REGRESSION ESTIMATION OF AGRICULTURAL PRODUCTION OF CROPS IN THE WESTERN REGION OF UKRAINE

Lyubov Hats
Ternopil Ivan Puluj National Technical University, Ternopil, Ukraine, Hats_L@ukr.net

Abstract
The results of the quantitative parameters analysis of agricultural crops production in the Western region of Ukraine have been presented. Deviations in the share of crops production (index) in the western regions of Ukraine in 2018 have been identified. A regression model of crop capacity estimation has been constructed. The research results testify that developed factor model is the proper one, and its use in the system of factors impact estimation on the resulting characteristics will make it possible for managers to make efficient immediate decisions on the business activity efficiency increase.

Keywords: agricultural production, estimation, model.

INTRODUCTION

Economic development of business entities depends on the efficiency of resources use providing the final result obtained in the sum of the expected income which is reinvested into the own capital. An essential aspect of such estimation is determination of the factors impact on the resulting economic indices taking into account the specific activity. A number of material, nonmaterial, labor, finance and other resources are involved in any sphere of the business entity activity. Each of them more or less makes impact on the efficiency level. Different results are caused by not only the increased number of resources involved but their rational balance and efficient use as well.

The rationality of the resources involved is estimated by the priority of its efficiency growth rate in comparison with its quantity change rate.

Every kind of resources is analyzed by the certain indices in dynamic aspect and characterizes a tendency of changes by means of ratios. Fluctuations in dynamics with positive (negative) characteristics according to the estimation indicator indicates the possibility of economic growth.

RESEARCH RESULTS AND DISCUSSION

The assessment of economic development type according to the changes structure – specific weight of the resources under assessment is taking place as a result of the business entity inclination to obtain the maximal results under additional investments use conditions or due to the intensive use of the existing investments.

For the general analysis of economic development of AIC of Ukraine in general and in its western region [1] the information data have been summarized in Table 1, Figure. 1.

The obtained results point at considerable share of crops production (73.7% in 2018, i.e. 2.36 percent more than in 2018) in the AIC of Ukraine. Although, due to the constant dynamic fluctuations the process of development is characterized as an unstable one (comparing to 2016 the rate of share increase is descending as it is 2.36% against 3.41% respectively).

Table 1. Dynamics of estimation of economic development indices of AIC in Ukraine

Years	share (%)		deviations (abs.)		deviations (%)	
	crop production	*animal production*	*crop production*	*animal production*	*crop production*	*animal production*
2010	64,3	35,7	x	x	x	X
2011	69,9	30,1	5,6	-5,6	108,71	84,31
2012	67,3	32,7	-2,6	2,6	96,28	108,64
2013	69,9	30,1	2,6	-2,6	103,86	92,05
2014	70,7	29,3	0,8	-0,8	101,14	97,34
2015	70,3	29,7	-0,4	0,4	99,43	101,37
2016	72,7	27,3	2,4	-2,4	103,41	91,92
2017	72,0	28,0	-0,7	0,7	99,04	102,56
2018	73,7	26,3	1,7	-1,7	102,36	93,93

Source: obtained by the author according to [2]

