

Analytical Basis of Financial Stability Management as a Component of Strengthening the Financial and Economic Security of Agribusiness

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Abstract: The agricultural sector is one of the dominant branches of the national economy of Ukraine, so the level of financial and economic security of agricultural enterprises depends on the overall level of the state's economy development and its financial stability. The purpose of the study is to improve the analytical basis of financial stability management as a component of strengthening financial and economic security (following the example of agribusiness of Ukraine). According to the results of the research, a scientific and methodological approach is justified, which is based on determining the influence of financial indicators on indicators of financial and economic security of agricultural enterprises and proves the influence of financial stability, business activity, solvency and profitability indicators on the coefficient of maneuverability of own capital as one of the basic indicators of economic security. It is substantiated that the positioning of own capital maneuverability within the established interval contours ensures financial stability, the efficiency of production and economic activity, which is the key to strengthening the financial and economic security of agribusiness. The novelty of the obtained results lies in the improvement of the analytical basis for managing the financial stability of agricultural enterprises thanks to the structural and logical unity of econometric approaches, as well as in the strengthening of the effectiveness of forecasting the parameters of financial and economic security and in the development of ways to strengthen it in conditions of uncertainty.

Keywords: Agrarian Economics, Accounting and Analyze, Economic Security, Econometric Modeling, Equity Capital Maneuverability, Financial Security, Forecasting, Model Verification.

JEL classification: O12, O13, G32, M41, Q12.

INTRODUCTION

Development of society at the beginning of the 21st century is marked by the decisive importance of the achieved economic level of each country and the level of meeting the economic needs of the population. Nowadays, modern economic thought is in the process of constant rethinking of

classical economic theories and changing the ideology of managing economic systems. Ensuring the appropriate level of economic security of the state, industry, business entity and citizen occupies a prominent place among the tasks of economic science. The management of economic security of agricultural enterprises solves such urgent problems as ensuring the economic security of economic entities, ensuring food security, population employment in the industry, as well as at processing enterprises, rational land use, development of rural areas, etc. (Zagorodniuk et. al., 2022).

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In the process of developing the theoretical and methodological foundations of accounting and analytical support for the management of economic security, it is important to clearly structure its manifestations at different levels of the economy. The analysis of literary sources shows the functional orientation of economic security from the point of view of the strategic management, financial analysis and anti-crisis management needs, which does not take into account the influence of the above-mentioned information age of human development. In the scientific sense, a number of economic security components are distinguished, among which the most used are financial, intellectual, personnel, social, technical, technological, anthropogenic, ecological, legal, informational, force, physical, energy, investment, innovative, market, interface, intellectual, political-legal, price, material-raw, economic-contractual, criminal, demographic, etc. At the same time, one of the dominant ones is financial and economic security, which can be defined as a system of mutually determined and mutually coordinated methods, tools and management solutions, which, being synthesized with the available resource potential and included in the composition of the accounting and analytical support objects, make it possible to counter risks in a timely manner, threats and fluctuations in the environment of the enterprise's functioning, ensure its financial stability, contribute to the development of its economic potential, the growth of competitive advantages and the improvement of the information support quality of management processes.

Ensuring financial and economic security involves the selection, analysis and assessment of existing threats for each of the functional components and the development of countermeasures and preventive measures system based on them. At the same time, the results of the analysis and assessment of the levels of economic security components are not final. They should be the basis for the development of a measures set aimed at countering threats and increasing the level of economic security of the enterprise and expanding its adaptation capabilities to changes in economic activity, creating conditions for steady functioning and development (Illishenko, 2016). However, in the process of assessing financial security, the dangers, which are escorted by financial managerial performance, production fading, non-effective property status, unsteadiness are not taken into account (Ganushchak, 2017).

The importance of applying economic and mathematical models to substantiate managerial decisions is increasing (Gonchar et al., 2020). Therefore, among the key issues of managing the financial security of business entities, a prominent place belongs to the formation of methodological tools for its assessment, which would meet the most modern requirements for economic diagnostics: information capability, convenience, systematisms and comprehensiveness (Dokiienko et al., 2021).

