PROFITABILITY MANAGEMENT OF ENTERPRISES IN THE AGRICULTURAL SECTOR OF UKRAINE: ANALYSIS OF DEVELOPMENT TRENDS AND MODELLING

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Abstract

The article analyses trends in the formation of profitability of enterprises in the agricultural sector of Ukraine in the studied period, which made it possible to identify certain regularities and outline recommendations. The results of the economic-mathematical modelling of the return on equity of enterprises in the agricultural sector of Ukraine were developed and presented. Based on the evaluation and analysis of the developed models, recommendations are proposed for increasing the profitability of enterprises in the agricultural sector of Ukraine, taking into account modern challenges and prospects. In particular, several measures were proposed to help improve the profitability of Ukrainian farm producers` capital. Among them, it is advisable to highlight the reduction of the financial dependence of agricultural enterprises in terms of reducing the use of credit resources with a simultaneous increase in state support for the farm sector, as well as the further consideration of risk reduction factors during the formation of the commodity policy of agricultural enterprises.

Key words: agricultural sector, profitability management of farming enterprises, trend analysis, profitability, modelling, economic and mathematical model

INTRODUCTION

One of the strategic branches of the Ukrainian economy is agriculture. It also belongs to industries that require significant investments and have low returns. That is why the study of profitability for agricultural enterprises is particularly relevant.

Increase management efficiency and use available funds to maximise profitability in limited and exhaustible resource conditions. The company`s profitability is a fundamental indicator that expresses the state and stability of the enterprise and its position on the market, and it is essential for investors.

The problem of assessing the profitability of enterprises was studied by Ukrainian and foreign scientists, particularly N. Antoniuk [1], I. Arakelova [2], I. Artamonov [3], N. Khomiuk [4], Ja. Kostetskyi [5], L. Kozak [6], D. Manole [7], A. Popescu [8-17], T. Shmatkovska [18-23], R. Sodoma [24], A. Verzun [26] and others. Taking into account the significant scientific achievements of these researchers and the peculiarities of the functioning of enterprises in the agricultural sector, we consider it

appropriate to emphasise the need to develop and form economic and mathematical models that will contribute to the identification of factors for increasing the level of profitability of enterprises operating in the agricultural sector of Ukraine.

The analysis of scientific works makes it possible to determine the need for deepening research in the field of study of financial results of the activity of Ukrainian agricultural enterprises as a basis for deciding benchmarks in the evaluation and analysis of reporting data of individual enterprises and selecting resources for internal support of the economy of Ukraine.

MATERIALS AND METHODS

The purpose of the article is an analytical study of the composition, dynamics and structure of financial results and the level of profitability of agricultural enterprises of Ukraine as a factor of increasing economic potential, as well as modelling the profitability of enterprises of the agricultural sector of Ukraine, which will provide an opportunity to identify the main factors that affect profitability, determine the magnitude of this impact and establish possible causes of relationships. It will also make it possible to develop practical recommendations for increasing the profitability of enterprises operating in the agricultural sector of Ukraine in the current economic conditions.

Agriculture is vital because it belongs to the riskiest industries, so the probability of reliable model results for such enterprises is one of the lowest. Therefore, we chose the most famous and common method of profitability analysis, the DuPont factor model [6].

The main task of this model is to determine the factors that affect the enterprise`s efficiency and assess the identified factors [3]. There are many profitability indicators, so DuPont company analysts conducted calculations and found that the most significant is the profitability of equity capital. There are three modifications to this model.

A two-factor model of profitability of assets (ROA).

$$ROA = \text{Profitability of sales} \times \text{Asset turnover} \quad (1)$$

$$ROA = \frac{\frac{\text{Net profit}}{\text{Sales revenue}} \times \text{Sales revenue}}{\text{Assets}} \quad (2)$$

Three-factor model of equity capital (ROE).

$$ROE = \text{Profitability of sales} \times \text{Asset turnover} \times \text{Financial dependence} \quad (3)$$

$$ROE = \frac{\frac{\frac{\text{Net profit}}{\text{Sales revenue}} \times \text{Sales revenue}}{\text{Assets}} \times \text{Assets}}{\text{Own capital}} \quad (4)$$

Five-factor model of return on equity (ROE).

$$ROE = \frac{\frac{\frac{\frac{\text{EBIT}}{\text{Income}} \times \text{EBT}}{\text{EBIT}} \times \text{Net profit}}{\frac{\text{EBT}}{\text{Assets}} \times \text{Income}} \times \text{Assets}}{\text{Own capital}} \quad (5)$$

RESULTS AND DISCUSSIONS

According to data published by the Ukrainian Statistics Service [25], Ukraine`s agricultural sector produces one of the most significant exports, which indicates that it is strategic for the Ukrainian state.

