

**QUANTITATIVE CHARACTERISTICS OF THE IMPACT OF VARIOUS
FACTORS ON SOME INDICATORS CHARACTERIZING THE
COMPETITIVENESS OF AGRICULTURE IN RA**

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Introduction. Competitiveness is one of the most important characteristics of the market economy and the most important economic category. There are various definitions in the economic literature regarding the concept of competitiveness, in which emphasis is placed on its individual characteristics, including productivity. Therefore, 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 influence the size of the mentioned indicator, in particular: level and structure of agricultural mechanization, employment of the population, gross agricultural product, yield of agricultural crops and food yield of agricultural animals, level of agricultural commercialization, agricultural services tariff index, foreign currency (for example, USD) exchange rate. 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 among the factors determining the grain yield, the price of the milk producer, the price

index of livestock vaccinations can be considered. The influence of the mentioned factors on yield and grain yield may be more or less.

The separation of the factors that affect the competitiveness of agriculture and its sub-sectors to a greater or lesser extent makes it possible to direct efforts to the mitigation of specific negative factors and to make 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. In this context, the quantitative assessment of the impact of individual factors determining labor productivity, yield (in particular, wheat) and grain yield (for example, milk yield of cows) in RA agriculture is becoming relevant.

The aim of the article is to use a regression model to evaluate the quantitative impact of individual factors on individual characteristics of RA agriculture's competitiveness: productivity, wheat yield, and milk yield of cows, and to identify the more or less influencing factors, which will allow efforts to be aimed at mitigating specific negative factors and maximizing the possibilities of positively influencing factors. to use.

Methodology. The article uses dialectics, scientific abstraction, comparative analysis, logical and statistical 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 applies to the entire research, since the scope of the latter is limited to individual characteristics of agricultural competitiveness and a limited number of factors affecting them, 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 individual factors on individual characteristics of agricultural competitiveness.

The use of statistical methods is demonstrated in the calculations of correlation and determination coefficients.

Literature review. A number of economists, including A. Borel [Borel, 2014, 4], [Lenskaya, 2013, 87], K. Saubanov [Saubanov, 2010, 38-53], V. A. Klyukach [Klyukach, 1998, 208], Bespyatnykh [Bespyatnykh, 2000, 200], O Koryakina [Koryakina, 2019] and others have identified a more limited or comprehensive range of mentioned factors. As a result, individual factors were left out of view. We take into consideration, in particular, the gross agricultural output, the level of commercialization, the index of tariffs for agricultural services, the exchange rate of foreign currency (for example, the US dollar), the gross yield of the given crop, the price of the milk producer, the price index of livestock vaccinations, which are not all were considered by economists 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 assessment 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.

Scientific novelty. The statistical relationship between individual characteristics of the competitiveness of RA agriculture in the studied period: productivity, wheat yield and milk yield of cows and a number of factors determining them, as well as the factors that have more or less influence on these characteristics, were revealed. 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.

As a result indicator characterizing the competitiveness of the mentioned branch, we considered, first of all, the productivity in agriculture and we tried to separately consider the influence of various factors on that indicator.

Within the framework of the research, the task is to specify the range of factors that have a statistical relationship between them and the productivity index, as well as to perform a regression analysis characterizing the influence of the mentioned factors.

The application of the regression model provides an opportunity to assess the impact of various factors on agricultural productivity. For this purpose, we have considered many factors that can logically affect the productivity of agriculture. We carried out multivariate linear regression and correlation analysis with ms excel program [Vardanyan, Keshishyan, 2022, 41-43]. 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 (2000-2020). First, we consider the impact of

the gross agricultural product at current prices on the result indicator characterizing competitiveness. The observations were carried out for a long period (21 years) for 2000 - 2020. We observed the effect of the factors graphically, and evaluated the direction of the effect using aligned indicators (diagram 1).