The agricultural sector is one of the leading branches of the national economy of Ukraine, which in 2021 provided almost 14% of the population employment (especially rural), formed almost 11% of GDP and more than 40% of national exports (State Statistics Service of Ukraine, 2023). Therefore, the economic security of the state as a whole depends on the level of financial and economic security of agrarian

business, which is the core of the development of the state agrarian sector. At the same time, it is the agricultural sector that forms the food security of Ukraine and a number of countries in the Middle East, Africa, Asia and Europe. Therefore, the issue of strengthening the financial and economic security of agribusiness is a strategically important task for both the state and individual enterprises. This causes increased scientific interest in scientific research related to the assessment of certain factors impact on the level of financial and economic security of agribusiness, in particular, their financial stability.

The unstable financial condition of some agrarian corporations is a consequence of insufficient organization of individual subsystems management of their economic activity (Davydenko et al., 2020). The rational formation and effective allocation of financial resources is one of the defining stages of managing the financial and economic security of agrarian enterprises, as it directly affects their financial stability and competitiveness. The gradual decrease in the share of own sources of financial resources requires constant analysis of the attracting bank lending expediency, the main function of which is to satisfy the need beyond the norms. However, in our opinion, one indicator cannot characterize the economic situation. At the micro level, it is affected by the lack of quick effect and profit as a result of investment and innovation activities. At the macro level, this is not facilitated by the crisis situation in the country's economy, due to which enterprises are in survival conditions, which is not always consistent with the requirements of financial and economic security.

There are a number of indicators of assessment and analysis of financial stability, the most frequently used are Leverage Ratio, The Equity Multiplier, Degree of Financial Leverage (DFL), The Debt-to-Capitalization Ratio, The Consumer Leverage Ratio, The Debt-To-Capital Ratio, The Debt-To-EBITDA Leverage Ratio, The Debt-To-EBITDAX Ratio, etc (Fridson et al., 2011; Blank, 2004; Lemishko, 2020; Samorodov et al., 2020).

All of the listed indicators have a direct impact on the financial and economic security of agricultural enterprises, as they determine the normative values that can be used to assess the level of financial stability in the process of financial analysis and management decision-making based on information generated by the accounting system and reflected in financial statements. Ultimately, the analysis of financial stability indicators together with the parallel analysis of production indicators and assessments of the potential impact of risks and threats allows to form a comprehensive analytical basis for managing the financial and economic security of business.

In particular, according to the results of econometric modeling conducted by scientists led by Sirenko N., increasing the level of operational activities profitability due to an increase in the coefficient of autonomy (financial independence of the enterprise from external sources of financing its activities) will increase the level of financial and economic security of the enterprise (Sirenko et al., 2021). Another group of scientists, led by O. Stashchuk, emphasize on the need to identify and calculate the general indicator of the integrated state of financial security of JSC, which will allow us to identify

trends in its change in general, compare the levels of different JSCs operating in the agriculture and identify relevant factors of their financial security (Stashchuk et. al., 2021). Scientists led by I. Kolodii in order to develop measures to prevent bankruptcy, propose recommendations for improving the financial state of agricultural enterprises on the example of cluster analysis (Kolodii et. al., 2022).

In the conditions of high cost of credit resources, during the analysis of financial resources, we connect the strengthening of financial and economic security, first of all, with the acceleration of the own capital maneuverability of agricultural enterprises. The term "maneuverability" has a certain "military" origin. After all, maneuverability was understood as the ability of the army to place its troops in defensive and offensive positions in order to inflict maximum damage on the enemy with minimal own losses. Subsequently, the term began to be used in economics and management.

According to a group of scientists headed by H. Kornelius, for a company to succeed, the management should focus on strategic maneuverability, consisting of organizational agility, organizational flexibility, and organizational responsiveness, to navigate through the dynamic business environment, survive the hyper competition, maintain the company's competitive advantage and increase firm performance (Kornelius et. al., 2021). Nowadays, the term "maneuverability" of an enterprise should be understood as the ability of a business entity to place funds raised from various sources of financing in the assets of the enterprise in such a way as to ensure its financial stability, stability and efficient production and economic activity as much as possible and therefore financial and economic security.