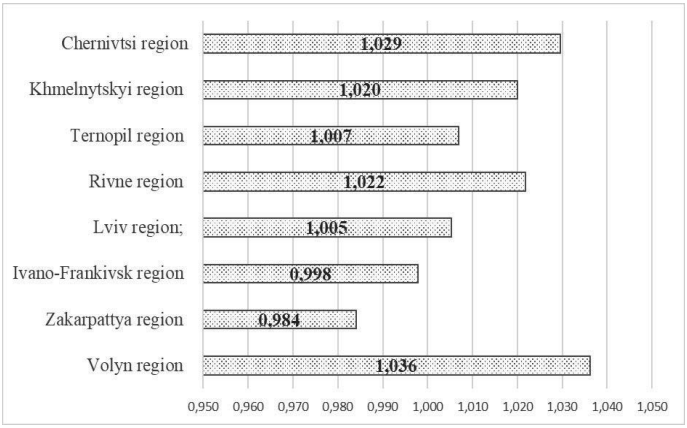
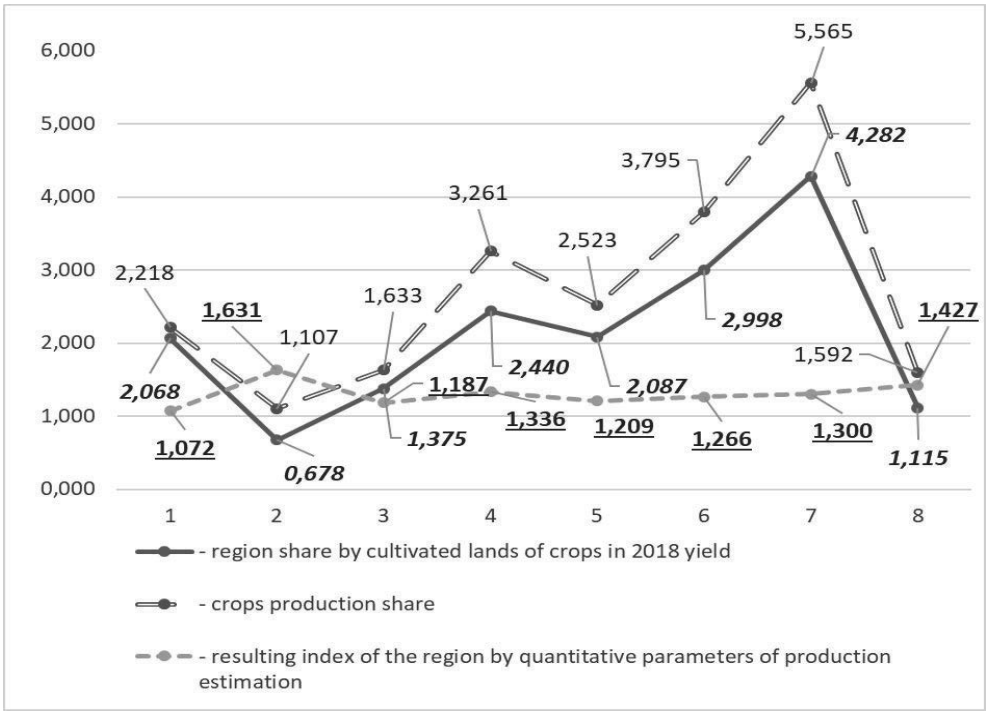


Figure 1. Deviations in the share of crops production (index) in the western regions of Ukraine in 2018

Source: obtained by the author according to [2]

The estimation of economic activity development dealing with crops production of AIC sector according to the qualitative criteria presupposes the use of efficiency parameter, namely a resulting index of the region due to the quantitative parameters of the production estimation.

The obtained results of the study have been summarized in Figure 2.



(1 – Volyn region; 2 – Zakarpattia region; 3 – Ivano-Frankivsk region; 4 – Lviv region; 5 – Rivne region; 6 – Ternopil region; 7 – Khmelnytskyi region; 8 – Chernivtsi region)

Figure 2. The share of resulting indices according to the quantitative characteristics of the estimation of western region of Ukraine in 2018

The results show that Zakarpattia region and Khmelnytskyi region are characterized by the best index of the development parameters ratio under estimation, and Volyn region has the lowest one though the share of cultivated areas of the region is not the worst. We should admit that the quantitative parameters of estimation can be broaden taking into account both the material factors of production and the labor ones as well aimed at more detailed resource aspect of production.

The qualitative criterion presupposes the use of efficiency parameter, namely the crop capacity index per 1 ha of cultivated area.

