

Original research paper

PROFITABILITY OF AGRICULTURAL ENTERPRISES IN UKRAINE (ON THE CASE OF LVIV REGION): ASSESSMENT OF TRENDS AND INTERDEPENDENCIES

ABSTRACT

The main objectives of the study are generalization of the economic essence of the process of profitability formation, discovery of its tendencies and conditions of the agricultural producers in Lviv region. The research was conducted basing on the results of the activity of agricultural enterprises, issued by Main Statistic Administration in Lviv region in 2009 – 2013. The paper determines that profit of agricultural enterprises is the source of its development through reinvestment and is also the basis of stable activity and fulfils a social function in the context of providing employment for rural population. The article proves that the profitability of an agricultural enterprise is its economic state, that displays the realized and potential ability to generate a positive financial result from the implementation of both the main (related to agricultural production), and the whole business. According to results of the research of profitability of the agricultural producers in Lviv region for 2009 – 2013, the instability and heterogeneity of their development, manifested in large variation of parameters of profitability, were detected. The article proves that the application of special preferential tax treatment influences on the profitability of agricultural enterprises positively but not sufficiently.

Key words: *profit; the profitability of agricultural enterprises; state financial support of profitability; preferential tax treatment; a multifactorial regression analysis.*

1. PROBLEM AND ITS CONNECTION WITH IMPORTANT SCIENTIFIC AND PRACTICAL TASKS

In the market environment the basis of carrying out of any goods production is attainment of profits by a subject of producing activity. Profitability is a leading force of business development and a mean of satisfaction of own requirements of entrepreneurs in different economical welfares.

Profitability of agricultural enterprises forms the perspective of production extension of agricultural output on the qualitatively-innovative base that enables to ensure the competitiveness of the production on the domestic and international markets, to guarantee the food security and food independence of the state. Profitability is a basic term of solving social problems, particularly the employment of rural population and the development of social assets of rural areas. However, profitability of agricultural enterprises of Ukraine is characterized by an unstable dynamic. The considerable specific gravity of subjects of agricultural sector regularly suffers from loss in the result of their commercial-economic activity. Such kind of situation causes the bankruptcy of enterprises, the reduction of the amount of manufacturers exacerbating social-economic problems.

2. LITERATURE REVIEW AND FORMULATION OF RESEARCH OBJECTIVES

The works of many classics and also modern scientists-economists are devoted to the economic essence of the rise of profit and parameters of its estimating, among which we stay out A Babo [1], I. Blanc [2], M. Bilyk [3], U. Brigham [4], A. Dayle [5], L. Dziubenko [6], B. Collas [7], L. Kostyrko [8], E. Negashev [10], D. Hann [11], L. Chorna [12], A. Sheremeta [13; 14] and others. Questions of profitability and economic effectiveness of agricultural production and organizational-economic aspects of their increase are reflected in the works of V. Ambrosov [15; 16], V. Andriychuk [17; 18], P. Berezivsky [19; 20], V. Zhmaylov [21], V. Messel-Veseliak [22; 23], m. Parhomets [2; 25], P. Sabluk [26; 27], G. Cherevko [28], V. Yurchyshyn [29; 30], V. Yakubiv [31; 32] and many other [33] authors. The research of economists from South Nigeria - Nsikan Edet Bassey, E. Okon Uwemedimo, Umoh Idaraesit Uwem and Nyong Eteyen Edet [34], who studied the determinants of fresh fish marketing and profitability among captured fish traders in South-South Nigeria, is worth paying attention among modern scientists.

There are also interesting works of modern scientists from Ghana – Kwasi A. Darkwah, Abeku A. Asare-Kumi, E. N. N. Nortey and Isaac Baidoo [35], who examined profitability of insurance companies in Ghana in their research.

Here at the essence of profitability of enterprises is often interpreted by scientists-economists only as an index of productivity that clears up its economic essence not completely enough.

The support of profitability on the state level is often characterized with a lack of system, the opacity of its giving, a problem prediction and a limitedness of financial capacity of the state. Profitability management in the enterprises very often doesn't have a strategic direction and a complex-systematic character that requires carrying out further systematic researches.

3. METHODOLOGY

3.1. The area of study

The study of profitability of agricultural enterprises was undertaken on the example of Lviv region, which is located in western Ukraine. The territory covers an area of 21,833 sq.km. and has the largest population in 2,533,384 people. Lviv regions' agriculture is represented by the cultivation of cereals, potatoes, vegetables, sugar beets, flax. There is widely manufactured meat and dairy cattle, pigs and poultry. Agricultural output in the Lviv region produced 583 large and medium enterprises in different ownership forms, among them – 257 private. In the private sector agricultural production produces 1190 peasant (farmer) households and 343,000 households. Today, agricultural land in farms of citizens who were granted land ownership and use, include 657 thousand hectares or 59 % of the area.

3.2. The Sources of Data Collection

For the study information on financial and economic activities of 63 small, medium and large farms was used. However, the research conducted analytical studies of agricultural producers in terms of their organizational and legal forms. The study is also based on statistics that were provided by official statistical agencies in the Lviv region (Central Statistical Office in Lviv region, Ukraine). The study was conducted basing on the results of the farm, provided the Central Statistical Office in Lviv region for

2009 – 2013 years. Place and Duration of Study – Lesya Ukrainka Eastern European National University in Lutsk (Ukraine).

