Evaluation of the sale of grain in certain categories of farms, as the main product of land cultivation

I G Generalov\textsuperscript{1}, S A Suslov\textsuperscript{1}, A S Kadyrberdieva\textsuperscript{2}, R I Bazhenov\textsuperscript{3} and O V Burik\textsuperscript{4}

\textsuperscript{1}Nizhny Novgorod State Engineering and Economic University, 22A, Oktyabrskaya Str., Knyaginino, 606340, Russia
\textsuperscript{2}Academy of Public Administration under the President of the Kyrgyz Republic, 237 Panfilov Str., Bishkek, 720040, Kyrgyz Republic
\textsuperscript{3}Sholom-Alechem Priamursky State University, 70A, Shirokaya Str., Birobidzhan, 679015, Russia
\textsuperscript{4}Pacific National University, 136, Tikhookeanskaya Str., Khabarovsk, 680035, Russia

E-mail: r-i-bazhenov@yandex.ru

Abstract. The purpose of the study is to assess the possibility of selling grain. The authors used a set of indicators describing the central trend, variability of time series data, as well as the forms of their distribution. The materials of the analytical part were the data of the Territorial Body of State Statistics of the Nizhny Novgorod Region and the Unified Interdepartmental Information and Statistical System. The article provides an economic and statistical assessment of the implementation of one of the agricultural regions of the Non-Black Earth Region - the Nizhny Novgorod Region. As a result of the study, a low level of grain sales was established. The analysis revealed the categories of farms with the weakest levels of grain sales in the region.

1. Introduction

Now the level of food independence in the Russian Federation for grain products has reached 108%. Grain, as a multipurpose product, provides the formation and development of food markets. It should also be noted that for many agricultural producers the sale of grain is a significant item in the revenue structure. However, one should take into account both the market capacity and the ability to realize the surplus production.

Many scientists have studied grain farming, but it should be noted Zander et al. [1] who reviewed the grain production in Europe; Duc et al. [2] who studied the conditions for transforming grain production to stabilize agriculture; Mahmood et al. [3], who modeled the impact of grain production on the economy of the country's macro-region; as well as Russian scientists Altuhov [4], whose studies reflect the impact of grain production on food security; Kovalenko [5], Minakov [6] and Sandu [7], who paid attention to the economic efficiency of grain production and sale.

The aim of the study is to assess the sustainability of grain sales. The object of the study was grain producers in the Nizhny Novgorod region.
2. Materials and methods
When conducting the study, the authors used a set of indicators describing the central trend, variability of time series data, as well as the forms of their distribution [8-9]. The calculations were carried out in MS Excel.

To carry out the analytical part of the work, the materials of the Territorial Body of State Statistics of the Nizhny Novgorod Region and the Unified Interdepartmental Information and Statistical System (EMISS) were used, reflecting the production and sale of grain in the context of categories of farms (agricultural organizations, peasant (farmer) households and individual entrepreneurs, households) of the Nizhny Novgorod region for the period 2010–2019 [10].

3. Results
Statistical methods play an important role in economic research. Fundamental here are the assessment of the central trend, variability and the study of the shape of the data distribution. Table 1 shows the central trend in the dynamics of grain sales in the Nizhny Novgorod region.

| Farm category                                      | Max   | Min   | Median | Mode  | Mean  |
|---------------------------------------------------|-------|-------|--------|-------|-------|
| Peasant (farming) households and individual entrepreneurs | 60.75 | 22.57 | 49.93  | 60.75 | 48.73 |
| Agricultural organizations                        | 755.26| 361.26| 496.115| 755.26| 511.52|
| Households of the population                      | 3.05  | 0.89  | 1.87   | 3.05  | 1.86  |
| Farms of all categories                           | 802.76| 412.95| 556.530| 802.76| 562.09|

The central trend in the dynamics of grain sales in the Nizhny Novgorod region for all categories of farms is characterized by the fact that the maximum sales in the period amounted to 802.76 thousand tons, the minimum - 412.95 thousand tons. The most common grain sales volume is 556.3 thousand tons, and the median value is 802.76 thousand tons. On average, 852.09 thousand tons were sold in the region annually in the study period.