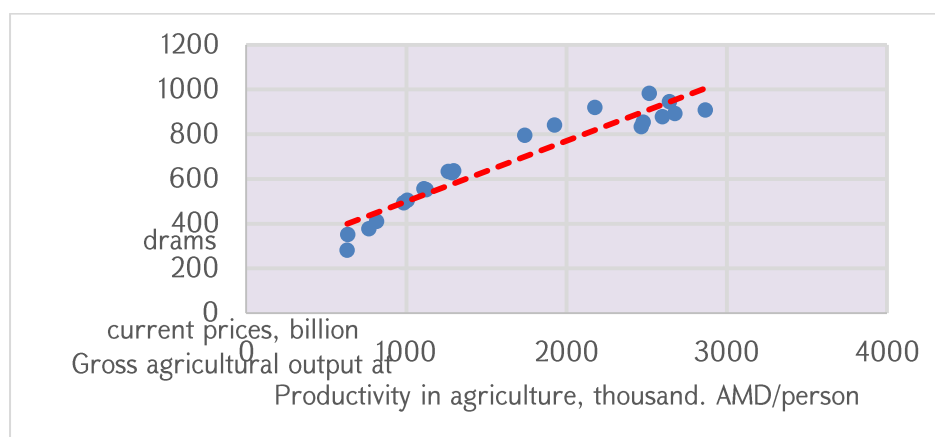


Figure 1. The data characterizing the dependence of the value of the gross agricultural product at current prices and the productivity in agriculture for 2000-2020
(www.armstat.am)

From the leveled data of the presented chart, it is obvious that the increase in the gross output of agriculture at current prices leads to an increase in agricultural productivity. In particular, a 1.5-fold increase in the gross output of agriculture leads to an increase in agricultural productivity by about 2.2 times. We considered it important to consider the impact of the level of agricultural commercialization on agricultural productivity. The mentioned dependency is presented graphically for the years 2000-2020 in chart 2. It is obvious from the data of the latter that the increase in the level of commercialization of agriculture leads to an increase in the level of agricultural productivity. Thus, from the data presented in the diagram, we can estimate that an increase in the level of commercialization by 6.5 percentage points, under other unchanged conditions, leads to an increase in agricultural productivity by about 4.6 times.

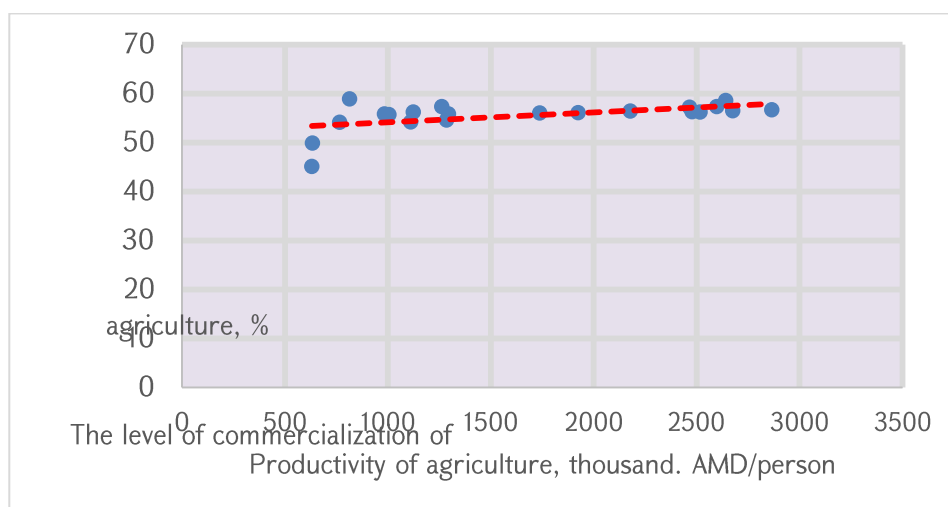


Figure 2. The data characterizing the dependence of the level of commercialization of agriculture and productivity in agriculture for the years 2000-2020 (www.armstat.am) for the calculation of productivity and the level of commercialization of agriculture.

We need to consider the effect of the change in the tariff index of agricultural services on the agricultural productivity index. Logically, an increase in the specified factor index should lead to a decrease in productivity. It is evident from the data in the 3rd chart.

