

The choice of indicators for monitoring financial regulation of sustainable development of agricultural regions: the example of Ukraine

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Abstract. The influence of a group of indicators on the integral assessment of the state of agrarian regions for improving the financial mechanisms for regulating sustainable rural development has been investigated. The goal is to identify the relationship between the level of economic growth (growth in agricultural GDP, GVA per employee, income per community resident) and the amount of resources that are financed from the budgets. The empirical study was carried out on the basis of panel data formed for a sample of individual indicators of the rating of regional development of Ukraine for 2017-2019. The nature of the distribution of the studied variables was determined by calculating the correlation coefficients. Based on the results, a relationship was established between the indices: budget financing and gross production - 63%; budget financing and integral production index - 58%; income of rural budgets and profit of agricultural production - 38%. It is recommended to reduce direct agricultural subsidies, increase the allocation of funds for social development, and finance the most effective programs in order to ensure sustainable development of rural regions. To monitor the process of the effectiveness of financial regulation, it is proposed to use production, economic and social indicators in conjunction with the integral, which will become a more reliable basis for the distribution of budgetary allocations for agricultural and social development in Ukraine.

1 Introduction

Ukraine is traditionally an agrarian country, where agriculture accounted for $\frac{1}{4}$ of the GDP. In recent decades, this contribution has decreased to 10%, but it is still a significant value against the level of developed countries, where it is not higher than 3%. The industry-specific gross product of Ukraine created annually is about UAH 350 billion or US \$ 13 billion [1].

Having a significant impact on the economy, the agricultural industry is an integral part of rural areas. Taking into account the challenges of the time and taking into account the experience of the European Union, it became necessary to create a comprehensive strategy for the sustainable development of the agricultural and rural sectors in the regional context. In practice, these sectors are little interconnected, especially in terms of financing and there

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is a need for government regulation. Establishing such interdependence requires defining the essence and introducing an effective financial regulation mechanism, otherwise there is a real threat of excessive polarization and growth of disproportions within the regions and the country.

The issue of regional agricultural development and the measurement of its indicators and indicators is relevant for the whole world, since the Food and Agriculture Organization of the United Nations has chosen a common strategy for Sustainable Development [2].

At the national level, Mesel-Veselyak & Grishchenko [3] determined that the integral indicator for regional development reveals three groups of indicators: assessment of the level of agricultural production (yield, productivity); assessment of the economic state of the agricultural sector (profitability, cost recovery); assessment of the social development of rural areas (demography, household cash income, unemployment rate; average monthly wages in the agricultural sector; consumption per person). Sokil et al. [4] provides a methodology for assessing and determining the integral indicator of sustainable development of agriculture on the basis of accounting and analytical indicators of three components of sustainable development (economic, environmental, social). Kozlovskiy et al. [5] believe that the lack of a generally accepted definition of the concept of "sustainable development of the agricultural sector" is caused by the lack of information to measure it. They offer a solution to the problem by drawing up an indicative plan for the development of the agrarian sector of the region in correlation with the concept of regional development. Chopin et al. [6] investigated that an assessment of agriculture on a regional scale is needed to better guide regional planning. A method based on a set of multiscale indicators has been developed to assess the contribution of agriculture to the sustainable development of regions.

International studies such as Morkunas et al. [7] are aimed at identifying and assessing the negative consequences of the introduction of a mechanism for financial support for direct payments under the Common Agricultural Policy for the sustainability of rural areas. It was found that high land prices, declining crop diversification, land degradation and farmers' financial indebtedness can be attributed to direct payments, and these effects have a significant negative impact on agricultural sustainability. Crescenzo et al. [8] analyze the financial allocations for regional policy, rural development policy and agrarian policy of the European Union in order to assess their territorial coordination and synergy for territorial cohesion. Regression analysis is used to identify the link between funding and territorial disadvantage, showing that both coordination and compatibility with territorial cohesion have not always improved in response to major policy reforms, but are critically dependent on appropriate local allocation mechanisms.

Considering the achievements of the researchers, problematic issues remain: despite the decisions of the Government of Ukraine adopted in recent years to stimulate the development of rural areas, today the effectiveness of most public policy measures in this area remains low.

