{1t} - 1.598x_{2t} - 11.182x_{3t}$
Coefficient of partial elasticity	$E_1 = 0.486,$ $E_2 = -0.085,$ $E_3 = -0.572$
Significance of regression coefficients	$a_1(p - value = 2.75E - 05),$ $a_2(p - value = 0.14),$ $a_3(p - value = 0.18),$
Significance of the model	$F = 16.8(signif. = 1.87E - 05)$

The calculated partial elasticity coefficients showed that in 2000-2021 a one percent increase in the average annual selling price of one liter of milk contributed to an increase in the average annual milk yield of cows by 0.486% ($E_1 = 0.486$), a one percent increase in the index of livestock vaccination rates led to a decrease in the average annual milk yield of cows by 0.085% ($E_2 = -0.085$), and a one percent increase in the agricultural services tariff index in RA led to a decrease in the average annual milk yield of cows by 0.572% ($E_3 = -0.572$).

Designation and calculation of the integral index of agricultural competitiveness

The above-mentioned indicators and methods for assessing the competitiveness of agriculture, despite their importance, do not provide a complete quantitative picture of the competitiveness of agriculture. In this case, we consider important to propose an integral index characterizing the competitiveness of agriculture. For the latter, we considered it necessary to propose a system of indicators related to various aspects of agricultural competitiveness, which should be a starting point for proposing and calculating an integral indicator of agricultural competitiveness.

Based on our studies, taking into account the availability of a specific indicator and the fact that it is a characteristic of different aspects of competitiveness, we propose the following system of indicators. The description of the mentioned indicators and the corresponding designations are presented below:

1. The agricultural production volume index (%), APVI.
2. The share of agriculture in gross domestic product (%), SAGDP.
3. The share of employees in agriculture (producers of marketable products) among the total number of people employed in the country (%), SGEA.
4. The share of agricultural crediting in the total volume of crediting of the country's economy (%), SACTVC.
5. The weighted average level of agricultural commercialization (%), WALAC.

6. The average level of self-sufficiency of priority necessary food products included in the national food balance of RA, estimated by energy value (%), ALSEEV.
7. The share of the value of exported agricultural products in the value of the gross agricultural product (%), SEAPGAP.
8. The share of agricultural commercial organizations among the total economic entities in agriculture (%), SACO.

Taking these indicators as a starting point, for calculating the integral index of agricultural competitiveness according to individual years, we offer their mean square formula (designation: IICAt integral index of agricultural competitiveness), which will look like this:

$$IICAt = \sqrt{\frac{APVI^2 + SAGDP^2 + SGEA^2 + SACTVC^2 + WALAC^2 + ALSEEV^2 + SEAPGAP^2 + SACO^2}{8}} \quad (13)$$

For the calculation of the integral indicator of competitiveness, we considered it appropriate to consider it based on the indicators of the last 10 years, in order to be able to more thoroughly assess the trends of the change in competitiveness. For the baseline data, some of which are calculated, the data of the website of the RA Statistics Committee (https://www.armstat.am/am/) and the website of the RA Central Bank (www.cba.am) were the source of information. The baseline data for calculating the integral indicators of agricultural competitiveness according to the considered years (2013-2022) and the calculated integral indicators of competitiveness are presented in Table 9.

Table 9. Baseline data for calculating the integral indicator of the competitiveness of RA agriculture and the integral indicators of agricultural competitiveness calculated on their basis for 2013-2022, (percentage)

INDEX DESIGNATION	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
APVI	107.1	106.3	108.4	96.2	97.2	92.8	95.9	103.2	99.1	100.4
SAGDP	18.4	18.1	17.2	15.9	14.9	13.9	11.5	11.3	11.3	10.4
SGEA	26.9	25.4	25.2	22.8	23.1	24.8	21.9	21.8	21.8	22.0
SACTVC	8.08	8.51	8.79	7.86	6.82	6.08	5.66	4.94	6.74	6.71
WALAC	56.4	56.2	58.6	57.3	56..7	56.5	56.3	57.2	57.0	57.3
ALSEEV	60.82	61.96	63.08	64.50	54.13	51.40	47.48	44.09	44.75	47.07
SEAPGAP	2.5	1.6	1.7	3.3	2.9	4.4	5.6	7.9	9.6	8.5
SACO	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.143
The integral indicator of the competitiveness of agriculture IICAt	49.35	49.19	50.22	46.83	45.28	43.75	43.73	45.49	44.46	45.12