To build a factor model taking into account the topic of the research we have used the information data summarized in table 2 and we have applied the method of correlation analysis.

In order to study the impact of mineral and organic fertilizers use, share of labor payments expenses and quality of agricultural lands on the crop capacity index per 1 ha of cultivated area a multifactor model has been built by means of electronic spreadsheets MS Excel.

Table 2. Input data to build a factor model of agricultural production development efficiency in the western region of Ukraine

Western region	Mineral and organic fertilizers per 1 ha of cultivated area, t	Share of labor direct payment expenses	CISQ in points according to agrochemical survey [3]	Share of capital investments in production expenses	Crop capacity , per 1 ha of cultivated area
Volyn	2008,92	0,0216	49,0	0,0398	7,71
Zakarpattia	410,09	0,0709	45,5	0,0497	11,73
Ivano-Frankivsk	1347,37	0,0197	44,0	0,0319	8,53
Lviv	1867,94	0,0269	38,5	0,0416	9,61
Rivne	1830,35	0,0240	52,5	0,0421	8,69
Ternopil	2355,44	0,0315	57,5	0,0490	9,10
Khmelhytskyi	2254,00	0,0346	51,5	0,0414	9,34
Chernivtsi	893,42	0,0278	51,0	0,0274	10,26

Source: obtained by the author according to [2]

CISQ – complex index of soil quality.

Identification of variables:

X1 – use of mineral and organic fertilizers;

X2 – share of labor payment expenses;

X3 – quality of agricultural lands;

X4 – share of capital investments in production expenses (due to the depreciation amount)

Y – crop capacity per 1 ha of cultivated area.

The dataset MS Excel has been used to build the regression.

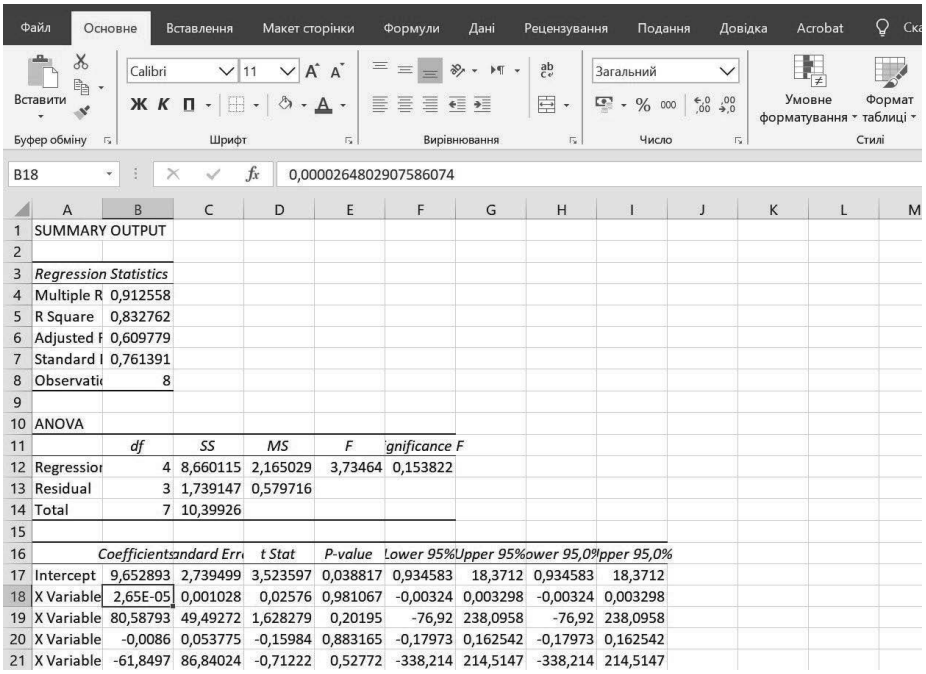
The conducted calculations using the package "Data analysis" have been resulted in the following parameters of the factor model and are shown in Figure 3.

