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**ODESSA NATIONAL ACADEMY OF
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International Competition of
Student Scientific Works

**BLACK SEA
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International Competition of Student Scientific Works

BLACK SEA SCIENCE 2020

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2. ECONOMICS AND **ADMINISTRATION**

MODELING OF SUSTAINABILITY OF COMPETITIVE POSITION OF AGRARIAN SECTOR OF THE REGION**Authors:** Diana Kozhemiakina, Vladyslava Bieliaieva**Supervisor:** Nadiia Pylypenko
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Abstract. *Purpose:* The aim of the study is the analysis of theoretical concepts for the formation of sustainable competitive advantages, assessment and modeling of the stability of the competitive positions of the agricultural sector in the region.

Results: It is revealed that in modern conditions, the concept of providing sustainable competitive advantages based on the resource approach is more adequate for the agrarian sector. To evaluate the stability of the competitive position of the agricultural sector of the region, a method of comparing the rate of change of the main economic indicators of the region and the industry as a whole is proposed. The assessment of the competitiveness of the competitive position of the agrarian sector of the region based on the proposed methodology has shown that, in order to ensure sustainable competitive advantage, it is first necessary to pay attention to cost reduction and innovation implementation. Carried out by the method of exponential smoothing with the use of the Brown-Meier model, the calculation of the predicted values of the integral index and its components allowed us to estimate the dynamics and tendencies of development of the agrarian sector of the Sumy region's economy, which are generally positive. The proposed model of dynamic assessment of competitive position stability allows simulating in the near future the situation on the market, gives the necessary information to the relevant state and local authorities for making sound management decisions.

The practical significance of the results obtained. Proposals have been taken into account by specialists of the Department of Agro-Industrial Development of Sumy Regional State Administration (reference # 01-18 / 202 of 30/01/2020). [Annex A].

Key words: agrarian sector of the region, sustainable competitive advantages, competitive position stability, modeling of competitive position stability.

I. Introduction

Relevance of the research topic. Sustainable development of the agrarian sector in the conditions of aggravation of competition is possible only in the presence of competitive advantages. Attention to the problem of their provision is increasing and new features of the study are emphasized, especially the focus of research on such a sign of competitive advantage as sustainability [1; 2]. Reliable diagnostics and modeling of the further situation are the bases for ensuring sustainable competitive advantages of the region.

Problems of diagnostics and providing of competitive advantages of enterprises in general, and agricultural, in particular, were dealt with by domestic and foreign scientists: I. Boryshkevych, Zh.S. Ptashnik, N. Stelmashchuk, N. Tkachova, O. Tridid, I. Shapovalova, V. Yatsenko, Barney J., Wang H., Hart S., Muger A, Grant R., Hamel G., Wernerfelt B., Porter M. etc.

Scientists have made a significant contribution to the study of this problem, but some aspects require additional research. In particular, the issues of assessment and modeling of the competitive position of the agrarian sector of the region as a result of

expressing competitive advantages are insufficiently researched. In this regard, the search for methods of assessing and modeling the sustainability of the competitive position of the agricultural sector of the region is of particular relevance.

The purpose of the study is to evaluate the competitiveness of the competitive position of the agricultural sector in the region and to simulate scenarios for the development of the competitive position of the region.

Based on the goals in the process of the study were set the *following tasks*:

- clarify the conceptual apparatus of the process of ensuring sustainable competitive advantages;
- to assess the stability of the competitive position of the agricultural sector of the region;
- on the basis of the assessment, to predict trends in the stability of the competitive position of the agricultural sector in the region.

II. Analytical review of the literature

In terms of sustainable competitive advantage, there are two opposing concepts in the scientific literature: the Resource-Based Approach [1] and models based on research on the environmental impact of competitive position [4].

According to Porter [4], the competitive position of the subject depends on the particular industry in which he belongs. M. Porter's «Five Forces» model explains the influence of external factors on the industry's competitive environment. M. Porter identifies two types of competitive advantage: low costs and product differentiation. According to Porter, a potential source of competitive advantage is a successful combination of different activities. The small number of activities creates the conditions for copying and imitation of behavior by other competitors [4]. The instability and uncertainty of the industry structure due to the transformation processes caused by the rapid technological development have led to a weakening of the dominance of this concept. Wang notes that Porter's five-force model has limitations because it implies the existence of a perfectly competitive market that is virtually non-existent in our current environment [5].

Critics of this concept, the founders of the resource approach [1; 3; 6-9], believe that it does not pay enough attention to the impact on the competitive advantages of internal features. From the point of view of proponents of the resource approach, the source of sustainable competitive advantage is resources that are endowed with a certain set of attributes, such as rarity, immaturity and uniqueness. The presence of these special features is reflected in the immensity of resources, which protects the company from copying competitors. Barney [1; 3] believes that barriers to entry do not provide sustainable competitive advantage. Barriers are only possible if there are differences in resources. If competitive advantages can be copied by other firms, they are unsustainable. That is, the source of competitive advantage is a unique combination of available resources. If the production of the resource itself and its component is monopolized, it will reduce the income of other producers who do not have such a resource. [6].

Grant R.M. Resources are also considered to be a major source of competitive advantage. But in his view, resources alone are not a source of concrete benefits. Resource characteristics such as poor mobility and complexity of reproduction are the cause of long-term success [8; 9].

To date, the agrarian sector is quite labor intensive and benefits from natural resources. But it has a negative impact on the environment and cannot be a source of sustainable competitive advantage. Hart explored the environmental impact of competitive advantage. Establishing certain environmental requirements by the state may be an external barrier to entry into the industry. Only environmentally oriented resources will be a source of sustainable competitive advantage in the future [12].

Unique resources, combined with a set of appropriate management actions, create sustainable competitive advantages [2]. This is evidenced by the fact that, under the same conditions of functioning within the same branch, the subjects provide different results.

Competitive advantages are the unique strengths of an entity with respect to competitors, which combine the best elements of doing business while ensuring competitiveness [13]. Consequently, the search for sources of sustainable competitive advantage should focus on the heterogeneity and inferiority of resources [14].