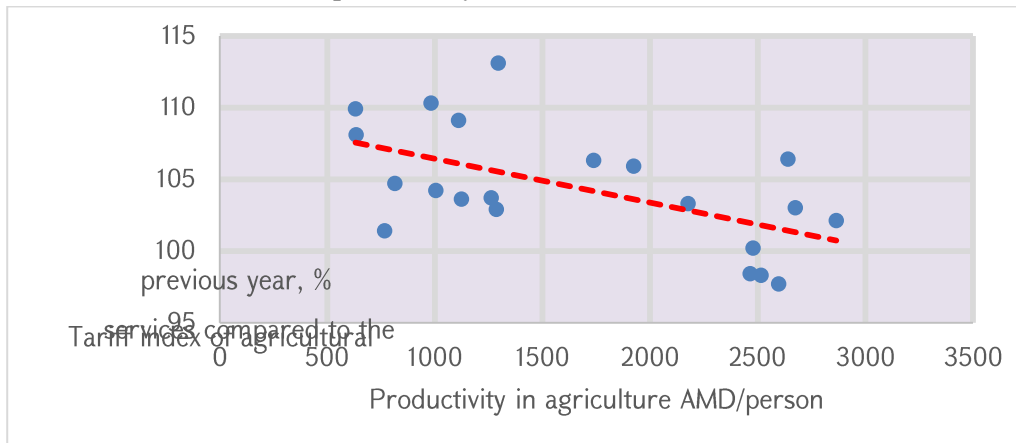


Figure 3. The data describing the dependence of the tariff index of agricultural services and the productivity in agriculture for the years 2000-2020. The basis for the calculation is www. armstat.am

According to the data of the chart, it can be estimated that the increase of the tariff index of agricultural services by 6.9 percentage points, under other unchanged conditions, leads to a decrease of the agricultural productivity index by about 4.6 times. That is, an increase in the index of agricultural services by 1 percentage point leads to a dec-

rease in the productivity index by about 0.67 times. We considered it important to study the impact of the change in the exchange rate of the US dollar on agricultural productivity. Logically, given that most agricultural inputs are imported, an increase in the exchange rate of the US dollar should lead to a certain decrease in the productivity index. The latter is evident from the data in the 4th diagram.

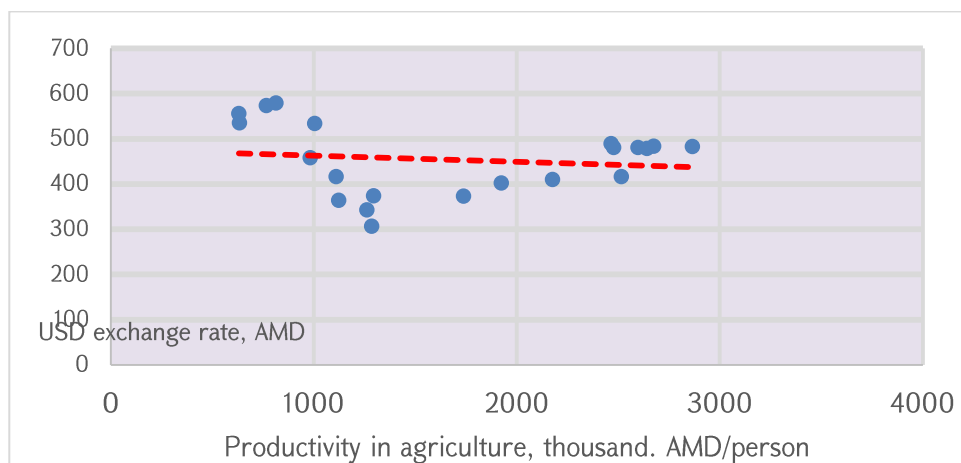


Figure 4. The data characterizing the dependence of the US dollar exchange rate and productivity in agriculture for the years 2000-2020. source: www.armstat.am

From chart 4, we can estimate that an increase in the exchange rate of the US dollar by 75 drams leads to a decrease in productivity by 4.6 times, or an increase in the exchange rate of the US dollar by 1 dram can reduce agricultural productivity by 6.1%. Then we observe the joint effect of a number of factors on productivity, the most important indicator defining competitiveness. Thus, we should note that in 2000-2020 the range of factors with a statistical relationship with the agricultural productivity of the republic, although at first glance it was quite limited, it nevertheless reflects the quantitative influence of a number of other factors on the magnitude of the indicated result index in a condensed form. So that the non-inclusiveness of the specified framework may not limit the possibilities of a full quantitative assessment of the impact of individual factors on agricultural productivity. We also consider it necessary to address the quantitative impact of various factors on the indicators characterizing the competitiveness in the crop and animal husbandry branches of agriculture, such as yield and grain yield indicators.

We examine the yield of wheat as the most important crop. The performed econometric calculations show that there is a statistical relationship between wheat yield and not all logical factors. Thus, our calculations show that the factor indicators presented in Table 1 are statistically related to the wheat yield index.

