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MODEL FOR EFFICIENCY EVALUATION OF FINANCIAL SECURITY MANAGEMENT OF JOINT STOCK COMPANIES OPERATING IN THE AGRICULTURAL SECTOR: A CASE STUDY OF UKRAINE

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Abstract

The study identifies a set of approaches to the formation of a financial security management system of joint-stock companies of the agricultural sector of Ukraine based on providing opportunities to increase their capitalization. To do this, it is necessary to determine an effective method of assessing the effectiveness of financial security management based on the application of a system of financial indicators and criteria that have an impact on the financial security of the enterprises of the agricultural sector as the financial results of their activities. The peculiarities of taking into account the indicator of financial leverage as the most effective criterion for assessing financial security of enterprises of the agricultural sector of Ukraine are considered. Emphasis is placed on the need to take into account industry risk when assessing the effectiveness of financial security management of joint-stock companies, which operating in the agricultural sector of Ukraine. It is proved that the use of the proposed approaches to assess the effectiveness of financial security of enterprises of the agricultural sector of Ukraine management makes it possible to predict the specific impact of each individual factor and indicator of the state of the company's financial security. The practical importance of the proposed method for its use in the process of assessing the investment attractiveness of joint-stock companies operating in the agricultural sector of Ukraine is determined.

***Key words*:** *agricultural sector, model, investment attractiveness, financial resources, joint-stock companies, financial leverage*

INTRODUCTION

The issue of determining the effectiveness of the formation and use of financial resources is fundamental in all economic research, which are the results of scientific research on its increase and improvement of the financial mechanism in a particular area in general. The main purpose of financial security management of joint-stock companies operating in the agricultural sector of Ukraine is to develop an effective model for assessing its effectiveness for timely detection of threats and/or dominants and the formation of the financial security strategy to increase the market value of the firm and create a positive investment image. It is investment resources that are decisive in terms of forming the financial potential of the economic growth of a joint-stock company operating in the agricultural sector.

Many scientists and practitioners have been involved in solving the problem of assessing the state of financial security of joint-stock companies, as well as the effectiveness of its management. In particular, researchers such as made a significant contribution to the formation of financial security assessment methods O. Agres [1], O. Apostolyuk [2] O. I. Baranovsky [3], I. O. Blank [4], A. Boiar [5], N. M. Davydenko [6-7], M. Dziamulych [8-10], V. M. Heyets [11], N. I. Kostina [12], A. Popescu [13-22], T. Shmatkovska [23-25], O. M. Shubalyi [26], I. O. Tsymbaliuk [27], V. Yakubiv [28], Ya. Yanyshyn [29], E. R. Zharova [30], I. V. Zhurakovska [31] and others. However, the results of scientific research of these authors are aimed at

determining the essence of financial security management of enterprises or its management mechanism and do not adequately cover the methodological aspects of assessing the effectiveness of financial security management of enterprises operating in the agricultural sector taking into account their organizational and legal form of management.

In general, the specialized scientific economic literature uses a large arsenal of methods for assessing both the financial security of economic entities and the effectiveness of their management. The most common of them are rapid analysis of the financial condition, financial and production leverage, integrated analysis. However, there is no clear sequence for conducting a certain type of analysis in terms of specific components of the system of financial security of domestic corporate structures. Instead, the same techniques are used to analyse the various components of this system, using variations of economic-mathematical and statistical analysis tools.

Thus, there is an objective need to generalize the existing methods of analysis of the effectiveness of financial security management of joint-stock companies operating in the agricultural sector, as well as to develop a model for assessing the effectiveness of financial security of joint-stock companies under the influence of relevant financial security factors.

MATERIALS AND METHODS

In the process of analyzing financial security, scientists in one way or another address the issue of its effectiveness, although they do not emphasize this. For example, rapid diagnostics often lead to conclusions about the deterioration or improvement of the financial condition of the entity, which is the result of effective management. And not for nothing, this technique can be considered a classic in the context of assessing the effectiveness of the formation and use of financial resources of economic entities, the effectiveness of which is confirmed by many years of use in financial analysis.

In addition to this, there are a number of other techniques that are very routine or created with the help of special software, and therefore - difficult to use. Thus, based on the selected factors, we can predict their impact on indicators of financial security in order to form an appropriate model using the regression equation. Regression-correlation analysis is an effective, and therefore a widely used tool for forecasting economic phenomena and processes. However, its effectiveness depends on the adequacy of the data for analysis. The reliability of the forecast by regression will be greater than the range of data underlying its construction. Preferably the following models have the form:

$$\overline{Y_x} = a_1 X_1 + a_2 X_2 + ... + a_n X_n ,$$

where:

$\overline{Y_x}$ – the resulting regression index;

X_{1-n} – causal variables;

a_{0-n} – parameters of the linear equation.

The resulting indicators are considered to be indicators of financial condition: the ratio of own working capital per unit of output, return on assets, liquidity ratios, etc., depending on the objectives of the research. The sample size is not defined and depends on the purpose underlying the construction of regression and subjective judgments of the researcher, however, the inclusion in it of a factor is preceded by checking it for collinearity with the resulting indicator, which provides a deviation from the analysis of those factors which with the analyzed indicator indicates a significant (≥0.9) or insignificant density (<0.75). There is no clear requirement for ranking the bond density, so different scientists set their limits at their own discretion.