Sustained competitive advantage ensures a stable competitive position. An entity's competitive position is its place in specific segments of the external market relative to competitors [15]. Competitive advantages can be of both external and internal origin [16]. Thus, a stable competitive position is to a large extent ensured by a set of internal factors, taking into account the possible impact of which and taking appropriate measures will ensure the development of both individual entities and a certain region (Fig. 1).

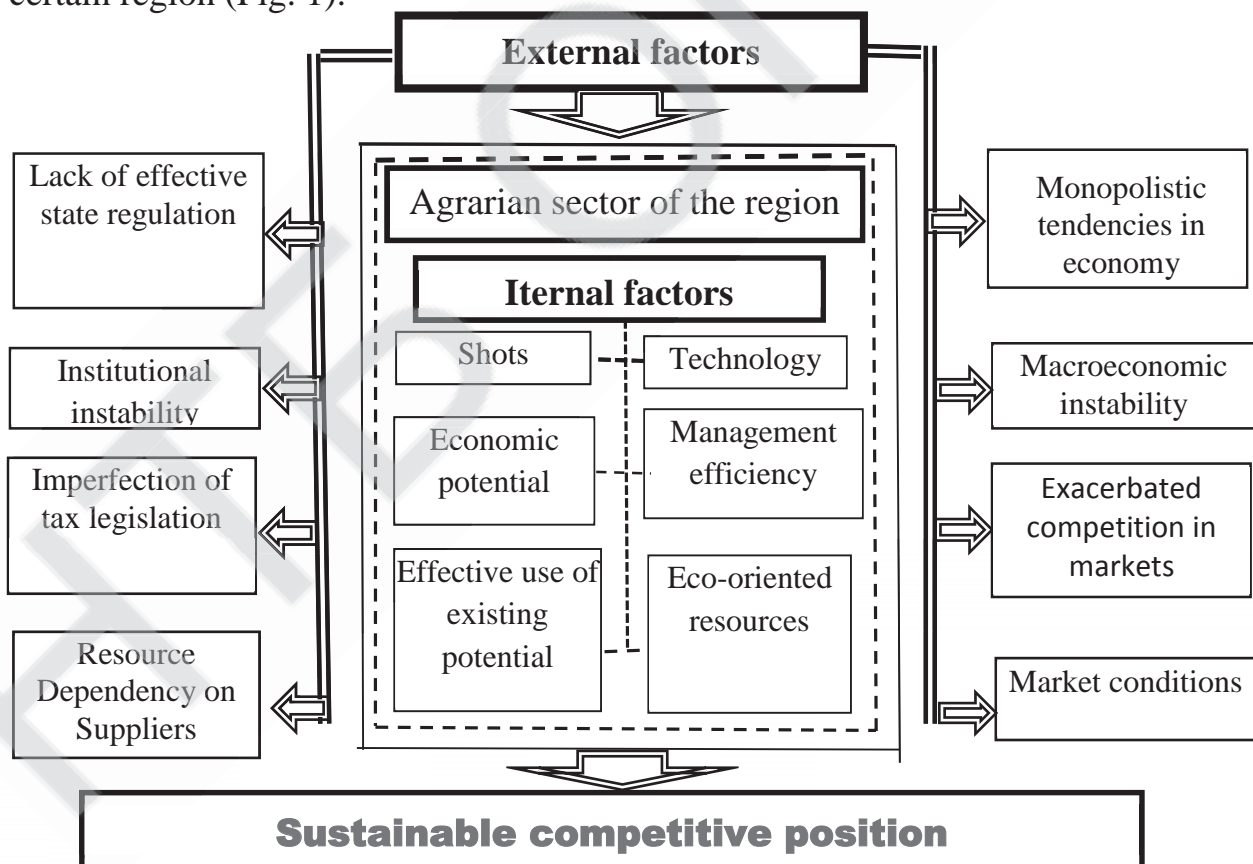


Figure 1. Impact of external and internal environment factors on the competitive position of the agricultural sector of the region

Source: Developed by the author.

The success of management decisions to secure the trajectory of competitive development depends directly on a reliable assessment of the sustainability of the competitive position. There are different approaches to assessing the competitive advantages of agricultural enterprises [17; 18; 19; 20; 21; 22]. When choosing the valuation method, we proceeded from the fact that the agricultural enterprises of the agrarian sector of the region are competing in the industry that, by its characteristics, is the closest to absolute competition, since each producer is a producer of homogeneous products.

III. Object, subject and methods of research.

The subject of the study is the peculiarities of the process of ensuring the sustainable competitive advantages of the agricultural sector of the region in the conditions of increased competition.

The subject of the study is a set of theoretical, methodological and practical bases for ensuring sustainable competitive advantages of the agrarian sector of the region based on evaluation and modeling of the stability of competitive position.

Research methods. In the course of scientific work, the following methods of economic research were used: abstract-logical (in studying and clarifying the essence of the concept of «sustainable competitive advantage» and «sustainability of competitive position»); the method of theoretical generalization (when formulating theoretical generalizations and conclusions, conducting a critical analysis of research results of domestic and foreign authors); economic and statistical (when assessing the competitive position of the agrarian sector of the region on the basis of their sustainability); forecasting using the Brown-Meier economic-mathematical function (to model the stability of competitive positions of the agrarian sector of the region).

IV. Results of work.

IV.I. Analysis of the stability of the competitive position of the agrarian sector of the region.

In assessing the stability of the competitive position of the agrarian sector of the region, we consider it necessary to take into account not so much the absolute values of certain indicators (productivity, cost, product quality and others), or their comparison with competitors (average industry), but rather the dynamic tendencies of changes of relevant indicators in comparison among ourselves.

In our opinion, the analysis of the competitive position should include an integrated assessment using indices of change of individual indicators in the comparison of industry and regional values. We propose to determine the agricultural competitiveness indexes of Sumy region in comparison with the values in Ukraine according to the following indicators: production level (gross production at comparable prices per 100 hectares of agricultural land), level of labor productivity (gross production at comparable prices in per 1 year average employee), level of efficiency (pre-tax financial result per 100 ha of farmland), level of production costs (unit cost), and level of market benefits (average selling prices).