Ensuring the profitability of agricultural enterprises guarantees the state`s food security and the population`s lives. That is why studying the effectiveness of agricultural sector enterprises` functioning is essential and a priority for any state.

We carried out the general economic characteristics of the indicators of profitability and loss of Ukrainian agricultural enterprises using aggregated statistical data, which are officially listed on the State Statistics Service of Ukraine's website [25].

According to the study`s results, the profitability of Ukrainian agricultural enterprises` operational activities in 2021 was significantly better than in 2010, which indicates an increase in profitability in the analysed period based on operational activity results.

It was also found that the worst profitability indicators of the operational activity of Ukrainian enterprises were observed in 2013 and 2019; in particular, in this period, a decrease in net profit was observed at

medium-sized and small-sized agricultural enterprises (Table 1).

Table 1. Profitability of the operational activity of agricultural enterprises in Ukraine for 2010-2021*

Years	The level of profitability (unprofitability) of the operational activities of enterprises				
	Total	including			
		large enterprises	middle enterprises	small enterprises	of them micro-enterprises
2010	22.8	29.7	23.1	17.8	10.3
2011	23.1	30.7	21.1	26.0	23.5
2012	21.6	29.6	19.7	22.8	19.3
2013	11.4	20.1	8.3	12.8	13.1
2014	20.5	23.9	20.9	18.6	14.5
2015	41.6	54.2	37.7	41.3	36.1
2016	32.3	29.4	30.3	37.3	33.1
2017	22.3	24.5	20.9	24.0	24.1
2018	18.2	22.8	17.2	18.7	16.5
2019	19.1	8.4	26.1	13.3	15.4
2020	18.5	16.1	18.6	19.9	18.2
2021	40.2	46.2	37.2	41.3	37.7

Source: S ummarized according to the data of the [25].
*According to the requirements to preserve Ukraine`s national security and territorial integrity, Ukrainian statistical information resources are limited from 2022.

Only large enterprises demonstrated appropriate resistance to changes in the external environment and, even in the most challenging years, showed positive operational profitability. We believe that this is primarily because large enterprises have more economic opportunities to resist negative factors (restrictions due to the coronavirus pandemic, martial law, loss of market share, exchange rate fluctuations, restrictions on turnover, changes in market conditions, etc.) at the expense of own capacities and state economic support provided to large enterprises in Ukraine.

Positive trends in indicators of financial results and profitability of operational activity undoubtedly indicate an increase in the overall profitability of agricultural enterprises. However, an equally important aspect is the quality of these financial results in successfully implementing opportunities to obtain them through cash flows.

According to the results of the analysis of the dynamics of net income from the sale of products of agricultural, forestry and fishery enterprises of Ukraine in 2017–2021, it was established that there are signs of a steady increase in the sales volume of enterprises in the studied industry (Fig. 1).
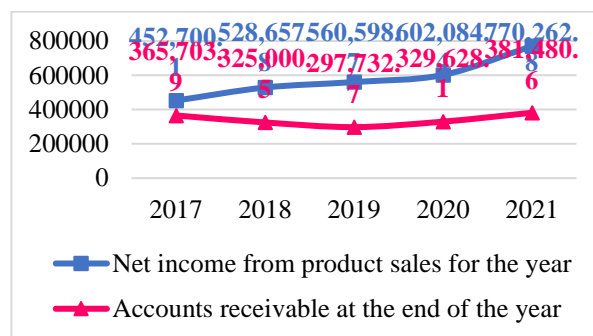

Fig. 1. Dynamics of net income from the sale of products and the balance of receivables of enterprises in the agricultural sector of Ukraine in 2017–2021, UAH million**
Source: Summarized according to the data of the [25].
**Access to Ukrainian statistical information resources will be closed from 2022 to preserve Ukraine`s national security and territorial integrity.