Thus, despite the presence of numerous approaches to assessing the level of financial stability according to various criteria, none of them is perfect due to probabilistic assessments and the contradictory nature of individual financial indicators concerning the industry specifics of business entities functioning. This determines the need to deepen the analytical basis of financial stability management as a criterion for strengthening the financial and economic security of agribusiness by expanding the range of analyzed cause-and-effect relationships.

The purpose of the study is to improve the analytical basis of financial stability management as a component of strengthening financial and economic security (following the example of agribusiness of Ukraine).

METHODOLOGY

Correlation-regression method and its peculiarities when analyzing the maneuverability of agribusiness equity capital

Modern economic science has in its arsenal numerous methods of researching cause-and-effect relationships in socio-economic phenomena, among which the leading ones are correlation-regression analysis and the method of analytical grouping. The main advantage of the correlation method, or correlation-regression analysis, is its universal ability to take into account the influence of both a general array of factors and each factor characteristic separately. At the same time, the method of analytical grouping makes it possible to analyse the influence of no more than 2-3 factors, while the cor-

relation-regression analysis provides an assessment of complex relationships between the resulting characteristic and 7-10 factors based on the use of data from a wide set of observation units.

In the process of research, we used an analytical approach to assessing the financial stability of agricultural enterprises based on the criterion of the equity capital maneuverability.

For modelling as a dependent variable, we chose the coefficient of equity capital maneuverability, which characterizes the degree of equity capital mobilization, because it shows what part of the capital is in circulation, that is, in the form that allows free maneuvering of own funds. The higher this indicator, the more flexibility is ensured in the use of the economic entity's own funds and its financial and economic security increases. The optimal value of the indicator is 0.5, (according to some authors, it is more than 0.3 (Lukianenko & Krasnikova, 1998).

Equity maneuverability ratio (k_m) is calculated as a share of the net working capital ($\sum NWC$) divided to the amount of equity capital ($\sum Eq$):

$$k_m = \frac{\sum NWC}{\sum Eq} \quad (1)$$

We have built an econometric model of financial and economic security level based on the criterion of the equity capital maneuverability of agricultural enterprises of the Kharkiv region (Ukraine). The study is based on data from the financial statements of 135 agricultural enterprises for 2018-2021 (average data). There are no data for 2022, because with the beginning of the military aggression, more than 25% of the territory of the Kharkiv region was under temporary occupation and in the zone of active hostilities, which led to the impossibility of conducting agricultural production, since with the beginning of a full-scale military invasion of the Russian Federation in 2022, the majority of agricultural land was mined and agricultural business was temporarily suspended.

During the study of economic processes, due to the heterogeneity of the data in the initial statistical population of agricultural enterprises according to the data of 2018-2020, there were sampling errors. If the population is heterogeneous, then the regression equation will not make any practical sense. In order to obtain a good result, units with abnormal values of the investigated characteristics were excluded from the total number of randomly examined units. The number of randomly surveyed farms was 135 units, which ensured a proper variation of financial and economic activity indicators and the dependent variable. Regression results represent sample characteristics.

The selection of factors for the multifactor correlation-regression model took place in several stages, including establishing the economic essence, the nature of their influence on other indicators; analysis of factors multicollinearity and individual factors and the resulting characteristic using correlation indicators. As a result, a 7-factor correlation-regression model of equity capital maneuverability was built ($y_{x_1, 2, \dots, p}$), Fig. (1).