The analysis for 2013-2018 was conducted according to the above indicators, with the values for 2013 being taken as the base (index = 1.00). The values of the respective indices for the following years were defined as the ratio of the absolute values of a given year to the value of the indicator for the previous year. Comparative dynamics

of agricultural production indices of agricultural sector of Sumy region and Ukraine are shown in Fig. 2.

The analysis shows that since 2016 production growth rates in the region have fallen below the industry average, although in 2017-2018 they were already higher.

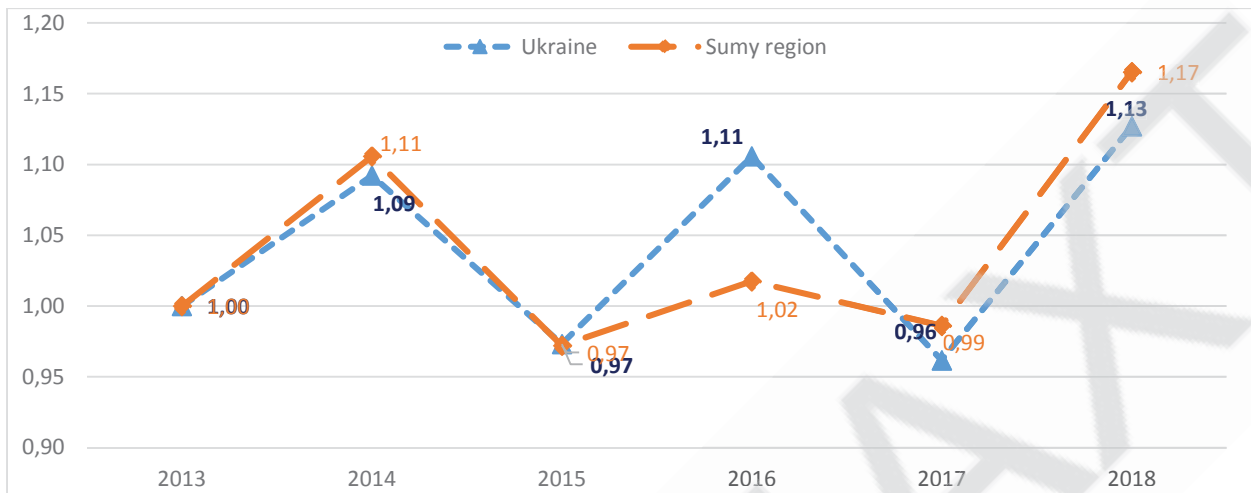


Figure 2 - Indices of change in the level of production (gross production per 100 hectares of farmland) for 2013-2018.

Source: Based on the State Statistics Committee of Ukraine [23-25].

The lower growth rates of the production level in 2016 also led to a lag with the growth rates of labor productivity (Fig. 3).

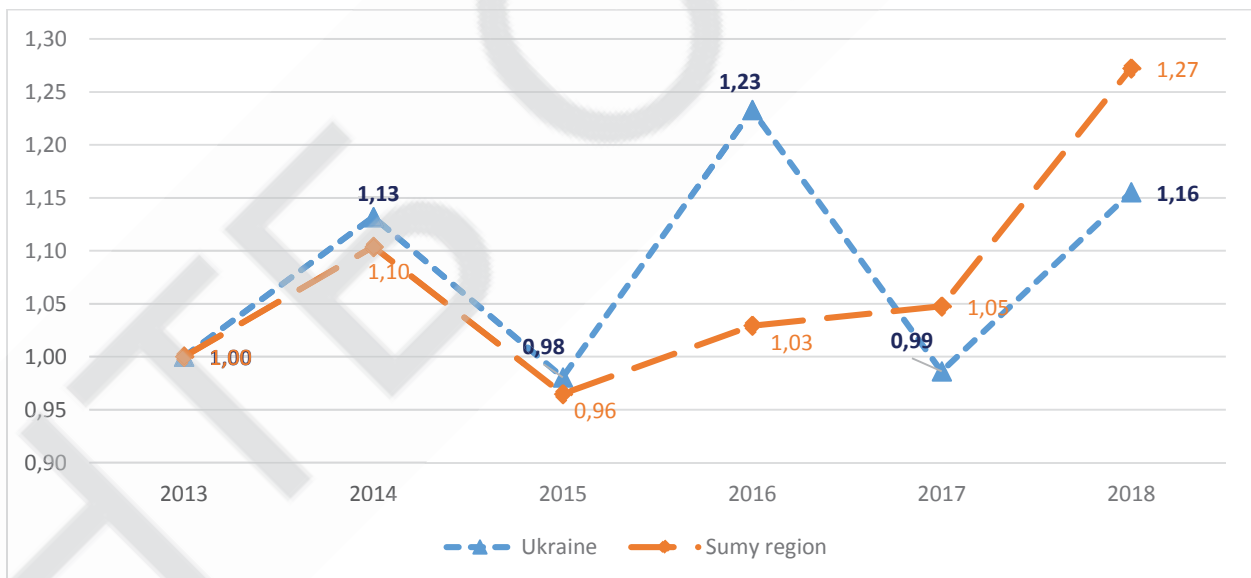


Figure 3 - Indices of change in labor productivity (gross output per 1 average worker) for 2013-2018.

Source: Based on the State Statistics Committee of Ukraine [23-25].

Comparison of agricultural efficiency indices production is shown in Fig. 4.