2 Research methodology

To assess the nature and features of the impact of financial regulation on the sustainable development of the agricultural sector and rural areas, general and special methodological approaches are used: determining the degree of development of a rural region involves the use of special indicators, the main of which is the sectoral agrarian gross product (GDP), its dynamics during research period (per employee); identification of the nature of the dependence of agricultural GDP, production, financial results and social factors and other macro indicators; identifying the nature of the dependence of changes in agricultural GDP and the distribution of financial resources that the state controls (lending, the Regional Development Fund, support for agricultural production from local budgets).

The indicators of payments from the Regional Development Fund (SFRD) were selected as the basis for assessing the regional financing rating as a comprehensive assessment; lending to agricultural enterprises with government subsidies for loan repayment; payments from local budgets to support agricultural production.

The calculations took into account the Methodology for monitoring and the effectiveness of the implementation of the state regional policy [9] and Information on monitoring the development of rural areas [10].

Regional rating assessments of agricultural development are calculated according to the following algorithm (Mesel-Veselyak & Grishchenko, [3]): the ratio (indices) of each indicator of the regions to the average for Ukraine with differentiation of indicators, the increase of which has a positive value (stimulants), and negative (destimulants) value; the integral rating is calculated as the arithmetic mean of the sum of the rating indices of a particular region for all groups of indicators according to the formula:

$$I_0 = (I_n + I_e + I_c) / 3 \quad (1)$$

where I_0 is the general index for three groups of indicators; I_n - production index; I_e - economic condition index; I_c - social.

The general rating assessment [9] is carried out by comparing the deviation of the values of indicators for each specific region from their best values for the regions for the corresponding (reporting) period and the corresponding ranking of regions.

The rating assessment is carried out on the basis of calculating the relative deviations of the indicators of each region of the maximum and minimum values of such indicators of other regions according to the formula:

$$R_j = \sum_{i=1}^n \frac{x_{\max i} - x_{ij}}{x_{\max i} - x_{\min i}} + \sum_{i=1}^n \frac{x_{ij} - x_{\min i}}{x_{\max i} - x_{\min i}} \quad (2)$$

where R_j is the sum of the ratings of a particular region for each of the indicators characterizing a particular area of activity; x_{ij} is the value of the i -th indicator of the j -th region; $x_{\max i}$ - maximum value of the i -th indicator; $x_{\min i}$ - the minimum value of the i -th indicator.

The definition of the arithmetic mean of the sum of the ratings of a particular region for all indicators of the annual assessment, characterizing a particular area of activity, is carried out according to the formula:

$$R_{cpj} = \frac{R_j}{n} \quad (3)$$

where R_{cpj} is the arithmetic mean of the sum of the ratings of a particular region for all indicators of a particular direction; n is the number of indicators for which the calculation was made in certain areas.

Based on the results of the calculations, the integral rating is determined as the arithmetic mean of the sum of rating assessments of a particular region in all areas according to the formula:

$$I_j = \frac{\sum_{i=1}^m R_{cpi}}{m} \quad (4)$$

where I_j is the arithmetic mean of the sum of the ratings of a particular region in all directions; m - the number of directions in which the calculation was made.

3 Results of the research

3.1. Analysis of the production group of indicators of agrarian and rural development

In general, the hypothesis of the study is formulated as follows: there is a high statistical relationship between the indicator of financial regulation of the economy and indicators of sustainable agricultural and rural development of production.

To test the hypothesis, we will conduct an econometric analysis of the influence of factors on the resulting indicators, construct an econometric equation of linear multiple regression. We use three criteria that characterize the main trends in the state of agrarian and rural development: 1) production index by indicators: gross output per hectare, output per person and gross added value of the industry per hectare; 2) the index of economic condition: profit per hectare, per 1 person, per 1 hryvnia of expenses; 3) social index: employment, unemployment, wages per employee, income per person. As a result, we get a general index for three groups of indicators and a rating by the region behind it (Table 1).

The period of three years used by us (2017-2019) is a sufficient lag to determine medium-term trends, and the geometric mean serves as the basic average for studying time series. Used data from the official website of the State Statistics of Ukraine [11].

Table 1. Rating of regions of Ukraine according to the integral assessment of agricultural production.