Despite the fact that this method of modeling the assessment of financial security of joint-stock companies allows you to accurately predict it, we still believe that it is not without its drawbacks. The model does not take into account the factors that have the greatest impact on the state of financial and economic activities, which calls into question the reliability of the forecast, as it means incomplete analysis.

Ensuring maximum profitability is possible by full-scale use of all financial opportunities to increase the market value of the firm, and

minimization of financial risk - by constant monitoring of the effect of financial leverage. In view of this, we consider it appropriate to determine the effectiveness of financial security management of JSC of the agricultural sector engineering based on a cost-oriented approach to the capital structure by modifying existing approaches [6] to assess the investment image of the entity, which involves determining the weighted average cost of capital; the value of the firm or its rating through capitalized income and leverage; industry risk assessment.

Such an algorithm for assessing the effectiveness of financial security management of JSC (which essentially allows analyzing the financial potential of economic growth) was proposed due to the lack of necessary data for factor analysis of financial leverage, and which is based on the method of N. I. Kostina [12]. Despite the fact that financial leverage occurs only when the structure of financial resources available borrowed funds, we consider it appropriate to determine it even in the absence of borrowing, considering the amount of borrowed resources, which we have allocated in a separate block to emphasize ownership - the company uses them, but they do not belong to it.

According to research, a number of joint-stock companies of the agricultural sector in the field of mechanical engineering are permanently unprofitable in terms of net financial result, but the profitability of their operating activities is positive, indicating their business activity and, in general, reflects the feasibility of their operation. market. Therefore, they are all exposed to systematic risk, the assessment of which indicates the dependence or, conversely, independence from the industry, and thus - the level of security for investors. Based on such considerations, we consider it necessary to determine such a risk for each joint-stock company in the industry.

This risk is a synthesis of the likely negative impact of a number of endogenous and exogenous financial factors, including investment activity, turnover of total and equity, changes in the legal framework, etc., and its value is calculated as follows:

$$\beta = \frac{K_{PPm}}{S_p^2} = R_{PPm} \times \frac{S_{Pm}}{S_P},$$

where:

β – the magnitude of industry risk;

P – a random variable that characterizes the agricultural sector;

P_m– a random variable that characterizes a particular JSC within the industry;

K_{PPm} – covariance coefficient between P i P_m;

S_p – RMS deviation P;

S_{Pm} – RMS deviation P_m;

R – correlation coefficient between P i P_m.

By assessing this risk, it is customary to compare the return on equity of a particular entity and the market average, and its value indicates how many percent the approximate return on equity will increase if market returns increase (decrease) by 1%. Extrapolating the origins of this concept to the subject of the study, we consider the systematic risk to be greater, the greater the indicator of its elasticity. More detailed characteristics of the β-coefficient are shown in the Table 1.

Table 1. Economic content and level of branch risk of joint-stock companies of the agricultural sector by β-coefficient

The value of the β-coefficient	Economic content	Risk level
β < 0	A unique case when the return on total capital of a certain JSC of the agricultural sector and the compared branch are not related	-
β = 0	The profitability of JSC does not depend on the changes taking place in the industry. That is, the level of financial security is moderate	There is almost no risk
0 < β	The total profitability of a certain JSC of the agricultural sector responds quite moderately to changes in the compared branch. Financial security tactics and strategies are protective.	The risk is low (depends on the industry, but not significantly)
β = 1	The profitability of JSC changes in proportion to changes in industry profitability	Risk at the level of the average industry
β > 1	The profitability of a particular JSC largely depends on the changes taking place in the industry	High risk (shows industry dependence)

Source: compiled by the authors.

In this case, if:

β=1, this means that fluctuations in the financial results of an individual JSC of the agricultural sector coincide with the industry;

β<1 – variation in financial results is less than the industry;

β>1 – fluctuations in the results of financial

and economic activities are greater than the industry.

As for the amount of financial leverage, which is the financial lever of profitability, its skillful use can lead to a situation in which a firm with less equity can achieve good profitability. Thus, the size of the lever arm is determined as follows:

$$F = \frac{FL}{FR + D},$$

where:

FL – shoulder of financial leverage;

D – total debt of the joint-stock company;

FR – own financial resources of joint-stock companies.

The value of the joint-stock company (V_{js}) calculated as:

$$V_{js} = FR + LC,$$

where:

LC – the level of capitalization of the joint-stock company.

In turn, the level of capitalization at a discount rate will be determined taking into account the level of return on total capital by the formula:

$$LC = \frac{NP}{RTC \times 0{,}01},$$

where:

NP – net profit;

RTC – return on total capital, %.

RESULTS AND DISCUSSIONS

To summarize the conclusions and assess the effectiveness of financial security management of the JSC, we take into account these factors and form an appropriate formalized model. At the same time, we consider it necessary to compare the weighted average cost of capital, calculated on net income, which characterizes the level of return on shareholders and the value of JSC from the standpoint of financial potential for economic growth, which is useful for investors when making decisions about investing in these JSCs. If the value of a firm exceeds its weighted average price at a positive or increasing level of return on total and equity, as well as the return on its shares, it means that it increases its financial potential by borrowed resources, and thus - investing in its activities is profitable. Adherence to such conditions indicates that the strategy of its financial security is aggressive and aimed at increasing the market value of JSC.