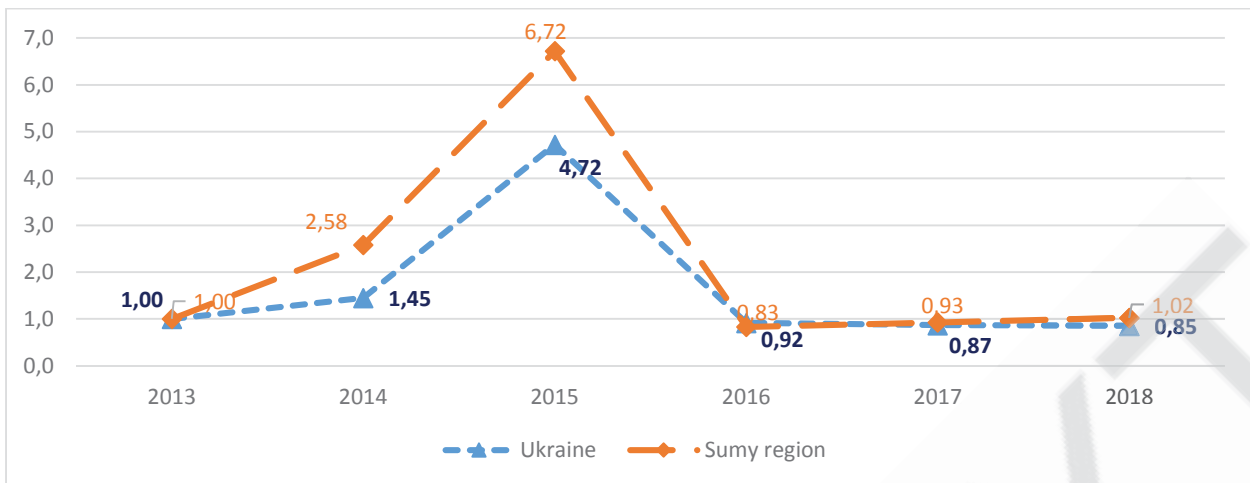


Figure 4 - Indices of change in production efficiency (financial result per 100 hectares of farmland) for 2013-2018.

Source: Based on the State Statistics Committee of Ukraine [23-25].

The analysis of the growth rates of the efficiency indices shows that starting in 2016, the growth rates of the production efficiency index in the region were lower than in the industry, which is confirmed by previous findings (Figures 2 and 3).

Analyzing the dynamics of growth rates of production cost indices and the level of market advantages, it should be noted that considering that different types of products may have different dynamics, we calculated complex indices of the level of costs and the level of market advantages on the basis of geometric values (formula 1).

$$I_{\text{итерп}} = \sqrt[n]{I_1 * I_2 * \dots * I_n}, \text{ where (1)}$$

I_n - the corresponding cost indices (selling prices) of the n-th type of production.

The dynamics of the complex cost level index are shown in Fig. 5.

The analysis shows that the growth rate of the level of expenditures in Sumy region is slowing down since 2016, which has led to an increase in the sustainability of existing competitive advantages in 2018.

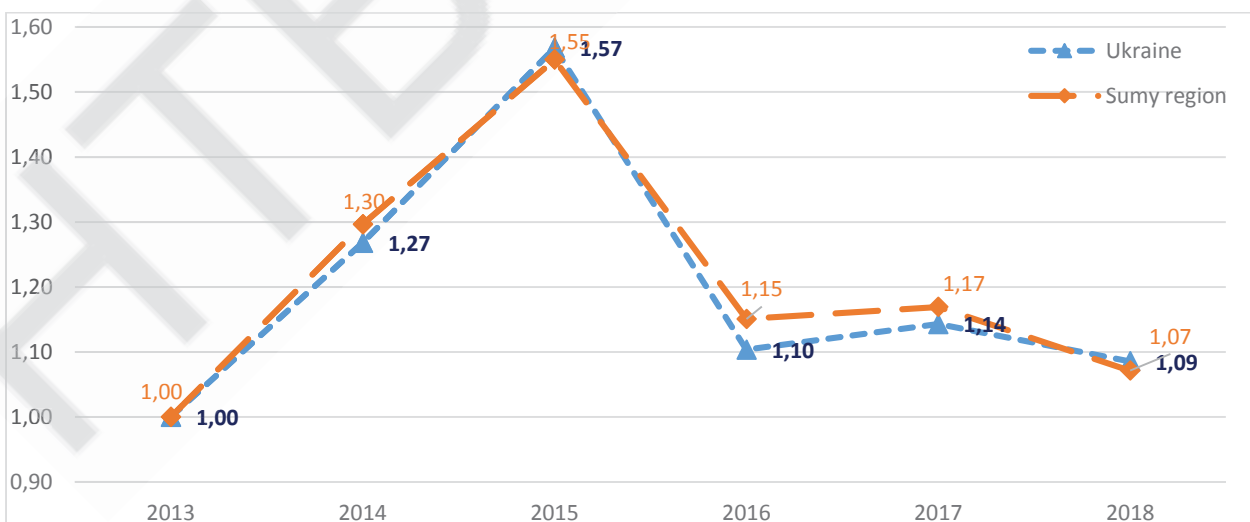


Figure 5 - Complex indexes of changes in the level of production costs (1c cost) for 2013-2018.

Source: Based on the State Statistics Committee of Ukraine [23-25].

Another trend is observed in the analysis of the level of market advantages (average selling prices). In this aspect, agricultural Sumy region enterprises in 2018 slightly reduced their competitive advantages (Fig. 6).