In matters of economic and statistical assessment of grain sales, one should apply not only indicators of the central trend, but also the variability and distribution patterns, which reflect the fluctuations of the economic indicator (tables 2 and 3).

To assess the variability, it is necessary to use such indicators as the range of variation, standard deviation and coefficient of variation (table 2).

| Farm category                                      | Swivel variation | Standard deviation | The coefficient of variation |
|---------------------------------------------------|------------------|--------------------|-----------------------------|
| Peasant (farming) households and individual entrepreneurs | 38.18            | 11.682             | 78.4                        |
| Agricultural organizations                        | 394.0            | 103.636            | 77.0                        |
| Households of the population                      | 2.16             | 0.812              | 116.3                       |
| Farms of all categories                           | 389.81           | 104.938            | 69.3                        |

In general, it can be noted that for all categories of farms, grain production is less stable relative to its implementation. Agricultural organizations, where the value of the coefficient of variation is 77.0%, are subject to the least variability in the sale of grain. It should be especially noted the imbalance of sustainability in households and peasant (farmer) households and individual entrepreneurs. Households of the population, with the necessary resources, have the potential for sustainable production, but this is constrained by the lack of an opportunity to enter a wider grain market.
Thus, in modern conditions, for a long time, the grain economy of the Nizhny Novgorod region will be determined by agricultural organizations that have the necessary production resources and access to the market, especially large producers. Despite this trend, an unstable level of production and sales is characteristic of the entire region, since from a statistical point of view, the values of the coefficient of variation above 35% indicate the heterogeneity of the data, and hence a low level of stability.

The study of the data distribution form allows drawing conclusions about the nature of the instability and is carried out on the basis of kurtosis and asymmetry (table 3). Low values of skewness and kurtosis indicate a slight deviation from the normal distribution and vice versa.

| Farm category                      | Excess | Asymmetry |
|------------------------------------|--------|-----------|
| Peasant (farming) households and individual entrepreneurs | 1.918  | -1.386    |
| Agricultural organizations         | 3.412  | 1.322     |
| Households of the population       | -1.747 | 0.089     |
| Farms of all categories            | 2.853  | 1.131     |

In peasant (farming) households and individual entrepreneurs in the sale of grain, there is a left-sided asymmetry of data and a positive excess. In agricultural organizations, a positive excess was also found in the data on grain sales, but a right-sided asymmetry was noted. The described data confirm the conclusions of the previous table. A different situation can be traced in households of the population, where there is a positive excess and right-sided asymmetry, which also confirms the generalized conclusions of the previous table.

4. Discussion

Having estimated the features of time series on the basis of the central tendency, variability and the study of the form of data distribution, one can proceed to assessing their trends, since the conditions under which the stability of the trends was formed are known. To solve this problem, it is necessary to determine and correlate the equations for the trend of grain production and sales (figure 1).

The equation of the linear trend of the dynamics of grain sales is expressed as $y = 447.01 + 20.924 x$, that is, it can be stated that in the analyzed ten-year growth in grain sales averaged 20.924 thousand tons per year. The study of the dynamics of grain sales in the Nizhny Novgorod region allows us to conclude that the degree of reliability of the equation is at a low level (36.4%).

Next, you should pay attention to the ten-year dynamics for certain categories of farms (table 4).
Table 4. Linear trends in the production and sale of grain in the context of farm categories.

| Farm category                                      | The equation       | $R^2$ |
|---------------------------------------------------|--------------------|-------|
| Peasant (farming) households and individual entrepreneurs | $y = 33.791 + 2.715 x$ | 0.495 |
| Agricultural organizations                        | $y = 411 + 18.275 x$ | 0.285 |
| Households of the population                      | $y = 2.221 - 0.066 x$ | 0.061 |
| Farms of all categories                           | $y = 33.791 + 2.715 x$ | 0.495 |

Peasant (farm) households and individual entrepreneurs.
The average annual growth in grain sales in this category of farms amounted to 2.715. It is important to note that in this category of farms, the trend equation has the highest accuracy.