We will use the DuPont three-factor model [5] to calculate the return on equity since we have the necessary data to implement the specified economic-mathematical model.

The main task of this model is to determine the factors affecting the enterprise`s efficiency and assess the determined factors [3]. There are many profitability indicators, so the DuPont company analysts conducted calculations and found that the most significant is the profitability of equity capital. The economic-mathematical model was developed using annual panel data for eight years, from 2010 to 2021 of four large Ukrainian agricultural enterprises.

In our model, the resulting variable (Y) is the return on equity of enterprises in Ukraine`s agricultural sector.

Based on the results of the research, the following hypotheses were proposed:

1) the level of return on capital is affected by the return on sales (X_1);

2) the level of profitability of capital is affected by the turnover of assets (X_2);

3) the level of capital profitability is affected by financial dependence (X_3).

Since all the indicators used are relative, we did not standardize the data. Based on the data collection results, 4 large agricultural enterprises were obtained from 2010 to 2021. Since the time series has the minimum number of observations sufficient to build the model, we calculated two regressions: the panel and average values of four enterprises for a more accurate assessment of the econometric model.

The STATA software package was used to analyze panel series data statistically, and the Microsoft Excel package was used to investigate a series of averaged values.

To describe the return on equity, a linear model was used, which takes the form:

$$Y = \beta_0 + \beta_1 \times X_1 + \beta_2 \times X_2 + \beta_3 \times X_3 + E \quad (6)$$

Therefore, the theoretical model (6) was used to test the hypothesis about the influence of factors on the resulting change.

Thus, based on the simulation results, the following econometric models were developed:

$$ROE = 0.27 + 0.8 \times X_1 + 0.23 \times X_2 - 0.27 \times X_3 \quad (7)$$

$$ROE = 0.37 + 0.38 \times X_1 + 0.1 \times X_2 - 0.25 \times X_3 \quad (8)$$

To select the final model, a series of tests were conducted for the model built on average data (8) and the model built on panel data (7). Thus, according to the results of checks of the obtained econometric models for representativeness, it was established:

Table 2. The coefficient of determination R^2 for the conducted economic and mathematical

Indexes	For a model built on the basis of panel data	For a model built on the basis of averaged data
R2	0.8493	0.9791
Normalized R^2	0.8331	0.9068

Source: own calculations.

The calculation results of the coefficient of determination (Table 2) established that the model built based on averaged data is more representative. Therefore, during the analysis of panel data, the significance indicator of the F-statistic during the assessment of the adequacy of the built econometric model is minimal (close to zero).

Table 3. F-statistics for the conducted economic-mathematical modeling

Indexes	For a model built on the basis of panel data	For a model built on the basis of averaged data
F	52.52	23.74
Significance of F	0.0000	0.0053

Source: own calculations.

For the averaged values, the significance indicator of the F-statistic = 0.0052, which is a high-reliability indicator. Therefore, the model (7) gives more reliable results.

Having analyzed the correlation between the factor and result characteristics (Tables 4 and 5), it can be stated that the profitability of sales (X_1) and financial dependence (X_3) have a significant impact on the return on equity (Y). Between asset turnover (X_2) and return on equity (Y), the correlation indicators, depending on the type of data, differ significantly; in particular, for panel data, the correlation is high and positive (39.24%), while for averaged data, the correlation indicator is negative and insignificant (-6.85%).

Table 4. The correlation matrix for the econometric model was built based on averaged data

	Y	X_1	X_2	X_3
Y	1	X	X	X
X_1	0.868728	1	X	X
X_2	-0.06865	0.301677	1	X
X_3	-0.90456	-0.66541	0.386353	1

Source: own calculations.

It should be noted that the correlation indicators between asset turnover (X_2) and sales profitability (X_1), as well as between financial leverage (X_3) and sales profitability (X_1), are high, which provides grounds for asserting the need to check the constructed econometric model for multicollinearity.