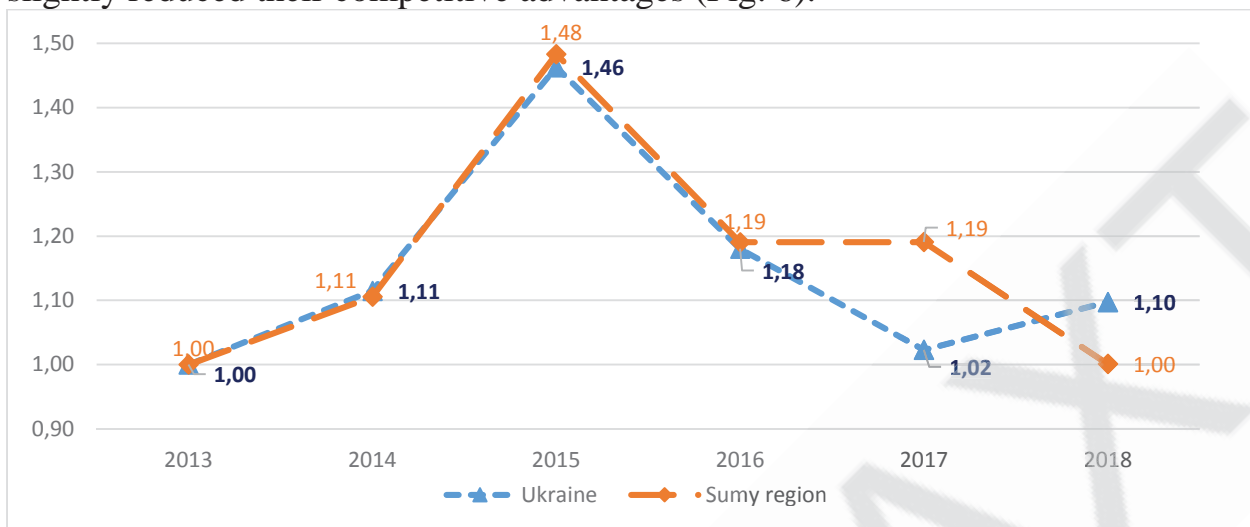


Figure 6 - Complex indexes of change in the level of average selling prices 1t) for 2013-2018.

Source: Based on the State Statistics Committee of Ukraine [23-25].

To better understand the overall trend of changes in competitive positions, we propose to use the integral index of changes in competitive position, as the geometric mean of the above calculated indices (Fig. 7), while taking into account that when evaluating the level of spending less value is better, we used the inverse of the cost level index.

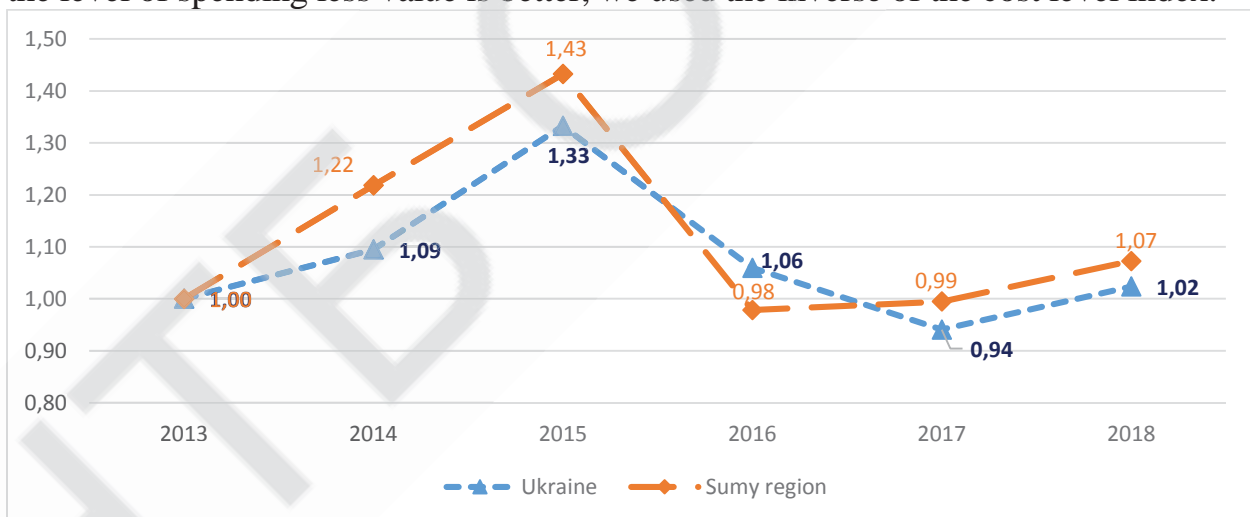


Figure 7 - Integral indices of change of competitive position for 2013-2018.

Source: calculated by the authors.

As the graph in Fig. 7 shows, Sumy Region in its dynamics strengthens its competitive position (except for 2016, when in almost all parameters the region was inferior to industry indicators). Moreover, the analysis of the components revealed that this was due both to a higher level of financial result per unit of agricultural land and a slightly higher level of selling prices (which also affects the financial result to a certain extent) and due to internal competitive factors (production and efficient use of material and labor resources), which in the future contributes to the strengthening of competitive positions.

IV.II. Predicting the stability of the competitive position of the agricultural sector in the region.

Development of the forecast of stability of the competitive position of the Sumy region involves the integrated estimation using indices of change of separate indicators in comparison of the average industry and regional values.

After calculating change indices: production level ($I_{B\Pi}$), level of labor productivity (I_{III}), level of efficiency ($I_{\Phi P}$), level of production costs (I_{CB}) and level of market advantage (I_{IP}), the integral index of competitive position is calculated as the geometric mean of the product of the above indices (formula 2).

$$I_{KP} = \sqrt[5]{I_{B\Pi} * I_{\text{III}} * I_{\Phi P} * I_{CB} * I_{\text{IP}}}, \text{ where (2)}$$

I_{KP} is an integral index of the competitive position of the agrarian sector of the region; $I_{B\Pi}$ - the index of change in the level of production; I_{III} - index of change in labor productivity; $I_{\Phi P}$ - production efficiency change index; I_{CB} - Production Cost Change Index; I_{IP} is an index of change in market preferences.

At the same time, as noted above, that the increase in the level of costs is a negative factor, WIS recognized as the inverse of the index of change in costs

The corresponding indices for the period 2013-2018 for the Sumy region and for Ukraine as a whole were calculated (Table 1).

Table 1 - Dynamics of the index of competitive position of the agrarian sector of Sumy region for 2013-2018.