3.3. Methods of research

3.3.1. Basic research methods

Conducting of the research is based on the use of such methods and methodological approaches:

- Analysis and synthesis - to determine the nature and the role of profits in development of the agricultural enterprises;

- Factor analysis - to identify the key factors that influence the efficiency of formation and use of profit of the agricultural enterprises;

- Structural analysis - to research the level of profitability of agricultural enterprises in terms of their organizational and legal forms of the ménage, the scope of the financial and economic activities as well as the unit of occupied area, livestock and taking into the account the produced products;

- Grouping methods - for distribution of the totality of the researched enterprises according to the special features of their functioning;

- Graphical and tabular methods - to display visually the results of the research on the profitability of the agricultural enterprises of Lviv region in 2009 – 2013;

- Regression statistical analysis – to build a regression model to assess the relationship of profit and revenue from the agricultural enterprises with such factors as the capital ratio, the average annual amount of assets of enterprises, the labour costs and the amount of material costs per unit of land area.

3.3.2. Construction of regression multifactorial econometric model

Step 1. Application of the regression of econometric modeling in the research

To determine the density of the identified relationship using the software Microsoft Excel, the multifactor regression model was elaborated and the basic statistical characteristics were calculated.

The equation of the regression contains one effective variable y and an unlimited number of factors –

X_i . While researching of economic indicators from three to eight most significant factors carry almost all the information. Input of the additional variables makes it necessary to increase the number of totality of units ($n \sim 10x$).

The process of building a multifactorial regression model begins with the selection of all possible factors which influences the effective rate.

Then checking of factorial signs on multicollinearity is conducted and special statistical ratios to evaluate the adequacy of the correlation of the econometric model are counted. The coefficient of multifactor equation of regression reflects the conditional impact of certain factor on effective feature, namely the coefficient of multifactor equation of regression shows the impact of certain fixed factorial variable on the effective indicator in term of certain values of the other factors that may change with the shift of the effective indicator.

The coefficient of multifactorial regression equation reflects the net impact of the factorial variable if regression of the econometric model covers all factors which affect the efficient variable. Herewith, the total impact of factors allocated between them. But actually the number of factors is quite larger

and it is impossible to take them into account in the model. It is proved that there are several important factorial variables among all the other and the influence of others is insignificant.

It is important that in the multiple (multifactorial) regression equation its parameters describe a conditional net impact of a single factorial variable on the effective in term of fixed average values of other factors which are included in the model, but the rest factors, which are not included, are variable.

While constructing the multifactorial (multiple) regression equation the background information should be submitted in the form of numbers of one order that will enable to interpret the economic content of individual regression coefficients better.

However, it is impossible to determine the factors that influence the value of the effective rate the most, if it is based on partial regression coefficients. Therefore, it is advisable to calculate the β_i -coefficient, where i - serial number of the factor sign in this regression econometric models.

Partial β_i -coefficients are calculated as a product of the regression coefficient of this factor and the ratio of standard deviation factorial and efficient features. The coefficients that were received in such way show how much the value of resulting sign will change as for the standard deviation with the change of the corresponding factor to one standard deviation granted the fixed (average) value of the other investigated factors.

Step 2. The concept and definition of multicollinearity in econometric regression models

One of the classical assumptions of the regression statistical analysis is the absence of multicollinearity.

Multicollinearity is a phenomenon in which there is the relationship between the factorial signs that is close to the functional ($r_{x_i x_j} \rightarrow 1, i \neq j$).

To examine the model on the multicollinearity the symmetric matrix of coefficients of pair correlations is built.

	Y	X_1	X_2	X_3	...	X_n
Y	r_y^2	r_{yx_1}	r_{yx_2}	r_{yx_3}	...	r_{yx_n}
X_1		$r_{x_1}^2$	$r_{x_1 x_2}$	$r_{x_1 x_3}$	...	$r_{x_1 x_n}$

where: $r_y^2, r_{yx_1}, \dots, r_{x_1 x_n}$ – linear correlation coefficients (coefficients of pair correlation) between the relevant factors and the effective indicators.

So, in order to detect possible multicollinearity, the phenomenon of existing of a close linear dependence or a strong correlation between two or more variables that negatively affects the quantitative characteristics of econometric model or even makes its construction impossible, the matrix of coefficients of pair correlation of factorial and effective features is built.

If the inequality for the constructed model is carried out: $r_{x_i x_j} > 0,8 (i \neq j)$.

then there is the multicollinearity in the model.

Step 3. Interpretation of indicators of the econometric regression model

The indicator for evaluating of the density of the correlation due to the multifactorial model is cumulative (multiple) coefficient of determination.

The formula for its calculation is as follows:

$$R^2_{yx_1x_2x_3...x_n} = \frac{Var(\tilde{y})}{Var(y)}$$

The total variance is determined by the formula: $Var(y) = \overline{y^2} - \bar{y}^2$.

Theoretical variance is determined by the formula:

$$Var(\tilde{y}) = \frac{1}{n} \cdot (a_0 \cdot \sum y + a_1 \cdot \sum x_1 \cdot y + ... = a_n \cdot \sum x_n \cdot y) - \bar{y}^2.$$

Another indicator that is used to evaluate the density of the correlation in multifactorial regression models is cumulative (multiple) correlation coefficient, which is calculated using the formula:

$$R_{yx_1x_2...x_n} = \sqrt{\frac{Var(\tilde{y})}{Var(y)}}$$

It is important that if multiple correlation coefficient is 0.8 or more, the relationship between the factorial and effective features can be considered as tight.

$$R^2_{yx_1x_2...x_n} = \frac{a_1 \cdot Cov(yx_1) + a_2 \cdot Cov(yx_2) + ... + a_n \cdot Cov(yx_n)}{Var(y)},$$

or by calculating the coefficients using the formula:

$$R^2_{yx_1x_2...x_n} = \sum_{i=1}^n \beta_i \cdot r_{yx_i}$$

Step 4. F-test for econometric regression models

To examine the materiality of the relationship according the coefficient of determination $R^2_{yx_1x_2x_3...x_n}$

F-test is used (F – criterion).