№	Regions	Index				Rating
		Produc	Effic	Social	General	
		In	Ie	Ic	Io	
1	Vinnitsa	1,35	0,35	1,08	0,93	6
2	Volyn	0,73	0,24	1,04	0,67	18
3	Dnipro	1,27	0,39	0,95	0,87	11
4	Donetsk	0,81	0,25	1,13	0,73	17
5	Zhytomyr	1,06	0,27	1,05	0,80	14
6	Transcarpat	0,73	0,22	1,00	0,65	21
7	Zaporizhz	1,03	0,47	0,98	0,83	13
8	Iv-Frankivsk	0,79	0,10	1,08	0,65	20
9	Kiev	1,35	0,47	0,94	0,92	7
10	Kirovograd	1,55	0,46	1,06	1,02	1
11	Luhansk	0,71	0,30	1,23	0,75	16
12	Lviv	0,74	0,18	1,00	0,64	23
13	Nikolaev	1,24	0,44	1,00	0,89	9
14	Odessa	0,78	0,39	0,83	0,66	19
15	Poltava	1,45	0,37	1,10	0,97	3
16	Rivne	0,76	0,21	0,98	0,65	22
17	Sumy	1,43	0,45	1,01	0,96	4
18	Ternopil	0,89	0,33	1,11	0,78	15
19	Kharkiv	1,31	0,35	0,87	0,84	12
20	Kherson	1,20	0,43	1,02	0,88	10
21	Khmelnitsk	1,29	0,51	0,98	0,93	5
22	Cherkasy	1,29	0,43	1,05	0,92	8
23	Chernivtsi	0,81	-0,05	0,86	0,54	24
24	Chernihiv	1,40	0,43	1,10	0,98	2

Statistical analysis found that multiple R, which characterizes the tightness of the relationship between the analyzed factors, was 0.6576, that is, the characteristic of the relationship is moderate, but significant. At the same time, the R2 indicator is low - 0.4325, as well as the adapted R-square2 - 0.4067, with a standard error (deviation of all sample

means) 0.5268. The regression analysis of the integral assessment of agricultural production is given in table. 2.

Table 2. Regression analysis of the integral assessment of agricultural production.

	Coef..	Standard error	t-statistics	P-Value	Lower 95%	Upper 95%
Y	3,051 4	1,1474	2,659	0,015	0,6578	5,4450
In	0,032 2	0,4809	0,0669	0,9472	-0,971	1,0355
Ie	-3,914	1,0218	-3,830	0,0010	-6,045	-1,782
Ic	-0,462	1,0581	-0,437	0,6667	-2,669	1,744

3.1.1 Analysis of the financial group of indicators of agrarian and rural development

Another group of resulting indicators relates to financing of agricultural, rural and regional development. These are the following indicators: 1) the index of payments from the Regional Development Fund (SFRD) per 1 hectare of the IFR territory; 2) index of lending to agricultural enterprises with state subsidies for repayment of loans, per 1 ha of land area of enterprises Ikr; 3) index of payments from local budgets to support agricultural production Imb. As a result, we obtain a general index of financing Iph for three groups of indicators (Table 3) for a comparable period.

Table 3. Rating of regions of Ukraine according to the integral assessment of financial support.

Regions	Index				Rating
	SFRD	Soft loans	Local budget	General	
	Ifr	Ikr	Imb	Iph	
Vinnitsa	1,01	0,51	2,64	1,39	9
Volyn	1,23	1,71	4,97	2,64	2
Dnipro	1,51	1,05	0,53	1,03	14
Donetsk	3,24	0,11	1,49	1,61	7
Zhytomyr	0,98	0,75	1,10	0,95	15
Transcarpat	2,35	1,38	2,04	1,92	4
Zaporizhz	0,94	0,92	0,66	0,84	17
Iv-Frankivsk	2,34	1,22	1,77	1,77	6
Kiev	0,92	1,13	1,23	1,10	12
Kirovograd	0,58	0,86	1,27	0,90	16
Luhansk	1,88	0,17	0,04	0,70	21
Lviv	1,73	0,37	4,30	2,13	3
Nikolaev	0,68	0,67	0,38	0,58	24
Odessa	1,07	0,30	0,74	0,70	22
Poltava	0,73	1,74	0,79	1,09	13
Rivne	1,39	0,75	1,92	1,35	10
Sumy	0,91	0,51	0,34	0,58	23
Ternopil	1,81	2,90	0,86	1,86	5
Kharkiv	1,23	0,98	0,00	0,74	20
Kherson	0,85	0,40	0,99	0,75	19
Khmel'nitsk	1,43	1,85	0,70	1,33	11
Cherkasy	0,86	3,36	0,23	1,48	8
Chernivtsi	2,55	4,98	2,33	3,29	1
Chernihiv	0,64	0,39	1,43	0,82	18

For this sample of factors, the analysis found that the multiple R, which characterizes the tightness of the relationship between the analyzed factors, was 0.7716, the characteristic of the relationship is significant. The R2 index is 0.5953, the standard error is 0.4665.