Indexes		Years					
		2013	2014	2015	2016	2017	2018
Production level index	Sumy region	1,00	1,11	0,97	1,02	0,99	1,17
	Ukraine	1,00	1,09	0,97	1,11	0,96	1,13
Labor productivity index	Sumy region	1,00	1,10	0,96	1,03	1,05	1,27
	Ukraine	1,00	1,13	0,98	1,23	0,99	1,16
Production efficiency index	Sumy region	1,00	2,58	6,72	0,83	0,93	1,02
	Ukraine	1,00	1,45	4,72	0,92	0,87	0,85
Inverse production cost index	Sumy region	1,00	0,77	0,65	0,87	0,86	0,93
	Ukraine	1,00	0,79	0,64	0,91	0,87	0,92
Market Advantage Index	Sumy region	1,00	1,11	1,48	1,19	1,19	1,00
	Ukraine	1,00	1,11	1,46	1,18	1,02	1,10
Integral index of competitive advantages	Sumy region	1,00	1,22	1,43	0,98	0,99	1,07
	Ukraine	1,00	1,09	1,33	1,06	0,94	1,02

Source: calculated based on the State Statistics Committee of Ukraine [23-25].

The following methodology was used to determine the predicted values of the above indices.

First, the values of the baseline indices for the calculation of indices were predicted - corresponding indicators for Sumy region and Ukraine by applying the Brown-Mayer method based on the second-order parabola [26].

If a series of dynamics is described by a second-order parabola:

$$Y_t = A_0 + A_1 t + \frac{1}{2} A_2 t^2, \tag{3}$$

then the main exponential smoothing indices are calculated by the following formulas:

Initial conditions:

$$\begin{cases} S_0^1(Y) = A_0 - \frac{1-\alpha}{\alpha} A_1 + \frac{(1-\alpha)(2-\alpha)}{2\alpha^2} A_2; \\ S_0^2(Y) = A_0 - \frac{2(1-\alpha)}{\alpha} A_1 + \frac{(1-\alpha)(3-2\alpha)}{2\alpha^2} A_2; \\ S_0^3(Y) = A_0 - \frac{3(1-\alpha)}{\alpha} A_1 + \frac{(1-\alpha)(4-3\alpha)}{2\alpha^2} A_2. \end{cases} \quad (4)$$

Exponential averages:

$$\begin{cases} S_t^1(Y) = \alpha Y_t + (1-\alpha)S_0^1(Y); \\ S_t^2(Y) = \alpha S_t^1(Y) + (1-\alpha)S_0^2(Y); \\ S_t^3(Y) = \alpha S_t^2(Y) + (1-\alpha)S_0^3(Y). \end{cases} \quad (5)$$

Estimates of trend coefficients:

$$\begin{cases} A_0^\beta = 3[S_t^1(Y) - S_t^2(Y)] + S_t^3(Y); \\ A_1^\beta = \frac{\alpha}{(1-\alpha)^2} [(6-5\alpha)S_t^1(Y) - 2(5-4\alpha)S_t^2(Y) + (4-3\alpha)S_t^3(Y)]; \\ A_2^\beta = \frac{\alpha^2}{(1-\alpha)^2} [S_t^1(Y) - 2S_t^2(Y) + S_t^3(Y)] \end{cases} \quad (6)$$

Model according to which the forecast is made:

$$Y_{t+l}^\beta = A_0^\beta + A_1^\beta l + \frac{1}{2} A_2^\beta l^2 \quad (7)$$

As a result, the corresponding values of indicators for the period 2019-2021 (Annexes A,B) were projected

Secondly, the indexes of change were calculated on the basis of the projected values: production level (I_{ПІ}), level of labor productivity (I_{ПІІ}), level of efficiency (I_{ФП}), level of production costs (I_{СВ}) and level of market advantages (I_{ІП}).

The final stage was the calculation of the integral index of competitive position on the basis of formula 2. The results of the calculation are shown in table 2.

Table 2 - Forecast values of the index of competitive position of the agrarian sector of Sumy region and Ukraine for 2019-2021.

Indexes		Years		
		2019	2020	2021
Production level index	Sumy region	1,13	1,13	1,12
	Ukraine	1,10	1,10	1,11
Labor productivity index	Sumy region	1,22	1,22	1,22
	Ukraine	1,13	1,14	1,16
Production efficiency index	Sumy region	1,24	1,61	1,99
	Ukraine	1,02	1,27	1,53
Inverse production cost index	Sumy region	0,91	0,88	0,85
	Ukraine	0,91	0,88	0,85
Market Advantage Index	Sumy region	1,05	1,10	1,14
	Ukraine	1,11	1,15	1,20
Integral index of competitive position	Sumy region	1,10	1,16	1,21
	Ukraine	1,06	1,11	1,15

Source: calculated by the authors.

Therefore, the stability of the competitive position of the agrarian sector of Sumy region, which is clearly shown in Figure 8, is increasing in the future.

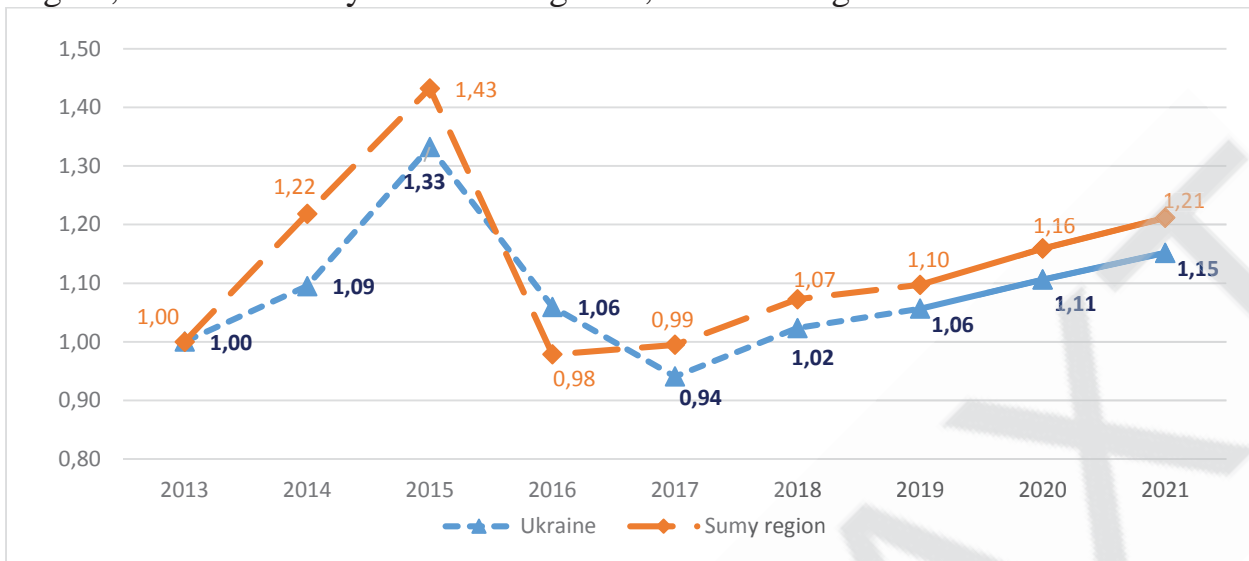


Figure 8 - Integral indices of change of competitive position for 2013-2018

Source: calculated by the authors.