The formula for calculating the F-test:

$$F = \frac{R^2_{yx_1x_2x_3...x_n}}{1 - R^2_{yx_1x_2x_3...x_n}} \cdot \frac{n - m}{m - 1},$$

$$k_1 = m - 1; k_2 = n - m.$$

where: m – number of factors in the regression econometric model;

n – the number of observations in the regression econometric model.

The actual value of F - criterion ($F_{(1-\alpha)}(k_1; k_2)$) should be compared with critical, which is included in the relevant calculation tables. If the inequality $F_{(1-\alpha)}(k_1; k_2) > F_{Tabl}$, is carried out, the relationship between effective and factorial features in the constructed regression econometric models is essential.

Thus, according to the results of the comparison of calculated value of F-test $F_{(1-\alpha)}(k_1; k_2)$ in term of the degrees of freedom k_1 and k_2 and the adopted level of probability $(1 - \alpha) = 0,95$ with tabular (F_{Tabl}) it is set that : $F_{(1-\alpha)}(k_1; k_2) > F_{Tabl}$, which is a confirmation of materiality of connection between the dependent and independent variables of the constructed multifactorial regression econometric model.

As a result, if all the parameters are typical for the econometric model, the indicators of connection are essential, then the constructed econometric regression model is adequate and can be used for further analysis and forecasting.

4. THE PRESENTATION OF THE MAIN RESULTS AND THEIR JUSTIFICATION

The functioning of agricultural production in Ukraine is characterized by dynamic environment that often makes negative influence on producers. The last decade is characterized by a reduction of number of farms, in most cases because of their unsatisfied economic situation, and as a result - the redistribution of land is used.

The effectiveness of the agricultural enterprises of Lviv region in recent years, largely caused by market transformations of economy and reform of the agricultural sector, started in 90-ies Twentieth century. Agrarian reform in Ukraine became a part of the fundamental reform of the entire national economy and provided increase of businesses' profitability, the increase of efficiency of agriculture, and improves living standards generally. One of the most complex process of economic restructuring is suffered agriculture. Decreased production of agricultural products, sharply reduced profitability of agricultural enterprises, practically most households became unprofitable. The main reasons of problematic state of national agriculture, especially in the early and mid 90s of last century, were not socio-political and not purely economic factors, but drastic changes in the nature of agriculture production. In the reality of our economic activity in the agricultural sector inherently is entrepreneurial. Entrepreneurship provides vital functions of agriculture and its dynamic development.

In the Lviv regions' agricultural sector there are different legal forms of enterprises. Among them the largest share is occupied by non-state enterprises, including a commercial limited liability companies, private enterprises among which major farmer-Soviet economy. Among the companies that identified by the Department of Statistics, as big products enterprises, more than half - Corporations Limited Liability Company, 26% - large farms and private enterprises in the region located 5 state enterprises and 3 cooperatives. As of 2013, according to the data of Department of Statistics, in the Lviv region operated 186 farms that are fully reporting and realizing agricultural products. We believe that negative development in the agricultural sector during the whole period of its reform and transition to a market economy continuing trend to reduce the number of farms resulting aggregate the impact of

negative factors on economic. Thus, in 2000 operated 624 farms, in 2005 – 365, in 2013 – 186, to with nearly decade with the number of enterprises have decreased by half, and for 15 years - almost four times.

On the basis of research of the works of classics and modern representatives of economic science we have found out that profit is a natural result of effective economic activity of the enterprise and has a versatile economic essence. Taking the part of an embodiment of added value in a product of manufacturing, a purpose guideline and an incentive for the development of production activity, at the same time is a reward to the entrepreneur for his enterprising talent and risk. In this context, the profit of an agricultural enterprise in its many displays is a base of determining the profitability as a multidimensional economic category, which is a qualitative characteristic of the effectiveness of business management.

Profitability of an agricultural enterprise reflects both the effectiveness of its internal organizational management and the adequacy of adaptation to dynamic factors of the external competitive environment, expressed in the ability of accomplishment of its special social-economic mission and accumulates in itself the achieved results and the possibilities of their increase in future. Therefore under profitability we should understand such economic state of the enterprise that appears as an accomplished and potential ability to generate a positive financial result from carrying out both agricultural production and the whole business activity, which lies in exceeding of the profit over the made expenses in the amount sufficient for the further effective functioning and meeting corporative and public interests.

4.1. DATA ANALYSIS

We have discovered that during 2009 – 2013 the amount of medium and large agricultural enterprises in Lviv region were reduced for 20 %. First of all it was caused by the unprofitableness of the part of them. Selective choice gave certain positive results. It was discovered that in 2013 in Lviv region with the increase of the areas used by researched agricultural enterprises for 36 % the amount of production of the gross output of plant growing in them had increased for 75 %, cattle breeding for 41 %. It affirms the combination of extensive and intensive methods of the development of agricultural enterprises of the region on the base of their enlargement.

Analytic research of profitability of agricultural enterprises in the region, in the view of their organizational legal forms of management, gave an opportunity to make a complex of particular conclusions (table 1).