The analysis of the correlation coefficients between the integral indicator of financing and production factors of the first correlation-regression model showed that the correlation dependence for I_{ph} is observed for all production factors as a de-stimulating one: I_w (-0.5361), I_e (-0.7689), I_c (-0, 1017) (Table 4).

Table 4. Correlation matrix of the relationship between the integral indicator of financing and the factors of the production correlation-regression model.

	I _φ	I _β	I _c	I _c
I _φ	1,0000	-0,5361	-0,7689	-0,1017
I _β	-0,5361	1,0000	0,7094	-0,0059
I _c	-0,7689	0,7094	1,0000	0,0507
I _c	-0,1017	-0,0059	0,0507	1,0000

To confirm the direction and closeness of the relationship, we construct a correlation field between the indicators of the financing index (I_{ph}) and the production index (I_c) (Fig. 1).

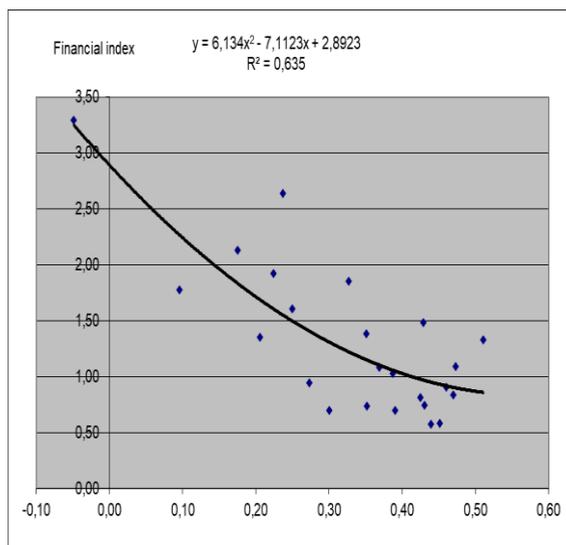


Fig. 1. Correlation dependences between the financing index (I_{ph}) and the production index (I_v).

The correlation dependences between the financing index (I_{ph}) and the integral production index (I_c) are shown in Fig. 2.

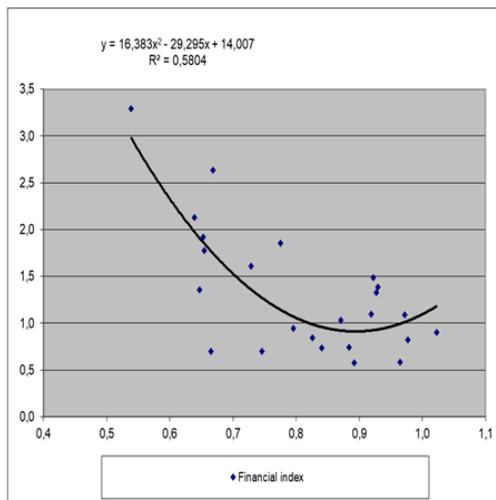


Fig. 2. Correlation dependences between the financing index (Iph) and the integral production index (I3).

3.1.2 Analysis of a group of indicators of the development of territorial communities

In addition to the factors of centralized budget financing and support for agricultural production, it is important to take into account the financial capacity of local budgets. According to the regional state administrations [12], thanks to the decentralization reform and the introduction of new tools to support the development of territories in most of the united territorial communities (UTGs), there is an increase in the main indicators characterizing the economic and financial efficiency of their development. The assessment is carried out on the basis of available official statistics and information from central and local executive authorities [13; 14], for 62 indicators characterizing the situation in 12 areas in different areas of socio-economic development of regions, the place of each region in a separate area and a generalizing rating place in all areas of assessment were determined.