If the weighted average cost of capital is higher than the value of the JSC in terms of positive or growing return on equity, total and share capital with little financial leverage - this means that the JSC is aimed at satisfying the interests of owners, and financial security strategy is protective. The peculiarities of such a strategy are the financing of development only from its own sources of financial resources.

The value of relatively and absolutely unprofitable JSCs should be estimated by the amount of retained earnings, which can be considered as a reserve of additional equity as a potential source of equity, which can be used to cover losses or the depth of the “debt pit” at a net loss. It is possible to allocate such types of strategies of financial safety of joint-stock companies depending on their purposes (Table 2).

Table 2. Types of the financial security strategy of joint-stock companies operating in the agricultural sector depending on their market value

Type of strategy	The level of management efficiency	Content	Features
Aggressive	High (strategy effective)	Aimed at increasing the value of JSC and increasing the financial potential of economic growth in the short and long term. Market activity is high	In the structure of financial resources, in addition to own and involved, there are borrowed funds. The cost of JSC exceeds the weighted average cost of capital, providing a positive value of return on equity and total capital
Protective	Medium (moderately effective strategy)	Aimed at satisfying the interests of shareholders and maintaining a stable financial potential for economic growth. JSCs are passive in the stock and credit markets	There are no borrowed funds in the structure of financial resources. The weighted average cost of capital is higher than the cost of JSC, the return on equity and total capital is positive or growing, and the level of financial leverage is low
Passive	Low (strategy ineffective)	Aimed at maintaining operating activities and covering losses. JSC passive on the stock market and active on credit (periodically or in dynamics)	The structure of financial resources is formed by own, involved, and borrowed funds. The amount of retained earnings decreases in dynamics or the number of uncovered losses exceeds the amount of registered and additional capital (periodically or in dynamics)

Source: Own research.

The financial security strategy of such JSCs should be considered passive, and the financial potential of economic growth is exhausted by the amount of registered capital, increased by the amount of retained earnings, if any. If the amount of uncovered losses exceeds the amount of registered and other additional capital, the internal financial potential of economic growth of such an entity is absent and can be replenished only by the state, as it is extremely difficult to attract private investors to finance the JSC.

Taking into account the above, and in order to simplify the process of assessing the effectiveness of financial security management of JSC, we form an appropriate model, introducing symbols, which distinguish three levels of efficiency of financial security management of JSC of the agricultural sector: effective, moderately effective and inefficient (Fig. 1).

