The impact of structural changes on the profitability of agricultural organizations in the region

V Vorobyova1*, S Vorobyov1 and A Chernykh2

1 Altai State University, 61 Lenina prospekt, Barnaul 656049 Russia
2 Altai Branch of RANEPA, 187 Partizanskaya str., Barnaul 656008 Russia

E-mail: vvvtoria@mail.ru

Abstract. Studies were conducted to determine the influence of structural factors on the profitability of agricultural production. The main hypothesis: the structural shifts of the sectoral structure are associated with changes in conditions in the market for agricultural products, raw materials and food, the system of state regulation of agricultural production, as well as relations between partners in the agro-industrial complex. It was revealed that the largest amplitude of structural fluctuations per unit specific weight of products was observed for sheep, beet, beekeeping, and pig breeding products. The decline in production in sheep breeding is associated with the elimination of unprofitable activities in the pig industry, mainly with the bankruptcy of the loaned pig farms. The influence of structural and quality indicators on the profitability of agricultural enterprises in the region as a whole and its natural-economic zones is shown. Given the number of industries, the standardized weighted profitability ratio is higher in municipalities with a high concentration of crops of grain crops, sunflower, sugar beet, and it is below with a concentration of milk production. The directions of the formation of the mechanism of balanced (proportional) development of agriculture are generalized, connected with the need to improve state regulation of the development of agriculture and the mechanism of producers’ adaptation to changes in external conditions.

Structural changes in the agrarian economy are both the result and the factor of the transformation processes occurring in it. According to G. N. Nikonova, “Transformation is a process that occurs under the influence of agrarian reform and adaptation of agricultural producers to the changes taking place” [1, p. 45]. This emphasizes the complexity of the object under study, which, on the one hand, is predetermined by the planned and purposefully carried out state transformations and by the contradictory interests of the economic entities of the agro-industrial complex, operating under conditions of practically perfect competition.

In assessing the effectiveness of transformation processes in the agrarian economy, it is necessary to assess the materiality of structural changes, the influence of structural factors on the change in its economic efficiency. It should be borne in mind that the interests (tasks) of carrying out structural reforms at the state level and individual economic entities are different and do not always coincide in their direction.

In our opinion, the territorial and sectoral structure of agricultural production was subjected to the greatest transformation in the agrarian economy in the period after 1990. Since during the transition to the market, commodity producers independently established activity directions, a combination of industries. However, the effectiveness of such management decision-making was not always high for
several reasons: the predominance of short-term goals over long-term ones; the uncertainty of environmental factors, including the complexity of modeling the behavior of competitors, contractors, public policy; lack of qualified specialists and weak level of organizational and methodological support for long-term planning.

The study of the influence of structural territorial-sectoral shifts on the efficiency of the agrarian economy functioning was carried out by us on the example of the Altai region, which is an agrarian-industrial region. Almost every second resident of the region lives in rural areas, for which agriculture is one of the main sectors of the economy. In the region as a whole, the share of agriculture in gross value added was 13.27-17.30% in 2004-2016. In 2013-2017, the Altai region ranked 8–9 places in Russia at the cost of gross agricultural products, and made 1.8 times more per person than the average value of gross output.

In the late 1980s, collective farms and state farms of the Altai region specialized mainly in livestock production: in the structure of marketable products, milk and meat of cattle accounted for 51.4% of revenues; grains – 25.4%; sheep, pig, and poultry products – from 4.8 to 5.8%. Under the influence of a variety of objective and subjective factors, the combination of industries in 2017 changed: dairy and beef cattle breeding industries (production accounted for 29.6% of revenues), field crops (28.3%), poultry farming (15.2%), sunflower seed production (10.2%). Pig farming, sheep breeding, and beekeeping occupied an insignificant share of income (Table 1).

| Branches                          | 1989 | 2004 | 2010 | 2017 |
|----------------------------------|------|------|------|------|
| Grain crops                      | 25.4 | 35.4 | 29.8 | 28.3 |
| Sunflower seed production        | 0.8  | 5.2  | 4.9  | 10.2 |
| Beet breeding                    | 1.1  | 1.3  | 1.7  | 4.5  |
| Vegetable growing, potato growing| 1.7  | 1.8  | 2.5  | 2.0  |
| Dairy and beef cattle            | 51.4 | 39.4 | 32.7 | 29.6 |
| Pig breeding                     | 4.8  | 2.8  | 2.8  | 1.5  |
| Poultry farming                  | 4.9  | 5.3  | 18.0 | 15.2 |
| Sheep breeding                   | 5.8  | 0.4  | 0.1  | 0.1  |
| Beekeeping                       | 0.4  | 0.1  | 0.1  | 0.0  |
| Processing of crop and livestock products | 3.8  | 8.3  | 7.5  | 8.6  |

When studying the income structure of agricultural enterprises, it is important to assess the ratios and changes in the share of individual industries and also to analyze structural changes, which would allow to identify the degree of structure changes over a certain period of time.