Conducting horizontal alignment according to tax capacity and calculating the amount of subsidies is carried out according to the following parameters: population size; personal income tax receipts for the last reporting budget period; the tax capacity index of the corresponding budget. The basic subsidies are received by poor local budgets (with the level of income tax on personal income per person below 0.9 of the average for Ukraine (80% of the amount required to the level of 0.9) to increase their level of financial security.

Reverse subsidies are used in the budgets of OTGs, where this figure is higher than the 1.1 average in Ukraine (50% of the excess of the 1.1 tax capacity index is transferred to the state budget). Equalization is not carried out if in the local budget the level of income tax on personal income per inhabitant ranges from 0.9 to 1.1. This approach stimulates local governments to expand the base and attract additional financial revenues, contributes to an increase in the income of the general fund of the OTG budgets. The rating of Ukrainian OTG by financial criteria for 2019 is given in table. 5.

Table 5. Rating of the united territorial communities of Ukraine by financial criteria.

Regions	number communities	income per person	Rating
Vinnitsa	37	3206	13
Volyn	50	2588	11
Dnipro	62	4402	19
Donetsk	10	5103	15
Zhytomyr	53	3135	8
Transcarpat	6	3367	10
Zaporizhz	44	3097	12
Iv-Frankivsk	30	1648	3
Kiev	16	4600	20
Kirovograd	20	4569	14
Luhansk	9	2770	6
Lviv	40	2525	5
Nikolaev	29	3543	21
Odessa	28	3562	22
Poltava	45	4988	23
Rivne	32	2316	2
Sumy	33	3617	9
Ternopil	49	2239	1
Kharkiv	17	4497	24
Kherson	28	2742	17
Khmelnitsk	45	2750	18
Cherkasy	54	1365	4
Chernivtsi	33	1714	7
Chernihiv	39	3302	16

The indicator "Financial self-sufficiency" includes indicators characterizing: the dynamics of growth of local budget revenues, the volume of capital expenditures per capita and repayment of the tax debt. In fig. 3 shows the correlation analysis of the dependence of the incomes of the OTG per 1 person. on the number of communities in the region.

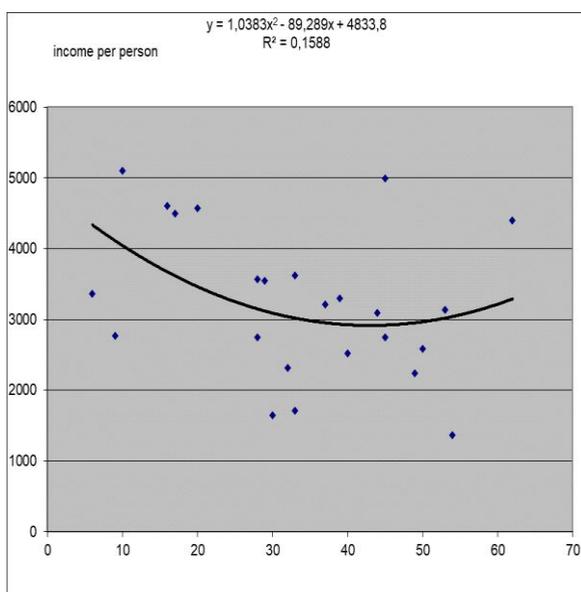


Fig. 3. Dependence of incomes of OTG per 1 person on the number of communities in the region.

It was found that the relationship is insignificant, only 16%. Thus, the number of communities is not conducive to an automatic increase in income; complex institutional measures are needed. Additional financial resources received by local budgets in recent years have made it possible to increase the volume of capital expenditures per capita in all regions, and on average in Ukraine per capita this indicator amounted to UAH 2.0 thousand in 2018-2019.

The analysis of the correlation dependence of the incomes of the OTG per 1 inhabitant on the integral index of agricultural production I_b is shown in Fig. 4.