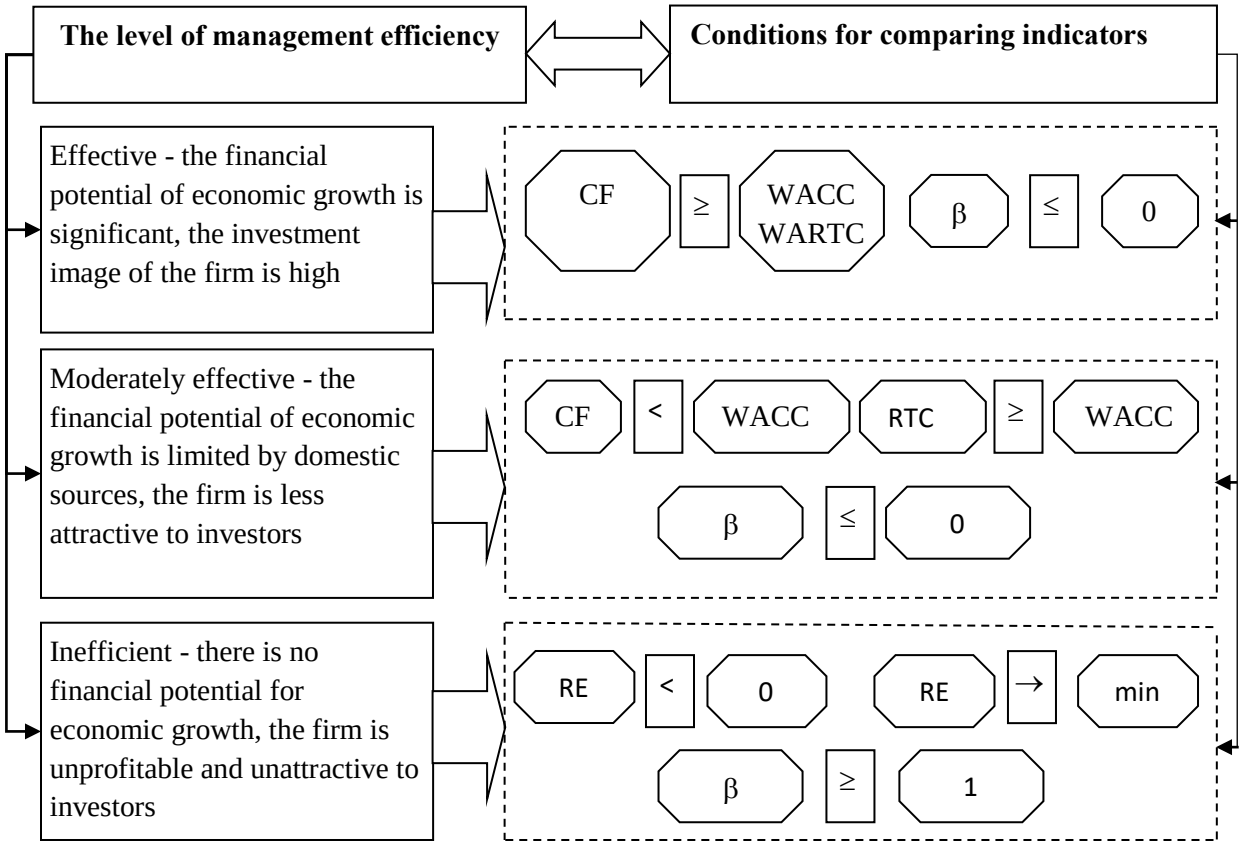

Fig. 1. Model for assessing the effectiveness of financial security management of JSC operating in the agricultural sector

Source: Own research.

Symbols: CF - the cost of the firm; WACC - the weighted average cost of capital; RTC - return on total capital; WARTC - the weighted average return on total capital; RE - retained earnings.

To determine the value of the studied join-stock companies of the agricultural sector of Ukraine according to the above algorithm and try to assess the effectiveness of managing their financial security from the standpoint of the financial potential of economic growth, comparing it with the weighted average cost of total capital and taking into account the amount of financial risk.

It should be noted: all indicators will be calculated in thousands of UAH except for some of them, the units of which are listed directly in the tables.

As can be seen from the Table 3, the value of the leverage of PJSC "Mykolaiv Agricultural Company" was the largest in 2019, which indicates the greatest financial risk this year, which is also confirmed by the largest

percentage of debt in the value of the firm and a simultaneous decrease in return on equity.

Table 3. Indicators for assessing the effectiveness of financial security management of PJSC "Mykolaiv Agricultural Company"

Indexes	2016	2017	2018	2019
Own financial resources	9,242,542	10,762,429	14,234,040	16,252,316
Financial resources involved	3,422,440	5,270,041	5,874,065	5,905,174
Aggregate own resources (group 1 + group 2)	12,664,982	16,032,470	20,108,105	22,157,490
Borrowed funds (debt)	531,128	546,984	648,436	2,968,164
Total capital (gr. 1 + gr. 2 + gr. 3)	13,196,110	16,579,454	20,756,541	25,125,654
Net profit	1,319,191	1,560,367	3,399,842	1,964,443
Operating profit	2,190,854	3,644,326	5,921,863	3,471,445
Return on equity taking into account borrowed funds,%	*10*	*10*	*17*	*9*
Return on total capital,%	*10*	*9*	*16*	*8*
Net profit per 1 share, UAH	634.84	750.90	1636.12	945.36
The weighted return on total capital,%	7	4	10	5
The weighted average cost of capital	**19,916,855**	**36,443,260**	**32,899,239**	**38,571,611**
Capitalized income	19,916,855	36,443,260	32,899,239	38,571,611
Shoulder of financial leverage	0.054	0.048	0.044	0.154
The cost of the firm	**20,447,983**	**36,990,244**	**33,547,675**	**41,539,775**
% of debt in the value of the firm	4.24	3.39	3.32	11.97
Systematic risk	***β-factor = -0.11 risk absent***			

Source: Own research.

This means that the company does not use the opportunities to manoeuvre the effect of financial leverage over its shoulder in order to extensively increase the latter, resulting in avoiding problems of loss of financial independence, increasing the value of "risk premium" in loans. The fact is that with the permanent and excessive growth of borrowed resources there is a risk of losing financial stability due to the need to divert funds to repay the body of the loan and interest on it. In such a situation, the level of financial leverage grows, which automatically increases the "risk fee", which is included in the cost of the loan by lenders. In addition, JSCs must have some untapped borrowing potential in case of unforeseen economic, socio-political, and market circumstances and, in case of urgent need, replenish financial resources with newly borrowed funds, providing a positive differential of financial leverage (i.e. use its stock). These features of the effect of financial leverage should be taken into account when formulating a policy to improve the efficiency of financial security management of JSC of the agricultural sector, which uses credit resources in its activities to increase the return on equity.

At the same time, the excess of the latter over the weighted average price of financial resources indicates that the JSC uses an aggressive strategy of financial security, forming a huge financial potential for economic growth, which indicates an increase in borrowed capital and good return on total capital. However, the reduction of the latter in 2019 to the lowest level for the entire period indicates the need to increase business and market activity in order to achieve the goals of sustainable development and neutralize financial risk. The small and negative value of the b-factor indicates the inverse relationship of the analyzed JSC with the industry and its independence from external factors. Therefore, the rating (and hence the effectiveness of financial security management) of this JSC is the highest in terms of investment among all surveyed entities, given the largest amount of net income per share (Table 3).

As for PJSC Agricultural firm "Verbivske" and PJSC "Bakhmut Agricultural Union", there are no borrowed funds in the structure of their financial resources, however, there are borrowed funds, which we will consider as debts. At the same time, the percentage of debt in the value of the JSC actually reflects the share of funds raised in it, however, affects the value of the JSC (Table 4, Table 5).