Table 1. Individual indicators (factors) of wheat yield in RA in 2000-2021

years	Wheat yield, t/ha USD	Last year's producer price, wheat per 1 kg, AMD	Gross wheat yield, 1000 ton	Agricultural services tariff index compared to the previous year, %	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

*For the previous calculations, the year 2021 is not included, because the number of people employed in agriculture for 2021 was not published during the calculation period.

With the methodology used to evaluate the joint effect of various factors affecting wheat yield, we performed regression calculations with a computer program. Here we have taken 2000-2021 as the result. Wheat yield index (denoted Y_i , cents/ha). As for the factor characteristics, they are as follows: last year's wheat producer's price per 1 kg (X_1 , AMD), gross wheat production (X_2 , thousand tons), agricultural services tariff index compared to last year (X_3 , %), USA dollar exchange rate (X_4 , AMD). The results of the calculation made by the computer program are presented in table 2.

Table 2. The results of the regression analysis characterizing the impact of the previous year's producer price of wheat, the gross wheat product, the agricultural services tariff index, and the exchange rate of the US dollar on the yield of wheat in the RA¹

Indicators and Observations	Coefficients	Significance of <i>P</i>	Accuracy of <i>F</i>
Multiple R	0.90349		
the square of R	0.81629		
normed square of R	0.77306		
Standard error	2.43387		
Observation	22		
Y-intersection	43.04882	0.02736	0-իւ մնւ
The variable X₁	0.06607	0.02950	
The variable X₂	0.04164	3.84E-0.5	
The variable X₃	-0.28010	0.07195	
The variable X₄	-0.01565	0.04654	

According to the calculations made in this way, the regression equation looks like this:

$$Y_i = 43.04882 + 0.06607X_1 + 0.04164X_2 - 0.28010X_3 - 0.01565X_4 \quad (1)$$

It should be noted that the significance coefficient (F) is close to 0 according to the calculation. The latter proves that the given model has statistical influence with almost 100 percent accuracy. The R² coefficient is equal to 0.81629. The latter testifies that 81.6% of the changes in the dependent variable (wheat yield index) are caused by the factor characteristics of the model, independent variables. The obtained regression equation shows that, other things being equal, an increase in the previous year's wheat producer price by 1 dram per 1 kg leads to an increase in wheat yield by 0.066 cents/ha. 1 thousand of gross wheat production. an increase in tons leads to an increase in yield by 0.042 cents/ha. As for the tariff index of agricultural services, its increase by 1% leads to a decrease in wheat yield by 0.280 cents/ha. The devaluation of the US dollar by 1 dram leads to a decrease in wheat yield by 0.016 cents/ha.

We also need to quantitatively assess the influence of factors affecting the average milk yield of cows, the most important index characterizing the competitiveness of cattle breeding. The econometric calculations show that there is a statistical relationship between not all of the considered logical factors and the average milk yield of cows. The agricultural services tariff index is also included in the mentioned factors.

¹ RA NSS, Agriculture of RA 2000-2005, 2006, 8; 23, 2004 Food security & poverty. Jan.-Dec., 2005, 8; 23; 2007, 12; 39; 42; 2012, 11; 35; 38, HR VC; 2016. Jan.-Dec., 2017, 11; 35; 38; 2012, 2022, 11; 36; 39.

Table 3. Average milk yield of cows in RA, individual factors affecting it 2000-2021¹

years	Average milk yield of cows, kg	Milk producer's price per 1 liter, AMD	Index of cattle vaccination prices, %
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

In order to evaluate the combined effect of various factors affecting the average milk yield of cows, we performed regression calculations with a similar methodology using a computer program. Here we have taken 2000-2021 as the result. the average milk yield of cows (denoted by Y_i , kg). The price of milk producers per 1 liter (X_1 , AMD), the price index of animal vaccinations compared to the previous year (X_2 , %), the tariff index of agricultural services compared to the previous year (X_3 , %). The results of the calculation made by the computer program are presented in table 4.