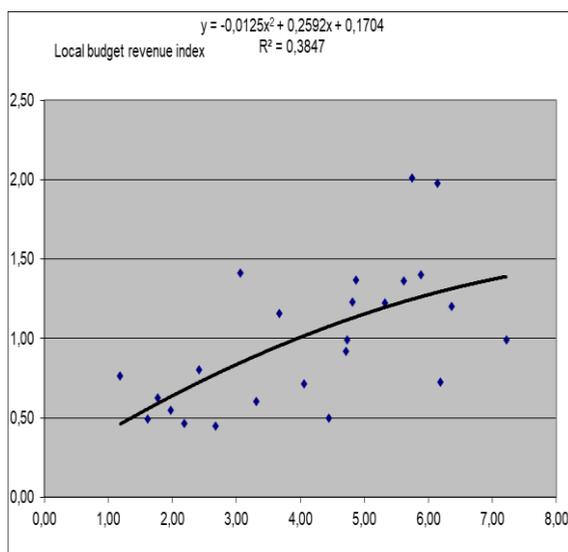


Fig. 4. Dependence of incomes of OTG per 1 person. from agricultural production I_b

The analyzed dependence is at the level of 38%. This indicates an average relationship between these indicators. It could be higher, since many peasant farms are engaged in commodity production, but due to their exclusion from the tax field, local budgets receive less revenue from taxes.

4 Discussion of results

Calculations confirm the impact of state financial regulation on sustainable agricultural and rural development of territories. Our econometric analysis on the selection of indicators that have the most significant effect on the efficiency of the allocation of funds proves the hypothesis of the existence of a statistical relationship between state financial support and indicators of sustainable development of regions.

However, despite the multiple data sets designated for monitoring in the Methodological Recommendations [13], not all of them are equally useful for determining the criterion for allocating budget funds for the development of regions. Therefore, there is a need to abolish some indicators, while others, on the contrary, to expand.

Given the limited financial resources that the Government of Ukraine can direct to the development of territories, it is necessary to prioritize the allocation of resources and focus them on effective measures that can provide high results in the shortest possible time and carry out a long-term and comprehensive impact on the development of regions.

The Strategy, developed in the pre-crisis period, contains a list of many performance indicators, based on the analysis of the main trends in the socio-economic development of regions over the past 20 years and problems. Objective 3 "Effective public administration in

the field of regional development" has been defined, which has 5 points of the structure and by 2020 some results have already been obtained [12] (tab. 6).

Table 6. Components of public administration Regional development strategies (Goal 3).

Structure of Goal 3	Status of implementation
1.Decentralization of power, reform of local government	Measures are being taken to further introduce decentralization processes, as of 19.03.2020 1,049 communities were formed
2.Improving the system of strategic planning for regional development	The new model of financial support contributed to an increase in the revenue base of local budgets, revenues increased 4 times to UAH 275 billion in 2019 against 2018
3.Improving the quality of public administration of regional development	The introduction of tax preferences by the government, a land market, additional budgetary support motivated the unification of communities
4. Strengthening cross-sectoral coordination of government policy	Modern methods and means of cooperation are used, 1285 communities signed 566 cooperation agreements in 2019
5.Institutional support of regional development	Formation of regional development agencies as a factor in ensuring sustainable development and creating conditions for enhancing investment

As a result of the national and global crises, a need arose to reduce the list of priorities for regional development in order to concentrate financial resources on the main tasks that have a systemic and long-term impact on the development of regions and the national economy as a whole.

To substantiate this conclusion, we have constructed a diagram of the optimal distribution of funds to support agricultural production from local budgets according to the integral index of production (I_h) (Fig. 5). At the same time, the blue lines are the actual distribution, the red lines are the leveled distribution of funds to support agricultural production from local budgets according to the integral production index.

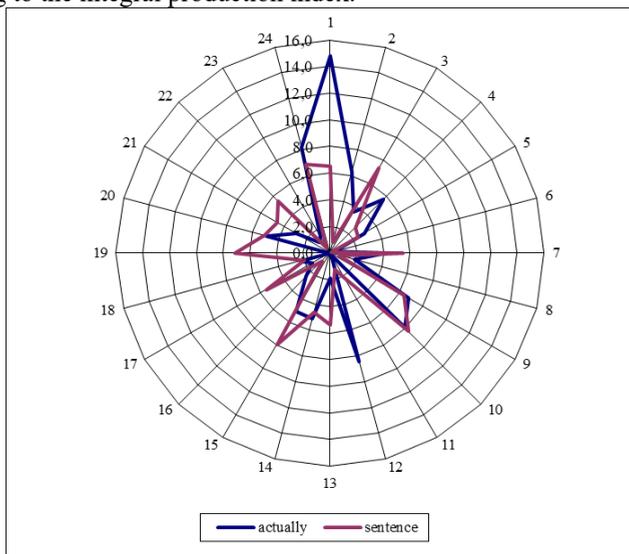


Fig. 5. Optimal distribution of funds to support agricultural production from local budgets according to the integral index of production (I_z).