According to the values of the linear coefficient of the absolute structural changes, the maximum change in the structure of income by industry was observed in 2004-2010 (by 2.75 pp on average), the smallest was in 2015-2016 (0.82 pp), and it was 1.32 pp in 2016-2017. To determine the weight of changes in the income structure, the amplitude of structural fluctuations per unit specific weight of each type of product was determined: the value of this indicator for the period 1986-2017 was the highest in sheep products (2.79%), beekeeping (2.48%), beet breeding (2.47%), pig (2.22%) (Figure 1).
The main reason for the significant amplitude of structural changes in the agricultural organizations of the Altai region was a significant decrease in the number of animals in them. In 1990-2017, the number of pigs decreased by 5.7 times, sheep – 45.4 times, bee colonies – 16.2 times. Reducing the size of production in beekeeping and sheep farming associated with unprofitability of the products produced in them. Thus, in the sheep farming of the Altai region, the return on meat production costs in 1995 was only 60.3% without subsidies, 50.7% in 1996, 34.2% in 1997. The allocated subsidies at the level of 6.0-53.0% of the price increased the cost recovery for the meat of sheep in these years by only 4.0-38.4%, and it only partially compensated costs for wool, not taking it out of the loss ratio. In the face of difficulties in organizing the sale of wool, agricultural enterprises reduced the number of sheep by 7.1 times in 1991-1998.

In a profitable pig breeding, a completely different situation took shape. In the early 1990s, pig breeding in the Altai region was represented mainly in multi-field agricultural organizations. After 2010, highly specialized pig farms began to develop at an accelerated rate. Since 2012, the departmental target program “Development of Industrial Pig Production in the Altai region” for 2012-2014 has been in operation (approved by the Resolution of the Altai region Administration dated December 19, 2011 No. 747; extended to 2017 by the Resolution of the Altai region Administration No. 439 dated September 27, 2014), the goals of which were to increase the production of pork with high consumer qualities, stimulate the development of industrial pig breeding complexes using modern technology. The main pig enterprises of the region (“Altair-Agro” LLC, “Altaymyasoprom” LLC, “Antipinske” OJSC, ans “Sistema” LLC) took part in the program. In 2015, these organizations sold 11.9 thousand tons of pigs in live weight, or 90.9% of the total sales of agricultural enterprises, as well as 11.7 thousand tons of pork in processed form (97.1% of the total enterprises of the industry); banks transferred 917.4 million rubles interest on loans (90.9% of the total volume of enterprises in the industry, 2.3% of all agricultural organizations). However, the borrowed funds exceeded annual revenues by 3.8 times, 30.8% of revenues (excluding principal amounts) were used to pay off interest on loans. High credit intensity caused the bankruptcy of “Altair-Agro” LLC and “Altaymyasoprom” LLC. Both organizations were in the process of liquidation as of July 1, 2018 [2].

The decline in the sales of sugar beets is primarily due to the liquidation of three sugar factories located in Aleisk, Biysk, and Zavyalovo. At present, only the Cheremnovsky sugar plant in the Pavlovsky district functions. And the sown areas of sugar beet are concentrated near it, because the beet breeding became unprofitable with a transportation distance of over 100 km.

At the same time, the quantitative assessment of structural changes does not characterize the change in the efficiency of agricultural production. We share the position of those authors who believe that, from the point of view of the national economic criterion, the efficiency of agro-industrial production manifests itself as an increase in the production of raw materials and food in the necessary assortment and quality per capita [3].
The direct factors of changes in the level of profitability are the volume and structure of sales of products by type, price, and unit cost. Since agriculture produces heterogeneous products, it is impractical to use the three-factor model to assess the impact of the structural factor; therefore, we calculate the total level of profitability using the weighted average formula based on the sales structure and profitability level by product type:

$$
\bar{y}_p = \frac{\sum_{i=1}^{n} y_{r_i} \cdot y_{v_i}}{\sum_{i=1}^{n} y_{r_i}} = \frac{\sum_{i=1}^{n} y_{a_i} \cdot y_{p_i}}{100},
$$

where $y_{r_i}$ – the proportion of the i-th product in the total revenue, %; $y_{p_i}$ – the level of profitability of the i-th product type, %.