Here also the significance coefficient (F) is close to 0. In other words, this model with almost 100 percent accuracy has statistical influence. The R^2 coefficient is equal to 0.71361. This proves that 71.4% of changes in the dependent variable (average milk yield of cows) are due to independent variables of the model. The regression equation shows that, other things being equal, increasing the price of 1 liter of milk by 1 dram leads to an increase in the average milk yield of cows by 7.57 kg. An increase in the price index of agricultural animal vaccinations by 1 percentage point leads to a decrease

¹ NSS of Armenia, Statistical Yearbook of Armenia, 2002, 339. 2007, 289. 2012, 306; 2017, 314. 222, 366; 2004; Food security and poverty, Jan.-Dec., 2005, 22; 23; 2007, 36; 39; Food security and poverty of 2011, Jan.-Dec., 2012, 33; 35, HR VC, Food security and poverty in 2016. January-December, 2017, 28; 35, HR VC, Food security and poverty in 2022. January-September, 2022, 29; 36.

in the milk yield of cows by 1.8 kg. As for the change in the price index of agricultural services, its 1% increase leads to a decrease in the milk yield of cows by 10.16 kg.

Table 4. The results of the regression analysis characterizing the influence of the selling price of milk by milk producers, the price index of agricultural animal vaccinations and the price index of agricultural services on the average milk yield of cows in RA

Indicators and Observations	Coefficients	Significance of <i>P</i>	Accuracy of <i>F</i>
Multiple R	0.84475		
the square of R	0.71361		
normed square of R	0.66587		
Standard error	135.2308		
Observation	22		
Y-intersection	2323.29795	0.02706	Close to 0
The variable X ₁	7.57053	5E-0.5	
The variable X ₂	-1.80043	0.10686	
The variable X ₃	-10.16183	0.23328	

As a result of calculations, the regression equation looks like this:

$$Y_i = 2323.29795 + 7.57053X_1 - 1.80043X_2 - 10.16183X_3 \quad (2)$$

The results of the built regression models are considered important for the development of justified approaches, steps and policies in the direction of increasing the competitiveness of agriculture.

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

1. A 1.5 times increase in the gross output of agriculture leads to an increase in productivity by about 2.2 times.
2. A 6.5 percentage point increase in the level of agricultural productivity leads to an increase in productivity by about 4.6 times, under other unchanged conditions.
3. The increase of the tariff index of agricultural services by 6.9 percentage points, in other unchanged conditions, leads to a decrease of the productivity index by about 4.6 times.
4. An increase in the exchange rate of the US dollar by 75 drams leads to a decrease in productivity by 4.6 times, or an increase in the exchange rate of the US dollar by 1 dram can reduce productivity by 6.1%.
5. 81.6% of the changes in the wheat yield index are due to the factor characteristics of the model, independent variables.
6. Other things being equal, an increase in the previous year's price of wheat by 1 dram per 1 kg leads to an increase in its yield by 0.066 cents/ha.
7. Other things being equal, 1 thousand of the gross wheat product. an increase in tons leads to an increase in yield by 0.042 cents/ha.

8. A 1% increase in the tariff index of agricultural services leads to a decrease in wheat yield by 0.280 cents/ha.

9. The devaluation of the US dollar by 1 dram leads to a decrease in wheat yield by 0.016 cents/ha.

10. 71.4% of the changes in the average milk yield of cows are due to the independent variables of the model.

11. Other things being equal, increasing the price of 1 liter of milk by 1 dram leads to an increase in the average milk yield of cows by 7.57 kg.

12. Other things being equal, an increase in the price index of vaccinations of agricultural animals by 1% point leads to a decrease in the milk yield of cows by 1.8 kg.

13. Other things being equal, a 1% increase in the price index of agricultural services leads to a reduction in the milk yield of cows by 10.16 kg.

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Quantitative characteristics of the impact of various factors on some indicators characterizing the competitiveness of RA agriculture

Key words: agriculture, competitiveness, indicators, factors, budget allocations, index of agricultural output, productivity, gross output, commodityization of agriculture, index of tariffs for agricultural services, 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 isolate 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 role of productivity, yield and grain yield as the main result indicators characterizing the competitiveness of agriculture and its sub-sectors, the article highlighted and revealed the statistical relationship between these indicators and the individual factors affecting them in the period under study as a result of regression analysis (including considering the yield of wheat, and grain yield with the example of milk yield of cows). This made it possible to identify the factors that have a greater or lesser influence on the magnitude of the indicated indicators and to direct efforts to the mitigation of specific negative factors and to make the most of the possibilities of positively influencing factors.