Table 1. Dynamic of profitability of agricultural activity at the enterprises of Lviv region (Ukraine) in the view of their organizational legal forms of management*

Enterprises according to property category	Total	Economic companies	Private enterprises (including big farms)	Production cooperatives	Intereconomic and others	State
Specific gravity of profitable enterprises in their total amount,%						

2009	44	41	48	100	25	33
2010	48	46	53	100	100	0
2011	64	61	70	100	0	20
2012	63	58	71	100	0	40
2013	52	53	52	33	-	40
Change 2013 to 2009, percent points	22	25	3	-50	-	7
Profitability level of agricultural activity,%						
2009	22,4	26,1	11,6	1,4	-9,6	-13,6
2010	27,6	31	17,7	2,3	12,9	-15,1
2011	21,4	23,3	24,3	11,3	-	2,9
2012	2,2	-1,1	17	-6,7	-	2,8
2013	36,9	46,5	1,4	-21,6	-	1,7
Change 2013 to 2009	13,6	11,3	18,9	-7,7		17,4

**Source: integrated on the base of data of Main Statistic Administration in Lviv region (Ukraine)*

Therefore according to the results we ascertain that nearly a half of both economic companies and farm enterprises were unprofitable during the researched period, but the level of profitability of agricultural activity at the enterprises of Lviv region has in total increased. At the same time the effectiveness of activity of companies is higher in comparison with the effectiveness of activity of private agricultural firms and farm enterprises which get higher profits both per unit of expenses and per unit of used area of agrarian land. Commonly the discovered results are caused by a greater scale of activity, higher technical equipment of economic companies which operate with the main funds on the base of leasing of property shares of the company copartners that in comparison with farm enterprises and private enterprises gives opportunities for forming a lower cost of complete product.

It is well-known that the research of absolute indexes of the dimension of profitability is reasonable to carry out according to the involved resources and received production results of management. The effectiveness of planning and carrying out production activity is characterized by the amount of profit, received for the involved resources and per unit of the produced and sold output (Fig. 1.).

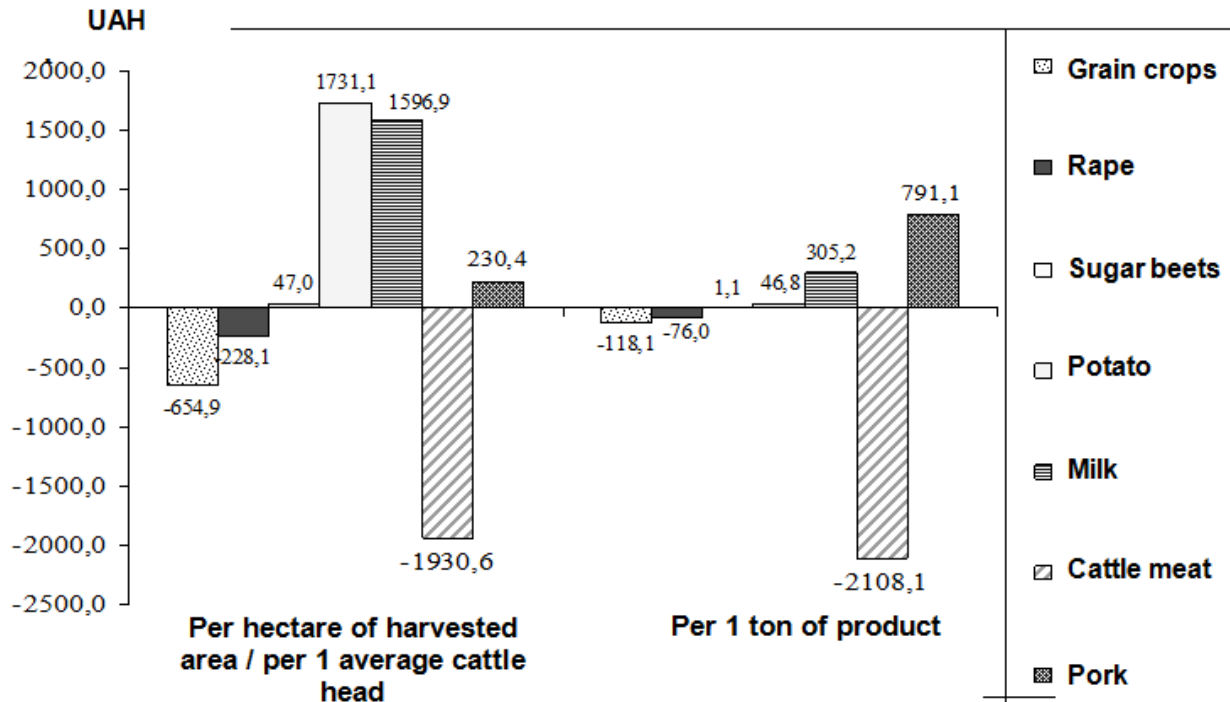


Fig. 1. Profit received by agricultural enterprises of Lviv region (Ukraine) in the account per unit of involved areas, cattle heads and in the account of produced output, 2013 (in UAH)*

**Source: built on the base of data [36].*

In the result of studying the dynamic of profit which was received by agricultural enterprises of Lviv region in the account per unit of the involved areas, cattle heads and in the account per produced output, it was determined that the effectiveness of usage of biological and land agricultural resources in many sectors according to the sum of 2013 had extremely unsatisfactory index.

According to the results of the research we have discovered that in the district view in Lviv region there had been a disproportional benefit from agricultural lands used by enterprises in the context of correlation: «quality of lands – amount of produced gross output» and «quality of lands – profit from agricultural activity». It points that productive-economic effectiveness of agricultural enterprises in present conditions of business management depends more on economic-organizational conditions of internal and external spectrum than on the quality of natural resources. On the base of the research as to the formation of the cost structure and prices of agricultural output, and comparison of the dynamic of price indexes of agricultural output and the output of subsidized industrial sectors we discovered an impossibility to overcome price disparity. It negatively marks on the effectiveness of considerable specific gravity of enterprises of Lviv region.