Table 5. The correlation matrix for the econometric model is built based on panel data

		Y	X_1	X_2	X_3
Y	Y	1	X	X	X
X_1	X_1	0.8595	1	X	X
X_2	X_2	0.3914	0.4359	1	X
X_3	X_3	-0.6704	-0.4587	0.0455	

Source: own calculations.

Based on the results of the calculations, we built regression equations (7) and (8).

According to the results of complex calculations for the econometric model (7) with a significance level of 95%, it can be stated that:

– if the profitability of sales increases by 1%, the level of profitability of own capital will increase by 0.8%;

– with an increase in financial leverage by 1%, the profitability of production will decrease by 0.27%.

We cannot conclude the turnover indicator, as it is statistically insignificant; the Student`s t-statistic is less than the critical value.

For model (8) with a significance level of 95%, a conclusion can be drawn only based on the indicator of financial leverage since the t-statistics of the remaining indicators are less than the critical value, which makes them statistically insignificant. So, with a significance level of 95% based on model (8), it can be stated that if the financial leverage increases by 1%, the return on equity will decrease by 0.26%.

As a result, based on the indicators of model adequacy, we conclude that it is appropriate to study the phenomenon using a model built based on panel data (7); therefore, the following tests will be conducted only for this model.

To test the model for heteroskedasticity, we used the White test. After conducting the White test, we accept the hypothesis of homoscedasticity and the absence of heteroscedasticity.

So, according to the results of the above tests, the model is adequate and describes the phenomenon with high accuracy and reliability. Having developed an econometric model and checked it for adequacy by conducting a series of tests, we can conclude the relationships between the performance indicator and factor characteristics. To reduce the cost of production of agricultural plant products, it is necessary to introduce new technologies for cultivation, grain processing and harvesting, as well as improve logistics systems to optimize transport costs and improve grain storage systems.

The correlation model we developed for estimating the asset turnover rate did not provide statistically reliable results. However, it is logical to claim that an increase in the value of the asset turnover rate will lead to a rise in the profitability of enterprises in the agricultural sector of Ukraine since the asset turnover indicates how finished products were sold during the study period. We note that the following measures are considered standard methods of increasing the turnover of assets: selling a part of unloaded non-current assets provided that there is no plan to increase the workload; reducing the number of stocks, returning receivables, as well as measures to increase the amount of the company`s revenue.

CONCLUSIONS

So, in analyzing the current state of the agricultural industry in Ukraine, we found out that there are positive and negative factors for conducting agricultural activities in Ukraine. First of all, it is appropriate to include the following positive aspects: the presence of significant resource potential for the rapid expansion of production capacities, the presence of a highly qualified and cheap labour force, and the production of mineral fertilizers, machines, and chemical means for plant protection. In addition, the transport infrastructure and grain storage infrastructure are being restored. There is domestic demand for agricultural products, and the world demand for grain is growing. International cooperation also creates conditions and increases the competitiveness of Ukrainian products in foreign markets.

The negative aspects of Ukraine`s agricultural sector`s functioning in the current operating conditions include price uncertainty, lack of market infrastructure, and unattractive investment due to low turnover.

According to the results of the construction and testing of the developed econometric model, the return on equity of enterprises in Ukraine`s agricultural sector is closely correlated with the level of profitability of sales; namely, an increase in the indicator of profitability of sales by 1% was accompanied

by an increase in the return on equity of enterprises in the agricultural sector by 0.8%.

Also, according to the study results, the practicality of reducing the financial dependence of enterprises operating in Ukraine`s agricultural sector was revealed since a decrease of this indicator by 1% leads to an increase in the return on equity of the analyzed enterprises by 0.27%.

In DuPont`s model, the turnover of its assets is an essential factor in the positive impact on the return on equity of enterprises in the agricultural sector. However, according to our research and the modelling results, this indicator was statistically insignificant, which is explained by the seasonal nature of farming enterprises` production.

Based on the simulation results we obtained, several measures were proposed to contribute to increasing the profitability of the equity capital of Ukrainian agricultural enterprises. Among them are reducing the financial dependence of farming enterprises in terms of reducing the use of credit resources with a simultaneous increase in state support for the agricultural sector, further consideration of risk reduction factors during the formation of the commodity policy of farming enterprises, etc.

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