Agricultural organizations.
In the study period, the increase in grain sales by agricultural organizations amounted to an average of 18.275 thousand tons per year. The accuracy of the obtained equations in this category was 28.5%.

Households of the population.
The average annual decline in grain sales volumes amounted to 0.066 thousand tons per year. The accuracy of the obtained equations for households of the population was 6.1%.

In general, we can note an overall weak level of implementation sustainability. Peasant (private) farms and individual entrepreneurs have the weakest level of production stability, and households have the weakest level of grain sales stability.

5. Conclusion
In the course of the study, the authors established a low level of sustainability, both in grain production and in its implementation, and also identified the categories of farms with the weakest levels of sustainability in grain production and sale.

According to Altukhov, who studies the grain industry, the determining factor for the sustainable development of the grain economy and the grain market is the organizational and economic conditions that ensure the profitability of farmers and the investment attractiveness of the grain industry, its transfer to an innovative and investment development path [11]. In turn, Rau notes that in 65 constituent entities of the Russian Federation, conditions for agricultural production are recognized as unfavorable, which is associated with the implementation of unrelated support in the field of crop production per hectare of sown area [12]. The paths outlined by the scientist are necessary in view of the current problem, but it is also necessary to highlight more specific ones for the Nizhny Novgorod region. So on the basis of the study, it is possible to note the problem of the output of households to the regional grain market and the lack of production resources of peasant (farmer) households and individual entrepreneurs.

References
[1] Zander P, Amjath-Babu T S, Preissel S, Reckling M, Bues A, Schlafke N, Kuhlman T, Bachinger J, Uthes S, Stoddard F, Murphy-Bokern D and Watson C 2016 Grain legume decline and potential recovery in European agriculture: a review. Agronomy for Sustainable Development 36 26
[2] Duc G, Agrama H, Bao S, Berger J, Bourion V, De Ron A M and Zong X 2015 Breeding Annual Grain Legumes for Sustainable Agriculture: New Methods to Approach Complex Traits and Target New Cultivar Ideotypes. Critical Reviews in Plant Sciences 34 381-411
[3] Mahmood F, Belhoucette H, Nasim W, Shahzad T, Hussain S, Therond O and Wéry J 2017 Economic and environmental impacts of introducing grain legumes in farming systems of Midi-Pyrenees region (France): A simulation approach. International Journal of Plant Production 11 65-87
[4] Altuhov A I 2009 Grain farm and food security of Russia. Agrarian and industrial complex: Economy, management 1 3–12
[5] Kovalenko N Y 2004 *Rural economics: the textbook for students of higher educational institutions* (Moscow: Yurkniga) 384

[6] Minakov I A 2004 *Economy of branches of agrarian and industrial complex* (Moscow: Koloss) 464

[7] Oglobin E S, Sandu I S, Svobodin V A and Kosolapova M V 2005 *Efficiency of agricultural production (methodical recommendations)* (Moscow: VNIIESH) 156

[8] Generalov I G, Zavivaev S N, Polyanskiy M V and Suslov S A 2019 Sustainability of grain production in the agroclimatic regions of the region. *Bulletin NGIEI* 6 96–105

[9] Generalov I, Suslov S, Bazhenov R, Sibiryaev A and Polivaeva O 2019 Factors of growth of efficiency of grain production in the Nizhny Novgorod. *The European Proceedings of Social and Behavioural Sciences* 58 875–881

[10] *Territorial body of the Federal Service of State Statistics in the Nizhny Novgorod Region* Retrieved from: https://nizhstat.gks.ru/

[11] Altukhov A I 2013 Improving the sustainability of the development of grain farming and the grain market in Russia. *Agri-food policy of Russia* 5 2–13

[12] Rau V V 2016 On the development strategy for the grain sector. *Studies on Russian Economic Development* 27 45-53