The research of sales activity of agricultural manufacturers of Lviv region in 2013 shows that nearly 60 % of their output is realized through intermediary marketing channels. They realized only 32,8 % of output, mainly - cattle or of cattle origin directly to rerolling enterprises. We have discovered an insufficient development of own sale chain of agricultural enterprises of Lviv region. Such situation is caused by the peculiarity of enterprises of the sector, which produce mainly raw output that needs

further processing as well as by the fact that a lot of small agricultural manufacturers have got limited resource possibilities for creating own marketing service and branches which would provide the sales of output.

Analysis of the dynamic of profitability level of agricultural sectors of Lviv region during the period from 2009 to 2013 gave us an opportunity to discover a stable tendency of its reducing (Fig. 2.). Especially such reducing was substantial in 2012.

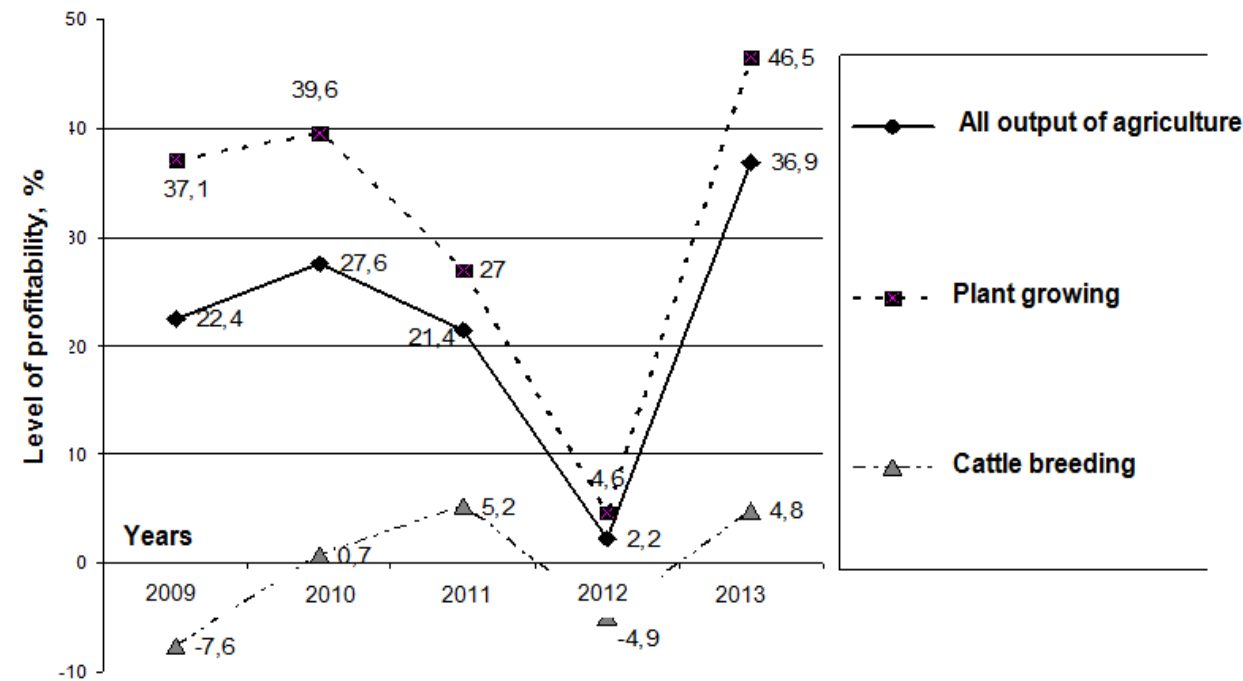


Fig. 2. Dynamic of profitability of the output of agricultural enterprises in Lviv region (Ukraine) during 2009 – 2013, %*

**Source: built on the base of data [36 - 40].*

However, even in the conditions of constant reduction of profitability indexes the production of the main part of kinds of agricultural output at agricultural enterprises of Lviv region since 2009 remained profitable, but it concerns only plant growing sector. But production and realizing of cattle output during the researched period was unprofitable and only in 2010 the sector overcame the profitability line.

We should admit that the determination of tendencies of formation of profitability of agricultural production in Lviv region was characterized by certain peculiarities. In particular, the received average level of profitability that was formed including the presence, in the totality of the researched enterprises of the region, of a few atypical farms with a super high level of profitability. So in the region there are large manufacturers in plant growing which are characterized with evidently atypical high indexes, which in the sum makes a contorting effect on the result average level of profitability index across Lviv region in the researched period.

According to the results of the research during 2009 – 2013 in this region it was detected considerable fluctuations of the profitability level of different sectors of agricultural production and a

substantial specific gravity of agricultural enterprises which had unprofitable production and realization of agricultural output (table 2). It affirms the ineffective adaptation of agricultural manufacturers to the market environment. In the researched totality of agricultural enterprises of Lviv region during 2009 – 2013 we discovered a considerable disproportionate of their distribution according to profitability levels of realization of typical for the region kinds of output. The indexes of profitability level of agricultural activity, profit norms for assets at the enterprises of the researched region widely vary.