Of course, this forecast, like all other forecasts, does not take into account all the factors that influence the stability of the competitive position, but it allows to simulate in the short term the situation on the market, which provides the necessary information to the relevant state and local authorities for making sound management decisions.

V. Conclusions

1. Sustainable development of the agrarian sector of the region depends on its competitive advantages. Generalization of approaches in the literature to determine the essence of the category «sustainable competitive advantages» has made it possible to define it as a set of features of the economic system, which provide it with a stable competitive position.

2. An important prerequisite for achieving competitive advantage is to assess the sustainability of the competitive position. We were asked to evaluate the stability of the competitive position of the agrarian sector of the region on the basis of indices of change of individual indicators in the comparison of industry and regional values. We propose to determine the agricultural competitiveness indices of the region's agriculture (for example, Sumy region) in comparison with the values in Ukraine according to the following indicators: level of production (gross production at comparable prices per 100 ha of agricultural land), level of labor productivity (gross production at comparable prices per employee per year (average per employee), level of efficiency (pre-tax financial result per 100 ha of farmland), production costs (unit cost) and level of market benefits (average selling prices).

3. To better understand the overall trend of changes in competitive positions, we propose to use the integral index of changes in competitive advantages, as the geometric mean value of the above indices, while considering that the cost level less value is better, we used the inverse cost level index.

4. Analysis of data for 2013-2018 showed that Sumy region in dynamics strengthens its competitive position (except for 2016, when in almost all parameters the region was inferior to industry indicators). Moreover, this was due both to a higher

level of financial result per unit of agricultural land and a slightly higher level of selling prices (which also has a certain effect on the financial result), and due to internal factors (production level and the efficiency of material and monetary use manpower), which in the future contributes to the strengthening of competitive position.

5. To determine the predictive values of the indices characterizing the stability of the competitive position, a method using the Brown-Mayer method based on the second-order parabola was used. As a result, the corresponding values of the indicators for the period 2019-2021 were initially projected. Then, on the basis of the projected values, indices of change were calculated: production level (I_{BII}), level of labor productivity (I_{III}), level of efficiency ($I_{\Phi P}$), level of production costs (I_{CB}) and level of market advantage (I_{IP}). The final stage was the calculation of the integral index of competitive position based on the geometric mean of the above indices, which showed that the stability of competitive advantages of the agrarian sector of Sumy region is increasing for the future.

The implementation of the proposed measures will help to ensure the competitive development of the agricultural sector and, on this basis, to ensure the sustainable development of Ukrainian agriculture.

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Intermediate calculations for calculating the regression forecast trend of competitive advantage indicators

Indicators	Options											
	A ₀	A ₁	A ₂	S ₀ ¹	S ₀ ²	S ₀ ³	S _t ¹	S _t ²	S _t ³	A ₀ ^β	A ₁ ^β	A ₂ ^β
Production level index in Sumy region	0,9837	0,0091	0,0233	1,2008	1,2782	1,3556	0,2500	1,1919	1,2566	1,3309	1,1367	-0,0055
Production level index in Ukraine	1,0227	0,0052	0,0081	1,0918	1,1125	1,1332	0,2500	1,1006	1,1095	1,1273	1,1005	0,0013
Labor productivity index in Sumy region	0,9690	0,0258	0,0395	1,3061	1,4065	1,5068	0,2500	1,2976	1,3792	1,4749	1,2301	-0,0064
Labor productivity index in Ukraine	1,0880	0,0077	-0,0040	1,0224	0,9811	0,9398	0,2500	1,0556	0,9997	0,9548	1,1224	0,0099
Production efficiency index in Sumy region	3,7733	-0,0914	-0,6704	-2,9916	-5,7342	-8,4767	0,2500	-1,9876	-4,7975	-7,5569	0,8729	0,3649
Production efficiency index in Ukraine	2,6732	-0,0312	-0,4409	-1,8625	-3,7530	-5,6435	0,2500	-1,1836	-3,1107	-5,0103	0,7708	0,2483
Inverse production cost index in Sumy region	0,7217	-0,0005	0,0532	1,2821	1,5232	1,7642	0,2500	1,1950	1,4411	1,6834	0,9451	-0,0318
Inverse production cost index in Ukraine	0,7455	-0,0021	0,0471	1,2466	1,4649	1,6832	0,2500	1,1653	1,3900	1,6099	0,9357	-0,0294
Market advantage index in Sumy region	1,3447	0,0085	-0,0796	0,4833	0,0996	-0,2841	0,2500	0,6127	0,2279	-0,1561	0,9983	0,0483
Market advantage index in Ukraine	1,2838	0,0087	-0,0602	0,6262	0,3294	0,0327	0,2500	0,7439	0,4330	0,1328	1,0654	0,0417

The results of the statistical analysis of the dependence of the production level index in the Sumy region on the index of the forecast value

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0,9837	0,0594	16,5590	0,0005	0,7947	1,1728
X Variable 1	0,0091	0,0159	0,5742	0,6060	-0,0414	0,0597
X Variable 2	0,0116	0,0103	1,1331	0,3395	-0,0211	0,0443

$$I_{PB}_t^C = 0,9837 + 0,0091 \cdot t + 0,0116 \cdot t^2$$

$$I_{PB}_{t+l}^C = 1,1367 - 0,0055 \cdot l + \frac{1}{2} \cdot 0,0011 \cdot l^2$$