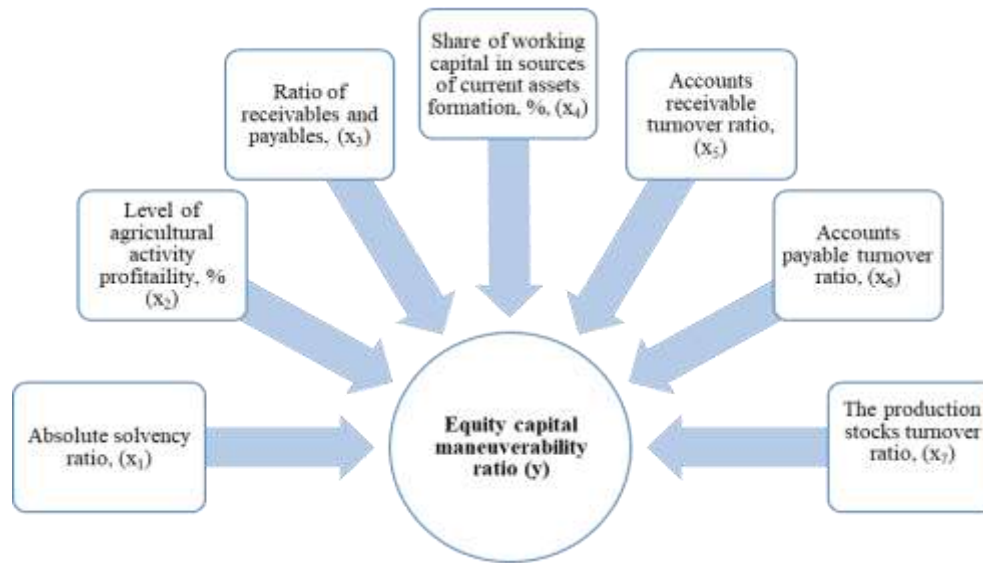


Fig. (1). Selection of independent variables when building a multivariate regression model.

Since as a result of building a multiple correlation-regression model, it is necessary to determine not only the combined effect of all factors on the indicator of the maneuverability coefficient of equity capital, which is being modelled, but also the influence of each factor separately, it is necessary to ensure the independence of the factors from each other. The coefficients of equity capital maneuverability selected for multivariable econometric models meet the following requirements:

- 1) they are quantifiable;
- 2) factors are not intercorrelated and are not in a functional relationship with each other (it is considered that two variables are clearly collinear, or are in a linear relationship with each other, if $r_{x_i, x_j} \geq 0.7$);
- 3) the number of factors for the production model is $p = 7$, which corresponds to the inequality $6p \leq N$ ($6 \cdot 7 \leq 135$).

Thus, the obtained indicators can be included for further modelling.

A linear function was used to express the form of the relation between the result and the selected factors (due to the simplicity and ease of its economic interpretation). The general formula of the multivariate regression equation is following:

$$y = \hat{f}(x_1, x_2, \dots, x_p); \quad (2)$$

$$y_{x_1, x_2, \dots, x_p} = a_0 + a_1 x_1 + \dots + a_p x_p + e = a_0 + \sum_{j=1}^p a_j x_j + e, \quad (3)$$

where p is the number of factors, e is a random variable that characterizes the deviation of the actual value of the result characteristic from the theoretical value calculated according to the regression equation.

Verification of the econometric model for adequacy and practical significance was carried out using multiple correlation and determination coefficients, Fisher's F-test, the pro-

cedure for determining which is integrated into the "Multiple Regression" module of the STATISTICA system. The average approximation error is determined using the actual and theoretically expected values of the model:

$$\bar{\varepsilon} = \frac{1}{n} \sum \frac{|y - y_{x_1, \dots, x_p}|}{y} \times 100 \quad (4)$$

Methodology for forecasting indicators based on the results of correlation-regression modeling

In the world economic literature, the verification of forecasts, that is, the assessment of their quality, is carried out using absolute and relative indicators of the forecast error, the main ones of which are: Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), Mean Square Error (MSE), Sum Square Error (SSE), Mean Absolute Percentage Error (MAPE), Mean Percentage Error (MPE), Theil's coefficient of discrepancy (Theil's Forecast Accuracy Coefficient).