Table 2. Dynamic of profitability level of realized output at agricultural enterprises of Lviv region (Ukraine) during 2009 – 2013, %*

Output	2009	2010	2011	2012	2013	2013 to 2009, (+/- ; per cent points)	Agricultural enterprises, that realized their output in 2013	
							Amount, unit	Among them - share Profitable in the sector, %
All output of agriculture	22,4	27,6	21,4	2,2	36,9	14,5	186	51,6
Plant growing	37,1	39,6	27	4,6	46,5	9,4	...	...
Cattle - breeding	-7,6	0,7	6,2	-4,9	4,8	12,4	...	...
Grain	13	4,5	8,3	4,3	-10,5	-23,5	132	53,8
Sugar beets	101	56	29,2	-3	0,2	-100,8	16	62,5
Rape	88,6	80,6	63,1	15,2	-2,4	-91	78	66,7
Vegetables	45,9	95,9	21,1	12,7	13,2	-32,7	16	68,8
Potato	-23,1	41,2	26,1	-39,3	3,4	26,5	22	63,6
Milk and dairy products	-27,5	15	23,6	3,2	15,8	43,3	28	14,3
Cattle meat	4,1	-36,4	-19,1	-27,2	38,8	34,7	42	16,7
Pork	4,1	10,8	18,7	-7,6	7,3	3,2	32	37,5
Poultry	-15,3	4	1,6	-0,4	6,9	22,2	14	64,3
Eggs	-7,2	-5,5	-16,7	4,4	12,1	19,3	6	100,0

*Source: built on the base of data [36 - 40].

According to the results of the research we stated that the profitability level of agricultural activity in the Lviv region during 2009 – 2013 was influenced by granting state financial support in the form of a preferential tax treatment for value added tax and address dotation (Fig. 3.). Automatic return of the value added tax for corresponding operations as to the realization of complete output, improving the financial support of manufacturers, is characterized with a better opacity than dotation support, the order and principles of their granting need considerable improvements.

We discovered that the effectiveness of the activity of agricultural enterprises in the Lviv region in 2009 – 2013 was positively influenced by a preferential tax treatment in the form of single tax for the preferential fourth group of payers of this tax. However, the reduction of state support programs for agricultural sector in all its types during the last years is negatively marked on the effectiveness of the activity of many agricultural enterprises of the Lviv region, especially in cattle – breeding.

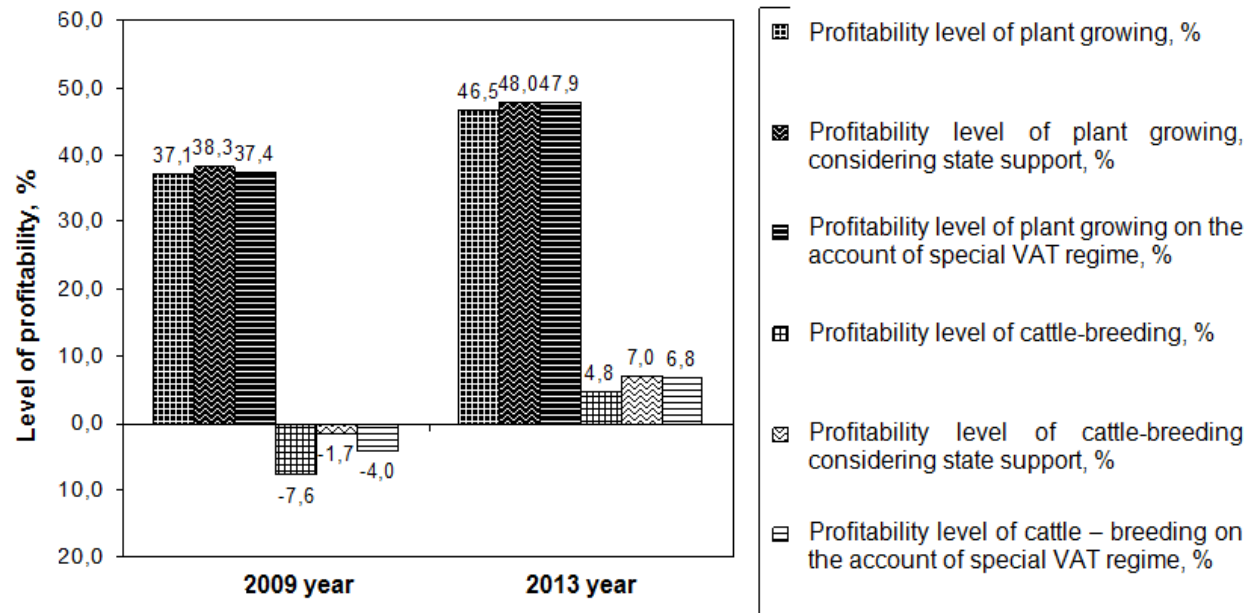


Fig. 3. Visualization of results of the effect of state financial support onto the profitability level of agricultural activity in Lviv region (Ukraine) during 2009 – 2013*

**Source: integrated on the base of data of Main Statistic Administration in Lviv region (Ukraine)*

We state that the profitability level of agricultural production of Lviv region is directly influenced by presence or absence of specialization of agricultural activity. In agricultural enterprises of Lviv region with a high level of specialization they received better indexes of profitability level of agricultural production in average in 2013 – 8.2 %, and in monoproduktive enterprises (enterprises with only one kind of output) – 11.4 %. This index does not reach even 3 % among enterprises with low and medium levels of specialization. At the same time the special gravity of unprofitable enterprises among the last exceeds 40 % that affirms rather ineffective planning of manufacturing activity of agricultural enterprises in Lviv region and their adaptation to the requirements and challenges of the market.

4.2. CORRELATION AND REGRESSION ANALYSIS AND INTERPRETATION OF ITS RESULTS

To summarize the identified trends correlation and regression analysis were conducted and both correlation and regression models were built. To ensure the representativeness of the results of the researched totality of the agricultural enterprises in the Lviv region atypical units were excluded (Table 3).