Between the sets x_1, x_2, x_3, x_4, and y there is a linear relationship, which can be described by the equation:

$$\bar{y}_x = b_0 + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4, \quad (1)$$

where b_1 b_2, b_3 b_4 – coefficient of regression,

b_0– parameter.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	SUMMARY OUTPUT												
2													
3	*Regression Statistics*												
4	Multiple R	0,912558											
5	R Square	0,832762											
6	Adjusted F	0,609779											
7	Standard I	0,761391											
8	Observatic	8											
9													
10	ANOVA												
11		*df*	*SS*	*MS*	*F*	*gnificance F*							
12	Regressior	4	8,660115	2,165029	3,73464	0,153822							
13	Residual	3	1,739147	0,579716									
14	Total	7	10,39926										
15													
16		*Coefficients*	*ndard Err*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95,0%*	*pper 95,0%*				
17	Intercept	9,652893	2,739499	3,523597	0,038817	0,934583	18,3712	0,934583	18,3712				
18	X Variable	2,65E-05	0,001028	0,02576	0,981067	-0,00324	0,003298	-0,00324	0,003298				
19	X Variable	80,58793	49,49272	1,628279	0,20195	-76,92	238,0958	-76,92	238,0958				
20	X Variable	-0,0086	0,053775	-0,15984	0,883165	-0,17973	0,162542	-0,17973	0,162542				
21	X Variable	-61,8497	86,84024	-0,71222	0,52772	-338,214	214,5147	-338,214	214,5147				

Figure 3. The parameters of regression factor model of crop capacity estimate in the Western region of Ukraine

Due to the results of calculations the model parameters are as follows:

$b_0 = 9{,}652892618$
$b_1 = 2{,}64803E\text{-}05$
$b2 = 80{,}58793028$
$b3 = -0{,}008595274$
$b4 = -61{,}84966426$

Thus, the crop capacity estimation model in regional aspect is as follows:

$$\boldsymbol{Y} = 9{,}652892618 + 0{,}000026X_1 + 80{,}587930X_2 - 0{,}008595X_3 - 0{,}008595X_4$$

The correlation between factor characteristics and the resulting index is directly and inversely proportional.

The indices of the strength of relationship at multiple correlation are even, partial and multiple correlation coefficients and a multiple determination coefficient.

$$R^2 = \frac{\delta_o^2}{\delta_3^2}. \tag{2}$$

where δ_o^2 – variance of resulting index found by the equation of multiple regression;

δ_3^2 – total variance of the resulting index.

$$\delta_o^2 = \bar{Y}_x^2 - \bar{Y}_x^2. \quad (3)$$

$$\delta_3^2 = \bar{Y}^2 - \bar{Y}^2. \quad (4)$$

The results of calculations have proved that the strength of relationship between the impact factors and resulting index is the following:

$$R^2 = 0{,}83276.$$

CONCLUSION

As the index $R^2 > 0{,}83$, then the factor model is the proper one, and its use in the system of factors impact estimation on the resulting characteristics will allow the management make efficient immediate decisions on the business activity efficiency rising according to the qualitative parameter of agricultural production estimation, namely the crop capacity. The similar model estimation should be formed in further research in every region using different factor characteristics and the resulting index in time slot.

REFERENCE

1. Article Western Ukraine [Online]. – Available at: https://uk.wikipedia.org/wiki/%D0%97%D0%B0%D1%85%D1%96%D0%B4%D0%BD%D0%B0_%D0%A3%D0%BA%D1%80%D0%B0%D1%97%D0%BD%D0%B0

2. State Statistics Service of Ukraine [Online]. – Available at: http://www.ukrstat.gov.ua

3.Barvinskyi A.V., Tykhenko R.V. Estimate and forecast of lands quality [Online]. – Available at: https://pidruchniki.com/81076/agropromislovist/otsinka_i_ prognoz_yakosti_zemel