The deterministic factor in this case is a combined (mixed) one; therefore, the influence of factors was assessed by the method of chain substitutions (elimination). So, for the period 2010-2016, the level of profitability of agricultural production in the Altai region increased by 10.2 percentage points due to the positive impact of both the sales structure (if the product profitability by species did not change in 2010-2016 and only the sales structure was adjusted, then the overall profitability index would increase by 4.1 percentage points) and product profitability (if the sales structure had not changed in 2010-2016 and only the product profitability by type was adjusted, then the overall profitability index would increase by 6.1 percentage points).

If compared to 2016, the level of profitability of production in 2017 decreased by 12.0 percentage points mainly due to the negative impact of changes in product profitability by type. The impact of the sales structure was positive, but insignificant: a 0.7 pp change in profitability contributed to the improvement of the sales structure, in which the share of more profitable types of products (primarily oilseeds of sunflower, sugar beet, rape, and milk) increased. However, the impact of changes in profitability by product as a whole reduced the overall profitability by 12.7 percentage points, which was mainly due to a decrease in the profitability of grain, sunflower oilseeds, prices for which decreased as a whole across the Altai region by 26.9% and 25.8%, respectively, with an insignificant change in the unit cost (Table 2).

| Types of products       | 2016 to 2010 | 2017 to 2010 | 2017 to 2016 |
|-------------------------|--------------|--------------|--------------|
|                         | common       | due to structure | common       | due to structure | common       | due to structure |
| Corn                    | 6.63         | 1.21          | -5.56        | -0.49          | -12.19       | -2.54          |
| Sunflower oilseeds      | 2.99         | 3.49          | 0.30         | 4.82           | -2.69        | 1.24           |
| Sugar beet              | 3.16         | 0.92          | 3.27         | 1.12           | 0.11         | 0.50           |
| Rape                    | 0.19         | 0.37          | 0.78         | 0.92           | 0.59         | 0.40           |
| Potatoes                | -0.12        | -0.05         | 0.09         | 0.07           | 0.21         | 0.09           |
| Vegetables              | 0.09         | -0.01         | -0.10        | -0.01          | -0.19        | 0.00           |
| Milk                    | -1.95        | -1.56         | -0.01        | -0.52          | 1.94         | 0.99           |
| Cattle meat             | 0.31         | 0.38          | -0.01        | 0.29           | -0.32        | -0.09          |
| Pig meat                | -0.54        | 0.02          | -0.47        | -0.25          | 0.08         | -0.01          |
| Sheep and goats meat    | 0.02         | 0.01          | 0.02         | 0.01           | 0.00         | 0.00           |
| Poultry meat            | -1.29        | -0.42         | -0.62        | -0.41          | 0.67         | 0.00           |
Egg  -0.32 -0.06 -0.34 -0.09 -0.02 -0.02
Wool  0.00  0.00  0.00  0.00  0.00  0.00
Honey -0.03 -0.01 -0.02 -0.02  0.00  0.00
Fish and fish products  0.00  0.00  0.00  0.00  0.00  0.00
Other products  1.10 -0.19  0.96 -0.12 -0.15  0.13
Total  10.24  4.10 -1.72  5.33 -11.96  0.69

For regions, such as the Altai region, to the features of which there is a large variety of natural-economic zones, one should take into account the influence on the efficiency of the enterprises’ activity, their territorial distribution and production types. This is evidenced by the ambiguity of production efficiency by municipalities of the region, which are grouped into 8 groups depending on the hydrothermal coefficient (HTC), allowing to estimate the amount of precipitation and the temperature regime of the territory. Thus, the level of profitability of grain in the natural-economic zones varied from 26.2% to 56.3%, sunflower oilseeds – from 24.2% to 72.4%, milk – from 9.7% to 40.7%, payback costs for cattle meat – from 56.4% to 139.4% (Table 3).