The results of the statistical analysis of the dependence of the production level index in Ukraine on the index of the forecast value

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	1,0227	0,0666	15,3462	0,0006	0,8107	1,2348
X Variable 1	0,0052	0,0178	0,2910	0,7900	-0,0515	0,0619
X Variable 2	0,0040	0,0115	0,3495	0,7498	-0,0326	0,0407

$$I_{PB}_t^Y = 1,0227 + 0,0052 \cdot t + 0,0040 \cdot t^2$$

$$I_{PB}_{t+l}^Y = 1,1005 + 0,0013 \cdot l + \frac{1}{2} \cdot 0,0010 \cdot l^2$$

The results of the statistical analysis of the dependence of the labor productivity index in the Sumy region on the index of the forecast value

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0,9690	0,0650	14,8974	0,0007	0,7620	1,1759
X Variable 1	0,0258	0,0174	1,4811	0,2352	-0,0296	0,0811
X Variable 2	0,0197	0,0112	1,7545	0,1776	-0,0161	0,0555

$$I_{\Pi\Pi}_t^C = 0,9690 + 0,0258 \cdot t + 0,0197 \cdot t^2$$

$$I_{\Pi\Pi}_{t+l}^C = 1,2301 - 0,0064 \cdot l + \frac{1}{2} \cdot 0,0016 \cdot l^2$$

The results of the statistical analysis of the dependence of the labor productivity index in Ukraine on the index of the forecast value

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	1,0880	0,0981	11,0892	0,0016	0,7757	1,4002
X Variable 1	0,0077	0,0262	0,2935	0,7883	-0,0758	0,0912
X Variable 2	-0,0020	0,0170	-0,1191	0,9127	-0,0560	0,0520

$$I_{\Pi\Pi}_t^Y = 1,0880 + 0,0077 \cdot t - 0,0020 \cdot t^2$$

$$I_{\Pi\Pi}_{t+l}^Y = 1,1224 + 0,0099 \cdot l + \frac{1}{2} \cdot 0,0012 \cdot l^2$$

The results of the statistical analysis of the dependence of the production efficiency index in the Sumy region on the index of the forecast value

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	3,7733	1,8644	2,0239	0,1361	-2,1600	9,7066
X Variable 1	-0,0914	0,4985	-0,1834	0,8662	-1,6777	1,4949
X Variable 2	-0,3352	0,3224	-1,0397	0,3749	-1,3612	0,6909

$$Ie\phi_t^C = 3,7733 - 0,0914 \cdot t - 0,3352 \cdot t^2$$

$$Ie\phi_{t+l}^C = 0,8729 + 0,3649 \cdot l + \frac{1}{2} \cdot 0,0056 \cdot l^2$$

The results of the statistical analysis of the dependence of the production efficiency index in Ukraine on the index of the forecast value

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	2,6732	1,2275	2,1779	0,1176	-1,2331	6,5795
X Variable 1	-0,0312	0,3282	-0,0950	0,9303	-1,0756	1,0132
X Variable 2	-0,2204	0,2123	-1,0385	0,3754	-0,8960	0,4551

$$Ie\phi_t^Y = 2,6732 - 0,0312 \cdot t - 0,2204 \cdot t^2$$

$$Ie\phi_{t+l}^Y = 0,7708 + 0,2483 \cdot l + \frac{1}{2} \cdot 0,0030 \cdot l^2$$

The results of the statistical analysis of the dependence of the inverse production cost index in the Sumy region on the index of the forecast value

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0,7217	0,0744	9,7064	0,0023	0,4851	0,9583
X Variable 1	-0,0005	0,0199	-0,0247	0,9819	-0,0638	0,0628
X Variable 2	0,0266	0,0129	2,0701	0,1302	-0,0143	0,0675

$$I_{BB}_t^C = 0,7217 - 0,0055 \cdot t + 0,0266 \cdot t^2$$

$$I_{BB}_{t+l}^C = 0,9451 - 0,0318 \cdot l - \frac{1}{2} \cdot 0,0004 \cdot l^2$$

The results of the statistical analysis of the dependence of the inverse production cost index in Ukraine on the index of the forecast value

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0,7455	0,0869	8,5791	0,0033	0,4690	1,0221
X Variable 1	-0,0021	0,0232	-0,0889	0,9348	-0,0760	0,0719
X Variable 2	0,0236	0,0150	1,5682	0,2148	-0,0243	0,0714

$$I_{BB}_t^Y = 0,7455 - 0,0021 \cdot t + 0,0236 \cdot t^2$$

$$I_{BB}_{t+l}^Y = 0,9357 - 0,0294 \cdot l - \frac{1}{2} \cdot 0,0005 \cdot l^2$$

The results of the statistical analysis of the dependence of the market advantage index in the Sumy region on the index of the forecast value

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	1,3447	0,0935	14,3755	0,0007	1,0470	1,6424
X Variable 1	0,0085	0,0250	0,3380	0,7577	-0,0711	0,0880
X Variable 2	-0,0398	0,0162	-2,4612	0,0908	-0,0913	0,0117

$$I\pi_t^c = 1,3447 + 0,0085 \cdot t - 0,0398 \cdot t^2$$

$$I\pi_{t+l}^c = 0,9983 + 0,0483 \cdot l + \frac{1}{2} \cdot 0,0001 \cdot l^2$$

The results of the statistical analysis of the dependence of the market advantage index in Ukraine on the index of the forecast value

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	1,2838	0,1160	11,0684	0,0016	0,9147	1,6529
X Variable 1	0,0087	0,0310	0,2800	0,7977	-0,0900	0,1074
X Variable 2	-0,0301	0,0201	-1,4995	0,2307	-0,0939	0,0338

$$I\pi_t^y = 1,2838 + 0,0087 \cdot t - 0,0301 \cdot t^2$$

$$I\pi_{t+l}^y = 1,0654 + 0,0417 \cdot l + \frac{1}{2} \cdot 0,0012 \cdot l^2$$

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