Table 4. Indicators for assessing the effectiveness of financial security management of PJSC Agricultural firm "Verbivske"

Indexes	2016	2017	2018	2019
Own financial resources	424,031	589,272	919,024	1,012,019
Raised financial resources (debt)	177,765	252,939	136,794	190,764
Total capital (group 1 + group 2)	601,796	842,211	1,055,818	1,202,783
Net profit	43,580	167,657	324,391	266,157
Operating profit	66,840	265,028	396,828	286,876
Return on equity,%	10	33	43	28
Return on total capital,%	7	20	31	22
Weighted average return on total capital, %	5	15	28	22
Net profit per 1 share, UAH	0.03	0.13	0.26	0.21
The weighted average cost of capital	**954,857**	**1,152,296**	**1,167,141**	**1,195,317**
Capitalized income	622,571	728,943	954,091	1,108,988
Shoulder of financial leverage	0.295	0.300	0.130	0.159
The cost of the firm	**800,336**	**981,882**	**1,090,885**	**1,299,752**
% of debt in the value of the firm	*22.21*	*25.76*	*12.54*	*14.68*
Systematic risk	***β-factor=-0.71 risk absent***			

Source: Own research.

As can be seen from the Table 4, borrowed funds slightly reduce the return on total capital compared to equity. However, during 2016-2018 the price of total financial resources exceeds the value of PJSC Agricultural firm "Verbivske", which indicates the effective management of its financial resources during this period and its slight decrease in 2019 (the value of JSC exceeded the weighted average cost of capital).

The permanent growth of capitalized income, the insignificant amount of financial leverage, and the negative value of the b-ratio of systematic risk testify to the strategy of increasing the dominance of financial security, which is obviously based on the stable development of this JSC.

As for PJSC "Bakhmut Agricultural Union", its value is higher than the weighted average cost of capital, which is due to the use of significant borrowed capital, the share of which in the value of JSC is higher than in the previously analysed JSC. Therefore, the strategy of its financial security is aimed at maintaining a certain financial condition (after all, borrowed capital is not used to finance current activities) and is protective given the value of the elasticity of systematic risk.

Despite the fact that financing activities at the expense of own funds are effective from the standpoint of financial independence, however, the current challenges of European integration and globalization, necessitate an increase in the rating of domestic JSCs of the agricultural sector, and hence their market value. And this cannot be achieved by limiting oneself to one's own funds.

That is why the financial potential of economic growth of PJSC Agricultural firm "Verbivske" and PJSC "Bakhmut Agricultural Union" is insufficient to increase the efficiency of formation and use of their financial resources from the point of view of investment, which indicates a much lower profit per share than PJSC "Mykolaiv Agricultural Company".

Table 5. Indicators for assessing the effectiveness of financial security management of PJSC "Bakhmut Agricultural Union"

Indexes	2016	2017	2018	2019
Own financial resources	2,161,308	2,579,448	3,770,326	3,374,477
Raised financial resources (debt)	1,559,722	1,435,878	1,044,834	1,364,129
Total capital (gr. 1 + gr. 2)	3,721,030	4,015,326	4,815,160	4,738,606
Net profit	582,944	637,397	1,632,751	1,065,328
Operating profit	689,633	628,654	1,867,361	1,178,855
Return on equity,%	31	27	51	30
Return on total capital,%	16	16	34	22
Weighted average return on total capital,%	14	16	32	20
Net profit per 1 share, UAH	1.37	1.50	3.86	2.52
The weighted average cost of capital	**4,056,665**	**3,929,088**	**5,046,922**	**5,358,432**
Capitalized income	3,429,082	3,983,731	4,412,841	4,842,400
Shoulder of financial leverage	0.419	0.358	0.217	0.288
The cost of the firm	**4,988,804**	**5,419,609**	**5,457,675**	**6,206,529**
% of debt in the value of the firm	31.26%	26.49%	19.14%	21.98%
Systematic risk	***β-factor = -0.15 risk absent***			

Source: Own research.

With regard to unprofitable JSCs, the effectiveness of their financial security management should be carried out by the size of the debt hole, which increases in proportion to the growth of losses and is reflected in the structure of their own financial resources. Some of them – PJSC "Vinnytsiaagrotransservis" and Agricultural PJSC "Ukraine" have in reserve retained earnings accumulated in previous periods, and PJSC "Blok Agrosvit" and PJSC "Technological agrarian company united" – accumulate value uncovered losses, further deepening the "debt hole" (Fig. 2).

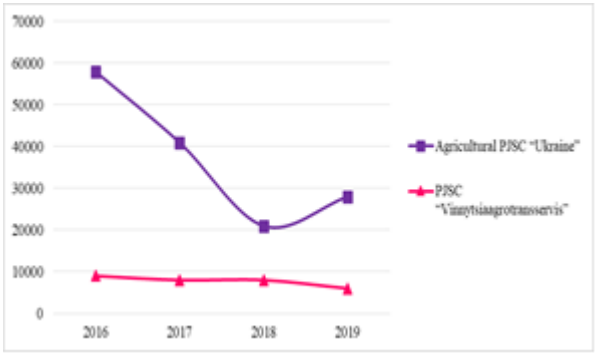

Fig. 2. The level of loss on retained earnings of JSC for the agricultural sector in Ukraine for 2016-2019, thousand UAH
Source: Own research.