Table 3. Initial indicators for the construction of multifactorial correlation and regression

No.	Researched agricultural enterprises	The profit from agriculture activity per unit of agricultural land thsnd. UAH. / ha.	The revenue from agriculture activity per unit of agricultural land, thsnd. UAH. / ha.	The average amount of assets per unit of agricultural land, thsnd. UAH. / ha.	The labour costs in agriculture per unit of agricultural land, UAH. / ha.	The material costs of agricultural production per unit of agricultural land, thsnd. UAH. / ha.
1	Enterprise 1	1,15	3,17	0,51	93,88	1,60
2	Enterprise 2	0,31	1,00	25,83	445,88	0,39
3	Enterprise 3	0,63	6,26	3,16	463,18	6,10
4	Enterprise 4	0,42	4,30	9,95	140,60	3,79
5	Enterprise 5	-0,26	2,86	12,64	1320,09	1,96
6	Enterprise 6	-6,03	7,29	9,31	1696,99	5,72
7	Enterprise 7	-0,26	0,36	7,03	488,24	0,47
8	Enterprise 8	-1,14	1,03	19,62	130,22	0,39
9	Enterprise 9	0,19	7,07	6,06	142,30	6,05
10	Enterprise 10	0,02	8,53	8,20	504,98	4,21
11	Enterprise 11	0,39	5,57	13,97	564,51	3,23
12	Enterprise 12	0,18	0,48	9,91	69,74	0,05
13	Enterprise 13	0,01	2,62	5,84	775,64	1,45
14	Enterprise 14	-2,50	4,31	24,96	2854,51	3,01
15	Enterprise 15	-0,07	2,25	9,14	255,97	2,08
16	Enterprise 16	-1,37	7,39	9,95	510,15	4,25
17	Enterprise 17	3,26	13,01	24,80	2198,66	9,57
18	Enterprise 18	-1,15	5,01	2,31	590,07	3,08
19	Enterprise 19	-40,14	4,39	9,88	1786,52	4,00
20	Enterprise 20	0,06	0,14	1,59	12,01	0,10
21	Enterprise 21	1,22	6,17	13,36	765,88	5,42
22	Enterprise 22	0,16	2,75	8,56	100,66	1,86
23	Enterprise 23	-0,64	25,37	170,41	2182,39	15,11
24	Enterprise 24	-0,12	0,29	2,98	1121,65	2,62
25	Enterprise 25	-3,81	1,97	9,70	481,53	2,80
26	Enterprise 26	-5,76	3,94	14,16	603,11	6,67
27	Enterprise 27	-2,58	12,59	19,15	4196,83	4,51
28	Enterprise 28	0,31	5,25	3,45	753,94	5,73
29	Enterprise 29	2,25	49,58	77,26	2912,36	46,80
30	Enterprise 30	0,54	6,67	12,28	178,12	1,83
31	Enterprise 31	-4,12	10,00	119,54	63,43	5,09
32	Enterprise 32	0,23	3,90	7,02	52,11	3,68
33	Enterprise 33	0,00	0,26	0,24	27,64	0,13
34	Enterprise 34	-0,25	7,45	10,62	253,13	3,08
35	Enterprise 35	-0,91	2,30	4,15	48,66	0,39
36	Enterprise 36	1,04	9,05	14,99	847,17	5,38
37	Enterprise 37	-0,92	2,62	8,53	915,07	1,75

38	Enterprise 38	-0,32	2,30	1,59	708,53	1,35
39	Enterprise 39	-0,12	0,76	5,28	66,45	0,91
40	Enterprise 40	0,32	11,28	13,03	390,04	6,02
41	Enterprise 41	-0,02	1,60	5,00	573,50	2,40
42	Enterprise 42	1,23	4,30	7,29	495,27	3,30
43	Enterprise 43	1,37	5,17	55,61	693,65	1,01
44	Enterprise 44	0,94	5,86	10,43	309,88	5,01
45	Enterprise 45	0,59	3,86	1,59	169,84	2,28
46	Enterprise 46	1,55	10,69	51,87	1138,62	8,00
47	Enterprise 47	0,69	7,57	6,78	316,56	5,59
48	Enterprise 48	0,61	8,59	16,13	1612,01	8,25
49	Enterprise 49	0,02	1,42	2,82	364,91	0,64
50	Enterprise 50	-0,08	3,03	4,02	216,83	2,87
51	Enterprise 51	-0,10	1,39	2,32	545,06	13,37
52	Enterprise 52	-0,77	6,36	6,05	204,38	6,11
53	Enterprise 53	-0,09	0,53	2,29	205,08	0,34
54	Enterprise 54	-0,08	0,28	0,51	75,90	0,27
55	Enterprise 55	-0,88	3,13	5,26	896,49	2,70
56	Enterprise 56	-0,23	3,19	5,83	1341,16	3,47
57	Enterprise 57	1,01	2,27	17,00	152,77	0,81
58	Enterprise 58	0,01	0,40	2,20	175,21	1,29
59	Enterprise 59	-0,03	2,70	7,37	343,32	2,03
60	Enterprise 60	11,49	77,15	153,91	2009,98	10,43
61	Enterprise 61	0,61	1,32	16,83	123,41	0,28
62	Enterprise 62	-1,17	3,49	4,73	1916,28	2,47
63	Enterprise 63	-0,46	0,41	3,02	147,85	0,10

*Source: integrated on the base of data of Main Statistic Administration in Lviv region (Ukraine)

According to the results of correlation and regression analysis it was established that the greatest impact on the formation of profit and revenue of the typical agricultural enterprises is carried out by the factors of security and costly nature. According to the results of the research the following factors were selected:

x_1 – average annual amount of assets, thsnd. UAH. / Ha;

x_2 – labour costs, UAH. / Ha;

x_3 – material costs of agricultural production, thsnd. UAH. / ha.