Table 3. The level of profitability of production by natural-economic zones of the Altai region in 2016, % (fragment).

| Type of main (additional) products          | HTC       |
|--------------------------------------------|-----------|
|                                            | 0.6 | 0.7 | 1.0 | 1.1 | 1.2 |
| Corn                                       | 56.3 | 54.1 | 26.2 | 53.1 | 79.8 |
| Sunflower seeds                            | 72.4 | 31.8 |      |      | 59.1 |
| Vegetables, potatoes                       |      |      | 85.9 | 4.7 |
| Cattle meat                                | -37.3 | -43.6 | 17.8 | 39.4 | 3.6 |
| Pig meat                                   | 13.4 | 1.1 | 12.1 |      |      |
| Poultry meat, egg                          |      |      | 2.5 | 12.3 |
| Milk                                       | 15.1 | 31.9 | 40.7 | 26.2 | 32.0 |
| Honey                                      |      |      | -55.1 | 31.6 |
| Sugar beet                                 |      |      |      |      |
| Other                                      | -12.9 | 119.2 | 52.4 | 108.8 |
| Grain, milk                                | 44.9 | 35.1 | 15.7 | 25.5 | 37.8 |
| Milk, grain                                | 42.0 | 20.5 |      | 30.1 |
| Grain, cattle meat                         |      |      |      | 20.5 |
| Cattle meat, grain                         |      |      |      |
| Milk, cattle meat                          |      |      | 4.9 |
| Cattle meat, milk                          |      |      |      | -4.7 |
| Grain, sunflower seeds                     | 2.4 | -48.5 | -17.9 |
| Sunflower seeds, grain                     |      | 22.0 | 59.8 |
| Other two types of products                | 15.4 | 32.7 |      |
| Grain, milk, sunflower seeds               |      | 31.2 |
| Other three types of products              |      |      |

At the same time, the share of each industry in agricultural enterprises in the natural-economic zones of the Altai region in total incomes varies. To achieve comparability of indicators of profitability of production (taking into account the placement), we have determined the weighted average profitability by the formula (1) and also applied the method of relative differences. Since it is in principle impossible to weigh negative and positive profitability, the payback indicator was used in the calculations.

The value of the weighted level of profitability of the $i$-th branch of production ($K_{ij}$) of the $j$-th natural-economic zone was determined by the formula:
\[ K^*_{ij} = \frac{K_{\text{max}} - K_i}{K_{\text{max}} - K_{\text{min}}} \]  

(2)

where \( K_{\text{max}} \) – the maximum value of the weighted profitability of the \( i \)-th branch of production in the aggregate;

\( K_{\text{min}} \) – the maximum value of the weighted profitability of the \( i \)-th branch of production in the aggregate;

\( K_i \) – the value of \( i \) weighted profitability of the \( i \)-th branch of production in the aggregate.

Standardization of all indicators was carried out within the limits of values from zero (the weighted profitability of the \( i \)-th branch of production in the \( j \)-th natural-economic zone characterized the minimal impact on the change in the total profitability of agricultural enterprises in the region) to unity (the weighted profitability of the \( i \)-th branch of production of the \( j \)-th natural economic zone characterized the maximum impact on the change in the total profitability of agricultural enterprises in the region). The sum of standardized weighted profitability ratios in the context of natural economic zones reflected the comparative degree of their influence on the change in the profitability of production of all agricultural enterprises in the region.

Taking into account our studies, the largest contribution to changes in the profitability of agricultural production was made by organizations located in municipalities with HTC 0.8 and 1.1, the smallest one was with HTC 1.0 and 1.6 (Figure 2).

Figure 2. The sum of standardized weighted profitability ratios in the context of natural and economic zones of the Altai region, 2016.

However, if we take into account the number of industries, then the standardized weighted profitability ratio per one economic activity is higher in organizations located in municipalities with HTC 0.9 and 0.6 (these rural territories concentrated the most profitable crops: cereals, sunflower, sugar beet), below is with the HTC 1.0 and 1.6 (in these rural areas, the production of milk was concentrated, which has a significantly lower profitability: the share of milk in marketable products reached 57.4-66.0%).

To improve the efficiency of transformational processes, it is necessary to strive not so much to increase the volume of production of high-margin agricultural products in the short term, which leads to destabilization of the market in conditions of high price volatility, but rather to the formation of a balanced (proportional) development of agriculture. In this case, the relevant is the statement developed by F. Perru, “Spontaneous development can be turned into orderly through consistently prepared imbalances” [4, p. 437-438]. From our point of view, with the structural shifts regulated by the main participants (the state, agricultural producers), conditions for the sustainability in the development of agro-industrial production dictate the formation of the so-called Smart Specialization...
[5, 13, 14], or an “effective organizational and economic structure” (S.G. Azikova’s term) [6]). On the part of the state, it is necessary to develop strategic programs for various types in the development of agricultural production, depending on the features of the processes taking place in rural areas, the transformation potential of economic entities [7]. On the part of agricultural producers, regardless of the size of production, not only adaptation to constantly changing economic conditions is necessary, but also interaction with the external environment, in which greater satisfaction of the interests of interaction participants.

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