In conditions of permanent loss, they all use borrowed resources to finance current activities, so – to determine the amount of financial leverage by the proposed method is impossible and impractical, as it is known that the risk of financial dependence is high and the firm's rating is low. However, we reflect the impact of losses on equity relative to unprofitable enterprises and the size of the "debt pit" of absolutely unprofitable JSCs of the agricultural sector of Ukraine (Fig. 3).

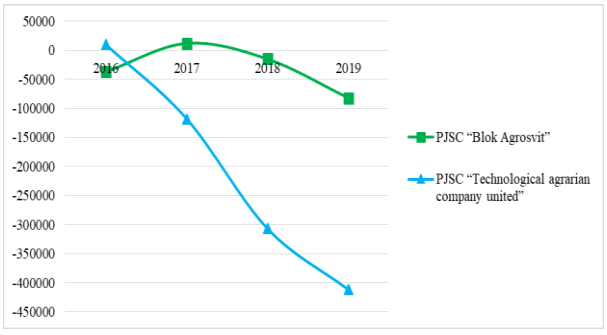

Fig. 3. The level of loss on retained earnings of JSC for the agricultural sector in Ukraine for 2016-2019, thousand UAH
Source: Own research.

As can be seen from Fig. 2 and Fig. 34, retained earnings of PJSC "Vinnytsiaagrotransservis" does not have a clear tendency to increase or decrease,

however, it is positive. The analysed indicator at Agricultural PJSC "Ukraine" was permanently decreasing during 2016-2018, but in 2019 it increased and is also in the safety zone, without falling to the negative axis of ordinates. Instead, its value at PJSC "Blok Agrosvit" is positive only in 2016 and rapidly decreases during 2017-2019, and at PJSC "Technological agrarian company united" - in 2017 and also decreases in 2018-2019

The analysis of systematic risk shows the inverse dependence of the profitability of the agricultural sector of Ukraine and PJSC "Vinnytsiaagrotransservis" and PJSC "Technological agrarian company united", which means the absence of risk associated with changes in the profitability of this industry. Instead, the systematic risk of Agricultural PJSC "Ukraine" indicates a slight dependence on the industry and, accordingly, the changes taking place in it. The highest risk is PJSC "Blok Agrosvit", which indicates a high dependence on the industry (Table 6).

Table 6. Calculation for the β-factor of systematic risk

Profitability of the agricultural sector	**2016**	**2017**	**2018**	**2019**	**K_{ppm}**	**b-factor**
	0.018	-0.133	-0.08	-0.004	**S_p^2=0.0048**	
PJSC "Mykolaiv Agricultural Company"	0.11	0.1	0.18	0.09	-0.0006	-0.1136
PJSC "Blok Agrosvit"	-0.04	-0.3	-0.32	-0.19	0.0058	1.2003
PJSC "Bakhmut Agricultural Union"	0.17	0.16	0.37	0.22	-0.0007	-0.1513
PJSC Agricultural firm "Verbivske"	0.07	0.23	0.34	0.24	-0.0034	-0.7077
Agricultural PJSC "Ukraine"	-0.03	-0.1	-0.19	0.06	0.0037	0.7632
PJSC "Vinnytsiaagrotransservis"	-0.06	-0.1	0.02	-0.11	-0.0003	-0.0711
PJSC "Technological agrarian company united"	-0.17	0.65	-0.25	-0.63	-0.0217	-4.4854

Source: compiled according to the State Statistics Service of Ukraine and the annual financial statements of the JSC of the agricultural sector of Ukraine.

To confirm the above conclusions and compare the investment attractiveness of profitable JSCs, we consider it appropriate to introduce a comprehensive criterion for the effectiveness of financial security management of JSC of the agricultural sector of Ukraine on the basis of individual partial criteria.

For this purpose, we use the analytic hierarchy process (the AHP), which for the past 10 years confirmed its effectiveness at various levels of planning on choosing a compromise solution among the possible alternatives. According to this method, the priority decision (selection of the most attractive JSC for investment) is selected on the basis of pairwise comparisons of scores of certain partial criteria.

The main purpose of our study is the choice of JSC, the overall efficiency of financial security management which is highest among PJSC Agricultural firm "Verbivske" (alternative Nr1), PJSC "Bakhmut Agricultural Union" (alternative Nr2) and PJSC "Mykolaiv Agricultural Company" (alternative Nr3). We believe that the degree of investment attractiveness will indicate the appropriate degree of effectiveness of financial security management for the reason that only a successfully functioning JSC of the agricultural sector that provides a high level of efficiency in the formation and use of financial resources can be attractive to investors. In fact, a high level of financial condition is a measure of the effectiveness of the management of financial security of the JSC of the agricultural sector of Ukraine in a stable development. Despite our understanding of efficiency as obtaining the best (largest) result at the lowest cost, we consider it necessary to move away from the classic practice of performance evaluation, introducing a standard of investment attractiveness or a criterion of the overall efficiency of financial security management.