The first group consists of absolute forecast error indicators. They make it possible to quantify the difference between the forecast and the actual values of the observation in the units of the dependent variable measurement:

1. Forecast error:

$$e_j = y_j - \tilde{y}_j \quad (5)$$

where y_j is the actual value of the dependent variable for the j -th dimension (the actual value of the equity capital maneuverability ratio); \tilde{y}_j is predictive value of the dependent variable.

2. Absolute forecast error:

$$\Delta_j = |y_j - \tilde{y}_j| \quad (6)$$

3. The Mean Absolute Error (MAE):

$$MAE = \frac{\sum_{j=1}^N |y_j - \tilde{y}_j|}{N} \quad (7)$$

4. The Root Mean Squared Error (RMSE):

$$RMSE = \sqrt{\frac{\sum_{j=1}^N (y_j - \tilde{y}_j)^2}{N}} \quad (8)$$

5. Mean Square Error (MSE):

$$MSE = \frac{1}{N} \sum_{j=1}^N e_j^2 \quad (9)$$

6. Sum Square Error (SSE):

$$SSE = \sum_{j=1}^N e_j^2 \quad (10)$$

The obtained absolute indicators do not fully characterize the quality of the forecast, as they are related to the dependent variable. At the same time, the indicator of forecast displacement is significantly related to the scale of observations. A larger set of observations increases the confidence that the MSE approaches zero, and therefore, that the forecast is not biased.

A more objective assessment of the forecast quality is provided by the relative indicators of the forecast error measurement, expressed in fractions of a unit or percentages.

The relative indicators of the forecast error of the fluctuation coefficient of equity capital in agricultural enterprises of the Kharkiv region were calculated on the basis of the following indicators:

1. Relative forecast error for each enterprise:

$$\varepsilon_j = \frac{|y_j - \tilde{y}_j|}{y_j} \cdot 100\% \quad (11)$$

2. Mean Absolute Percentage Error (MAPE):

$$MAPE = \frac{1}{N} \sum_{j=1}^N \frac{|y_j - \tilde{y}_j|}{y_j} \cdot 100\% \quad (12)$$

3. Mean Percentage Error (MPE):

$$MPE = \frac{1}{N} \sum_{j=1}^N \frac{y_j - \tilde{y}_j}{y_j} \cdot 100\% \quad (13)$$

Theil's coefficient of discrepancy (Thiele, 1909) is a measure of the quality of forecasting. They are used to compare data of retrospective information y_j , used in the development of the forecasting operator, with forecasting results \tilde{y}_j :

$$K_T = \sqrt{\frac{\sum_{j=1}^N (y_j - \tilde{y}_j)^2}{\sum_{j=1}^N y_j^2}} \quad (14)$$

The closer the Theil discrepancy coefficient is to zero, the better the predictive qualities of the model.

During forecasting, the relationship indicators of the multi-factor correlation-regression model are used to estimate general parameters, extrapolated to other factor values. Therefore, parameter values must be accompanied by probabilistic estimates, the average error and interval limits of the parameter with a given probability should be indicated (Lukianenko & Krasnikova, 1998):

Average error m_{a_h} of conditional pure regression coefficient a_p for the factor x_p :

$$m_{a_h} = \frac{S_{y_e}}{S_{x_p} \sqrt{n}} \cdot \sqrt{\frac{1}{1 - R_{x_p x_1 \dots x_{p-1} x_k}^2}}, \quad (15)$$

estimation of the residual (not explained by factors) mean square deviation of the resulting characteristic taking into account the degrees of freedom of variation:

$$S_{y_e} = \sqrt{\frac{\sum_{i=1}^n (y_i - \hat{y}_i)^2}{n - p - 1}} \quad (16)$$

estimation of the mean square deviation of the characteristic x_p :

$$S_{x_p} = \sqrt{\frac{\sum_{i=1}^n (x_{p_i} - \bar{x}_p)^2}{n - 1}} \quad (17)$$

variation share of the factor x_p , associated with the variation of other factors:

$$1 - R_{x_p x_1 \dots x_{p-1} x_k}^2 \quad (18)$$

The information basis of the research was made up of indicators of the annual financial statements of agricultural enterprises (form 1 "Balance Sheet (Statement of Financial Position)" and form 2 "Statement of Profit or Loss"). Calculations were made using the STATISTICA data analysis and management software system, which is an integrated data analysis and management system, a tool for developing user proposals in business, economics, finance and other areas. All analytical tools available in the system are available to the user and can be selected using an alternative user interface.