** The data on this baseline indicator is not available for the considered years. Therefore, we have taken as a basis the data of the period of observation of the data of the comprehensive registration of agriculture of the Republic of Armenia (2014).*

The results of the calculation of the proposed integral indicator of agricultural competitiveness show that the competitiveness had a fluctuating characteristic during the observed period – in 2013-2014. It had decreased somewhat, then had an increasing trend and in 2015 the highest index of the observed period was recorded (50.22%), then dec-

reased until 2019, and the lowest level was recorded in 2019. Then in the following year it had an upward trend and fluctuated somewhat in the following two years. Then we considered it appropriate to estimate the average level of the integrated indicator of agricultural competitiveness for the observed years $\overline{\text{IICA}\boldsymbol{t}}$: For the latter, we suggest using the following formula:

$$\overline{\text{IICA}\boldsymbol{t}} = \sqrt{\frac{\text{IICA}\mathbf{1}^2 + \text{IICA}2^2 + \text{IICA}3^2 + \text{IICA}4^2 + \cdots \ldots \ldots + \text{IICA}n^2}{n}} \quad (14)$$

Here n is the number of years observed (n=10).

Inserting the relevant data into the formula, we get the following: $\overline{\text{IICA}\boldsymbol{t}}$ = **46.60 %**

In fact, in the observed period in 2017 and after that, the integral indicators of agricultural competitiveness were lower than the average level of these indicators.

Conclusions. As a result of the research, the following conclusions were made:

1. The policy conducted in the agricultural sector has had a positive impact on the competitiveness of the sector with the demonstrated budgetary allocations, but this impact is weak.

2. Characterizing the separate or joint effect of various factors on the results indicators of the competitiveness of RA agriculture in 2000-2021, the results of the regression analysis allow us to conclude that the unit volume increase of the parameters characterizing the magnitude of these factors had an impact on the indicated indicators in different directions and sizes, and the fluctuations of the latter magnitudes to a greater or lesser extent were due to the combined influence of individual factors.

3. In all the years of the observed period, the integral indicators of agricultural competitiveness were below the average and were characterized by variable dynamics, and in 2017 and after that, the integrated indicators of agricultural competitiveness were below the average level of these indicators.

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Quantitative evaluation of the influence of individual factors on the result indicators characterizing the competitiveness of RA agriculture and the integral indicator of that competitiveness

Key words: agriculture, competitiveness, indicators, factors, integral index, budget allocations, agricultural output index, productivity, gross output, agricultural commodity, agricultural services tariff index, producer price.

It is impossible to get a comprehensive understanding of the impact of the factors determining the competitiveness of agriculture without a regression model and a quantitative assessment of that impact using econometric calculations, which allows to izolate the factors that have a greater or lesser impact. However, the range of result and factor indicators that have a statistical relationship with the competitiveness of the Republic's agriculture is not comprehensive (taking into account that not all of them may have such a relationship), which limits the possibilities of quantitative assessment of the joint impact of all factors on the said competitiveness. In this case, it is necessary to limit to the quantitative assessment of the impact of specific factors on individual characteristics of agricultural competitiveness. Taking into account the special role of the state policy factor in increasing the competitiveness of agriculture in terms of creating the necessary conditions and a favorable environment, the article highlighted and revealed the individual characteristics of the competitiveness of RA agriculture in the studied period: the value of the gross production of agriculture, the index of the volume of agricultural products, the productivity and commodity of agriculture, the statistical relationship between the level and the factor of budgetary allocations to agriculture considered as the bearer of the above-mentioned policy as a result of regression analysis.