The basis for such an assessment is the criteria that together form the characteristics of the aggregate effect of financial security

management. These return on equity (K1), business activity (K2), term liquidity (K3), profitability (K4), and solvency (K5). These criteria are based on the results of discussions of the agricultural sector of Ukraine experts (employees, potential investors, government officials, and local governments) to identify the most important indicators for the investor, according to which he decides on the feasibility of investing in JSC. The following indicators include net income per ordinary share and the values of inventory turnover ratios, term liquidity, profitability, solvency. The choice of these indicators of the state of financial security of the JSC of the agricultural sector of Ukraine is due to the sufficiency of information for the investor to draw conclusions about the effectiveness of the formation and use of financial resources of the JSC. Such a sample makes it possible to take into account the specifics of the functioning of the JSC, which is manifested in the difficulty of selling stocks of JSC products of the agricultural sector. In addition, the exclusion of indicators that characterize the same active financial and economic activities greatly simplifies the analysis.

Thus, to assess the solvency of a JSC, the investor needs to analyse the coefficient of financial autonomy, which is the most important in the group of financial stability and characterizes the adequacy of equity to finance operating and investment activities in the short and long term. Despite the fact that the normative value of the ratio is > 0.5, the investor is still interested in it varying between 0.4-0.6 (which will indicate a low level of financial risk and stability of the company in the medium and long term).

The next most important indicator defined by experts are the profitability indicator, which can be used to draw conclusions about the effectiveness of the operating activities of companies. The higher it is, the more profit each unit of the agricultural sector brings, and therefore, it is competitive. Of course, the investor will invest only in an enterprise that has a certain level of profit, so the value of this indicator should be greater than 0.1.

It is important to determine the liquidity of the JSC of the agricultural sector of Ukraine at the time of assessment of investment attractiveness, i.e. to calculate the term liquidity ratio. It is important for the investor that the quick liquidity ratio was in the optimal range – 1-1.5. This means that the company has enough liquid funds to fully repay financial debts and form a minimum reserve of investment resources. Instead, the effectiveness of inventory management should also be assessed by calculating an inventory turnover indicator, the value of which is a priority for the investor if it is more than one. That is, an effective policy of selling stocks requires their turnover once a year.

Another of the most important characteristics of the effectiveness of financial security management of the studied JSCs is the net profit per 1 ordinary share. This indicator characterizes the return on equity by investors and is chosen by experts given the lack of data on the market price of shares of comparable JSCs, which makes it impossible to calculate the return on equity in the classic version. And the value of net income per share is reflected in the financial statements, so there are no problems with the probable distortion of conclusions about the level of profitability of the company. In addition, the use of criteria in different measures is possible when using AHP. The optimal value, which will certify the minimum level of profit by experts, is set at UAH 0.1. Accordingly, exceeding this value will indicate the effectiveness of financial security management of the JSC of the agricultural sector of Ukraine.

Calculate the degree of consistency of the elements of the matrix *D* within the AHP, using the consistency index (consistency index *CI*), which characterizes the deviation of the maximum value of a criterion from what corresponds to the ideal option (which the investor wants to see) and is calculated by the formula:

$$CI = \frac{\lambda_{max} - m}{m - 1},$$

where:

λ_{max} – the maximum value of a certain criterion;

m – the desired (ideal) value of a certain criterion from the position of the investor.

Assessment of the acceptability of the consistency degree of the matrix elements is carried out by calculating the relative consistency (consistency ratio CR) as follows:

$$CR = \frac{CI}{CIS},$$

where:
CIS – the average value of the consistency index (Table 7).

Table 7. The experimental value of the consistency index

m	3	4	5	6	7
CIS	0.58	0.90	1.12	1.24	1.32

Source: Own research.

Therefore, we calculate the priority vectors for each of the alternatives in terms of criteria (Tables 8 - 12).

Table 8. The level of financial security management efficiency of joint-stock companies of the agricultural sector of Ukraine from the position of the investor on the criterion of return on share capital*

	Alternative Nr1	Alternative Nr2	Alternative Nr3	Vector of the priorities
Alternative Nr1	1	2	1/9	0.1140
Alternative Nr2	1/2	1	1/9	0.0718
Alternative Nr3	9	9	1	0.8142

*λ_{max}=3.054; *CI*=0.0268; *CR*=0.0462.
Source: Own research.

Table 9. The level of financial security management efficiency of joint-stock companies of the agricultural sector of Ukraine from the position of the investor on the criterion of business activity*

	Alternative Nr1	Alternative Nr2	Alternative Nr3	Vector of the priorities
Alternative Nr1	1	2	3	0.5499
Alternative Nr2	1/2	1	1	0.2402
Alternative Nr3	1/3	1	1	0.2098

*λ_{max}=3.0183; *CI*=0.0091; *CR*=0.0158.
Source: Own research.

We also define generalized priorities as the sum of the products of the priority vector of a specific criterion by the value of the priority vector by the same criterion for each specific alternative, making sure that the relative consistency does not exceed 10% (Table 13).

Table 10. The level of priority of financial security of joint-stock companies of the agricultural sector of Ukraine for the investor by the criterion of term liquidity*

	Alternative Nr1	Alternative Nr2	Alternative Nr3	Vector of the priorities
Alternative Nr1	1	9	4	0.7009
Alternative Nr2	1/9	1	1/6	0.0562
Alternative Nr3	1/4	6	1	0.2430

*λ_{max}=3.1078; *CI*=0.0539; *CR*=0.0929.
Source: Own research.