RESULTS AND DISCUSSION

Econometric Modeling of Agribusiness Equity Capital Maneuverability

Conditional-pure regression coefficients are intended to estimate the average deviation of the resulting characteristic from its average value when the value of the factor characteristic increases by 1 absolute unit of measurement, subject to the fixed values of other factors included in the correlation-regression model.

Under the hypothetical condition of inclusion in the correlation-regression model of all possible factors that influence

the resulting characteristic, value of a_i would reflect the net measure of such influence. However, it is impossible to predict the inclusion of all factors, that means, all coefficients a_i are under the indirect influence of other factors not included in the model.

The multivariate econometric model of the equity capital maneuverability, synthesized by a straight-line function, is following:

by conditional pure regression coefficients

$$y_{x_1...n} = -0,021656x_1 - 0,011461x_2 - 0,007022x_3 - 0,003205x_4 + 0,002115x_5 + 0,011572x_6 - 0,001267x_7 + 3,585415. \quad (19)$$

by standardized regression coefficients

$$\bar{r}_{1,2...n} = -0,550258t_1 - 0,143231t_2 - 0,381313t_3 - 0,596958t_4 + 0,156248t_5 + 0,084565t_6 - 0,188897t_7. \quad (20)$$

Out of the seven factors studied, only two of them contribute to the growth of the equity capital maneuverability ratio. When accelerating turnover of receivables (x_5) and payables (x_6) the resulting sign increases, respectively, by 0.002115 and by 0.011572 times (provided that other factors are at an average fixed level).

The regression coefficient $a_1 = -0,021656$ indicates a slowdown in the equity capital maneuverability with the growth of absolute solvency and average levels of other independent variables included in the multifactor model. The connection of the equity capital maneuverability with the level of the economy profitability is similar, reversed in direction ($a_2 = -0,011461$), the ratio of receivables and payables ($a_3 = -0,007022$), specific weight of working capital in sources of current assets formation ($a_4 = -0,03205$) and turnover ratio of production stocks ($a_7 = -0,001267$), subject to a fixed value of other independent variables included in the model.

The equation with standardized regression coefficients allows us to put forward the hypothesis that the main financial factors that determine the variation in the coefficient of equity capital maneuverability are the share of working capital in the sources of the current assets formation (x_4), solvency of the enterprise (x_1) and the ratio of receivables and payables (x_3).

According to the analysis of intercorrelation coefficients, the turnover ratio of accounts payable has the greatest dependence with the ratio of absolute liquidity $r_{x_1,x_6} = 0,481530$ and the specific weight of working capital in the sources of current assets formation $r_{x_4,x_6} = 0,558095$. Therefore, all the analysed intercorrelation coefficients do not exceed the norma-

tive value, which excludes the presence of multicollinearity of the model.

The practical significance of the synthesized multifactor model is confirmed by the following coefficients:

1) Cumulative correlation coefficient $R = 0,821$ indicates the presence of a close linear relationship between the equity capital maneuverability ratio and the investigated financial variables of the model;

2) The actual value of Fisher's F-test is 37.53. The tabular (critical) value of Fisher's F-test for 7 and 127 degrees of freedom of variation at a probability of false rejection of the null hypothesis of 0.05 is $F_{0,05;127;7} = 2,01$. Since the actual value of Fisher's F-test is greater than the tabulated value, the aggregate correlation coefficient is relevant, significant at the 0.95 probability level. Therefore, the dependence of the level of agricultural enterprises financial stability according to the criterion of the coefficient of equity capital maneuverability on financial factors can be considered proven.