The data indicate that some regions receive more funds from the state budget than their contribution to the structure of the agricultural GDP, which, in theory, was the guarantor of fair distribution. Such imbalances are eliminated precisely by a well-thought-out and

effective policy of financial regulation, which contributes to the sustainable development of rural regions.

We also investigated the possibility of equalizing the OTG rating in terms of local budget revenues according to the criterion of integral ratings of production I_f and financing I_f (Fig. 6). At the same time, the blue lines are the actual rating, the red lines are the aligned rating of incomes of local budgets of OTG according to the integral ratings of production I_f and financing I_f .

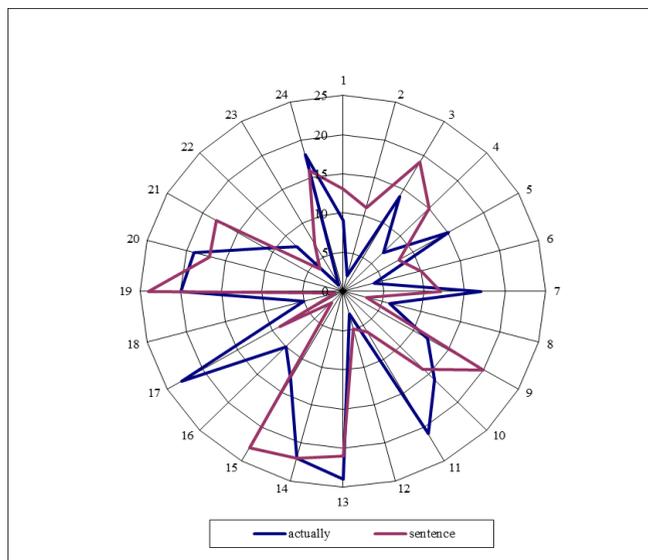


Fig. 6. Alignment of the rating of incomes of local budgets of OTG according to the integral ratings of production I_z and financing I_f .

In part, these conclusions were used to formulate the Strategy for Rural Development for the period up to 2030, developed by scientists of the NSC "Institute of Agrarian Economics" [15].

5 Conclusions

The confirmation of the influence of financial regulation on sustainable development was obtained, which confirmed the hypothesis put forward about the existence of a certain natural relationship between the dynamics of the development of the agricultural sector and state support, taking into account production, economic and social factors.

The indices and ratings of the development of the agrarian regions of Ukraine were determined according to the main indicators for 2017-2019. The analysis of the nature of the dependence of agricultural GDP, lending, payments from the Territorial Development Fund and other main macroeconomic indicators is carried out. The nature of the dependence of changes in the output of agricultural products, financial performance indicators and social factors is revealed, and the average degree of dependence between them is established. The existence of a significant statistical relationship (a significant correlation coefficient and a statically significant correlation-regression model) between the financing indicator and indicators of agricultural and rural development has been proved. The study makes it possible to substantiate the necessity and expediency of taking into account the influence of groups of factors on the formation of a package of government programs to support regions.

The rating assessment of sustainable development of rural regions by groups of indicators characterizing the patterns of distribution of financial resources is given, which will allow regions with a low rating to focus on the most important measures to level the estimated indicators.

In order to ensure sustainable development of rural regions, it is recommended to reduce direct agricultural subsidies, increase the allocation of funds for social development, and finance the most effective programs. To monitor the process of the effectiveness of financial regulation, it is proposed to use production, economic and social indicators in conjunction with the integral, which will become a more reliable basis for the distribution of budgetary allocations for agricultural and social development in Ukraine.

Further continuation of the study of the topic of choosing indicators for monitoring and assessing agricultural and rural development for Ukraine should be based on indicative planning [4] (Strategic Directions, 2020). according to the formed principles of the strategy for sustainable development of rural areas in the following areas: natural resource potential, settlement aspects, sustainable development management, diversification of the rural economy, employment, improving the well-being and social protection of the rural population; development of entrepreneurship and service cooperation, innovation support, improvement of housing conditions, transport infrastructure, general education services, medical assistance, agritourism and recreational potential, environmental safety, financial and investment support, credit support, information and consulting activities for the development of the village and the social sphere.

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