Table 11. The level of financial security management efficiency of joint-stock companies of the agricultural sector of Ukraine from the position of the investor on the criterion of profitability*

	Alternative Nr1	Alternative Nr2	Alternative Nr3	Vector of the priorities
Alternative Nr1	1	6	1/2	0.3681
Alternative Nr2	1/6	1	1/5	0.0821
Alternative Nr3	2	5	1	0.5498

*λ_{max}=3.0858; *CI*=0.0429; *CR*=0.074.
Source: Own research.

Table 12. The level of financial security management efficiency of joint-stock companies of the agricultural sector of Ukraine from the position of the investor by the criterion of solvency*

	Alternative Nr1	Alternative Nr2	Alternative Nr3	Vector of the priorities
Alternative Nr1	1	2	1/9	0.1211
Alternative Nr2	1/2	1	1/7	0.0830
Alternative Nr3	9	7	1	0.7959

*λ_{max}=3.0999; *CI*=0.050; *CR*=0.0861.
Source: Own research.

Table 13. Matrix of pairwise comparisons for criteria and its numerical estimates*

CRITERIA	Criterion 1	Criterion 2	Criterion 3	Criterion 4	Criterion 5	Vector of the priorities
Criterion 1	1	3	1/5	1/6	1/8	0.0519
Criterion 2	1/3	1	1/6	1/8	1/9	0.0298
Criterion 3	5	6	1	1/3	1/5	0.1433
Criterion 4	6	8	3	1	1/3	0.2706
Criterion 5	8	9	5	3	1	0.5044

*Herewith, λ_{max}=4.0796; *CI*=0.0265; *CR*=0.0772.
Source: Own research.

Summarizing the data on the level of priority for the studied JSC of the agricultural sector of Ukraine (Table 14), we calculate the global priorities for each of the criteria and their amounts (Table 15).

Given the numerical values of the Table 15, the most attractive for investment is PJSC "Mykolaiv Agricultural Company", the assessment of the effectiveness of financial security management, which from the position of the investor is the highest – 0.6335.

For PJSC Agricultural firm "Verbivske" such an assessment gave less value to the global priority – 0.2884, for PJSC "Bakhmut Agricultural Union" – even less (0.2834).

Table 14. Generalized priority assessments when choosing an alternative (summary data)

Alternatives	Numerical value of the priority vector of the priority criterion and evaluation of the priority criteria				
	К 1	К 2	К 3	К 4	К 5
	0.0519	0.0298	0.1433	0.2706	0.5044
PJSC Agricultural firm "Verbivske"	0.1140	0.5499	0.7009	0.3681	0.1211
PJSC "Bakhmut Agricultural Union"	0.0718	0.2402	0.0562	0.0821	0.0830
PJSC "Mykolaiv Agricultural Company"	0.8142	0.2098	0.2430	0.5498	0.7959

Source: Own research.

Table 15. Global priorities

Criteria / Alternatives	Global priorities by criteria					The sum of global priorities
	К 1	К 2	К 3	К 4	К 5	
PJSC Agricultural firm "Verbivske"	0.0059	0.0164	0.1004	0.0996	0.0611	0.2834
PJSC "Bakhmut Agricultural Union"	0.0037	0.0072	0.0080	0.0222	0.0419	0.0830
PJSC "Mykolaiv Agricultural Company"	0.0423	0.0063	0.0348	0.1488	0.4014	0.6335

Source: Own research.

Therefore, in this order, it is necessary to rank the researched joint-stock companies of the agricultural sector of Ukraine on the efficiency of management of financial safety.

CONCLUSIONS

Thus, as a result of the study, the main factors that may be dominant and threats to the financial security of joint-stock companies of the agricultural sector of Ukraine in terms of operating, investment, and financial activities of joint-stock companies have been identified. At the same time, a model for evaluating the effectiveness of financial security management of joint-stock companies of the agricultural sector of Ukraine taking into account relevant factors is proposed. This analysis of financial security covers almost all financial results and the factors that determine them, and therefore is quite thorough and allows you to highlight the various nuances of financial and economic activities that can positively or negatively affect the level of financial security and reflect the effectiveness of both formation and the use of financial resources of joint-stock companies of the agricultural sector of Ukraine.

Thereby, assessing the effectiveness of financial security management of joint-stock companies of the agricultural sector of Ukraine based on determining their value and assessing the amount of retained earnings as a reserve for economic growth or loss level allows distinguishing financial security strategies from the standpoint of investment,

which forms the investment image. And the calculation of a comprehensive criterion of investment attractiveness makes it possible to rank joint-stock companies of the agricultural sector of Ukraine according to the level of efficiency of their financial security management.

It should also be noted that the obtained model for assessing the effectiveness of financial security management of joint-stock companies of the agricultural sector of Ukraine can be used in practice to assess the investment attractiveness of individual companies and in terms of portfolio investment in the price of securities of joint-stock companies. At the same time, the criteria that show the level of financial security of the enterprise are also markers of investment security for investors. In addition, the results of our model can be successfully used to characterize the level of financial stability of joint-stock companies of the agricultural sector of Ukraine in the long run in the formation of their annual audit reports, the materials of which are markers not only for investors but also affect the market value of these companies.

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