As the effective indicators of these correlation and regression models were selected:

y_1 – the amount of profit from agricultural activities, thsnd. UAH. / Ha;

y_2 – the amount of revenue from agricultural activities, thsnd. UAH. / Ha.

Thus, the following factors were selected: the amount of average annual assets (x_1), labour costs (x_2) and material costs of agricultural production (x_3) per 1 hectare of the occupied agricultural land and the measure of their impact on the amount of profit (y_1) and the revenue from agricultural activities (y_2), that are received per one 1 hectare of farmland was determined. The regression equation is as follows:

$$y_1 = -5,44386 + 0,33937x_1 - 0,00133x_2 + 0,10177x_3;$$

$$y_2 = -39,4809 + 2,2591x_1 + 0,0056x_2 + 0,6434x_3.$$

According to the results of the research the coefficients of determination (0.99) and of the multiple correlation (0.99) for two dependencies indicate a high level of influence of selected factors on effective indicators and density of the detected correlation between them.

The β -coefficients which are received as the result of calculations show that the greatest impact on the level of received profit and revenue carry out such factors as the capital ratio and the volume of material costs per unit of land area, confirming the appropriateness and necessity of intensification of agricultural production in the researched region (Table 4). It was established that the rate of the labour costs per unit of land area has the least significant impact on the selected effective indicators.

Table 4. β -coefficients for the constructed correlation and regression models

β -coefficients	The average annual amount of assets per unit of agricultural land, thsnd. UAH. / ha.	The labour costs in agricultural per unit of agricultural land, UAH. / ha.	The material costs of agricultural production per unit of agricultural land, thsnd. UAH. / ha.
For model y_1	0,968	-0,105	0,137
For model y_2	0,832	0,057	0,112

[Made by the authors].

The value of $F_{critical}$ – calculated F-test for the received correlation models for the given degrees of freedom and $\alpha = 0,001$, meets condition $F_{critical} > F_{tabular}$, indicating the statistical significance of the constructed models, their representativeness and the suitability for analysis and forecasting.

The calculation of coefficients of pair correlation was conducted that confirms the correctness of selection of the researched factor features and effective indicators, as well as a representation and the adequacy of constructed multifactorial regression models (Table 5).

Table 5. Matrix of coefficients of pair correlation between the factorial features and effective indicators of the constructed correlation and regression models

The average annual amount of assets per unit of agricultural land, thsnd. UAH. / ha.	The labour costs in agricultural per unit of agricultural land, UAH. / ha.	The revenue from agriculture per unit of agricultural land, thsnd. UAH. / ha.	The profit from agricultural activity per unit of farmland, thsnd. UAH. / ha.	The material costs of agricultural production per unit of agricultural land, thsnd. UAH. / ha.
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The average annual amount of assets per unit of agricultural land, thsnd. UAH. / ha.	1,00	0,21	0,46	0,24	0,31
The labour costs in agriculture per unit of agricultural land, UAH. / ha.	0,21	1,00	0,45	0,04	0,15
The revenue from agricultural per unit of agricultural land, thsnd. UAH. / ha.	0,46	0,45	1,00	0,89	0,80
The profit from agricultural activity per unit of farmland, thsnd. UAH. / ha.	0,24	0,04	0,89	1,00	0,71
The material costs of agricultural production per unit of agricultural land, thsnd. UAH. / ha.	0,31	0,15	0,80	0,71	1,00

[Made by the authors].

As a result, we can state that the constructed multifactorial correlation and regression models allow to make the conclusion about availability of the significant impact on the profitability of the security of the agriculture enterprises in Lviv region and the level of their intensification of the production activities.

5. CONCLUSIONS

Profit of an agricultural enterprise is a purpose orient for manufacturing of agricultural output and, being a result of such manufacturing, is an index of its effectiveness. Profit of an agricultural enterprise plays the role of a source of its development on the base of reinvestment. It is also a principle of stable activity and, correspondently, carries out a social function in the context of providing employment for rural population. As a term of the stable filling of the market with domestic agricultural output, the profit increases food independence of the state, and in the sum it is the base of determining economic essence of profitability.

Profitability of an agricultural enterprise is such in its economic state, which reflects realized and potential ability to generate a positive financial result from carrying out both the main (connected with agricultural production) and the whole business activities. This result lies in such exceeding of profit over the made expenses, that is sufficient for providing further effective functioning of the enterprise and meeting interests of its owners and public interests. Therefore profitability is a qualitative characteristic of the effectiveness of agricultural management.

According to the results of the research of profitability of agricultural enterprises of the Lviv region during 2009 – 2013 we discovered the instability and heterogeneity of their development that appeared in a great variety of parameters of profitability exchange and potential profitability. The considerable effect of the environment of functioning of agricultural enterprises onto profitability of agricultural production was discovered. Such effect is generally injurious and appears as peculiarities of the development of the market of agricultural output in the country. Such effect is insufficiently corrected by the state policy of administration of the activity of agricultural enterprises and other agricultural manufacturers. The effect into profitability of agricultural enterprises of application of

preferential (subsidy) tax treatment is positive but insufficient. Negative tendencies of the reduction of state support programs of agricultural production in Ukraine cause the unprofitability of activity of the part of manufacturers, particularly in cattle – breeding.

According to the results of construction of multifactorial regression models, it was established that the greatest impact on the level of the profit and revenue of the agriculture enterprises in the Lviv region in the period that was researched have such factors as: the capital ratio and the amount of material costs per unit of land area, confirming the necessity of carrying out the intensification of agricultural production.

CONSENT

The authors declare that written informed consent was obtained from all participants.

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