3) The cumulative coefficient of determination is 0.6741, i.e. 67.41% of the total variation of the coefficient of equity capital maneuverability is explained by the change in the factors included in the correlation-regression model. The share of factors not taken into account is 32.59%. If additional factors are introduced into the model, the share of systematic variation in the coefficient of equity capital maneuverability in the studied population will be 65.6% (as evidenced by the adjusted coefficient of determination) and the random variation will be 34.4%.

4) The value of the average error of approximation ($\bar{\varepsilon} = 30,46$) testifies to the satisfactory accuracy of the financial model of the equity capital maneuverability ratio, since its value fell into the range from 20 to 50% (Lukianenko & Krasnikova, 1998).

Calculation of Q -coefficient arranged the rating of factors by influence on the equity capital maneuverability ratio in the multifactor model as follows: the share of working capital in the sources of the current assets formation (x_4), accounts payable turnover ratio (x_6), the level of agricultural activity profitability (x_2) and the solvency of the enterprise (x_1).

Let's break down the general variation of equity capital maneuverability ratio $R^2 = 0,6741$ on individual factors using standardized regression coefficients and paired correlation coefficients, Table 1.

As a result of the decomposition of the total amount of variation in the equity capital maneuverability ratio according to the parameters of the model ($R^2 = 67.41\%$) on separate factors, it was established that the most significant factors affecting the modelled indicator in the studied agricultural enterprises of the region are the share of working capital in the sources of the current assets formation (x_4), the specific weight of this factor is 28.42%, the ratio of absolute solven-

Table 1. The General Variation Breakdown of the Equity Capital Maneuverability Ratio Econometric Model for Individual Factors.

Factors	Standardized Regression Coefficient, β_{yx_j}	Pairwise Correlation Coefficient, r_{yx_j}	Coefficient of Separate Determination, $d_j^2 = \beta \cdot r_{yx_j}$	The Relative Share of the Factor, %
x_1	-0.550258	-0.433302	0.204616	20.46
x_2	-0.143231	-0.107824	0.013254	1.32
x_3	-0.381313	-0.379573	0.124210	12.42
x_4	-0.596958	-0.554826	0.284238	28.42
x_5	0.156248	-0.068456	0.009179	0.92
x_6	0.084565	-0.126309	0.009166	0.92
x_7	-0.188897	0.181694	0.029454	2.95
Total $\sum_{j=1}^p d_j^2$	-	-	0.674117	67.41

Table 2. Evaluation of the Linear Econometric Multifactor Correlation-Regression Model Parameters of Equity Capital Maneuverability Ratio for Agricultural Enterprises of the Kharkiv Region, 2018-2020.

Factors	Regression Coefficient a_i	Student's t-test $t_{0.05} = 1,9600$	Elasticity Coefficient, E_{x_i}	Q-coefficient	Standardized Regression coefficient, β	The share of the factor in the total variation, %
x_1	-0.021656	-6.17524	-0.017	-4.084	-0.550258	20.46
x_2	-0.011461	-1.26283	-0.080	-7.932	-0.143231	1.32
x_3	-0.007022	-5.13349	-0.012	-2.955	-0.381313	12.42
x_4	-0.03205	-9.27892	-1.892	-63.110	-0.596958	28.42
x_5	0.002115	-0.79617	0.029	4.640	0.156248	0.92
x_6	0.011572	-1.48584	0.113	14.330	0.084565	0.92
x_7	-0.001267	2.175065	-0.017	-4.965	-0.188897	2.95
Multiple (cumulative) correlation coefficient, R					0.8210	
Multiple (cumulative) coefficient of determination, R^2					0.6741	
Adjusted (adapted) multiple coefficient of determination					0.6562	
Fisher-Snedecor F-test					37.5299	
Average approximation error, $\bar{\epsilon}$					30.5	

cy of the enterprise (x_1), 20.46% and the ratio of receivables and payables (x_3) 12.42 %.

As a result of the independent variables ranking included in the multifactor econometric model of the equity capital maneuverability, according to various criteria for agricultural enterprises of the Kharkiv region for 2018-2020, the most significant factors that affect the level of economic security of agricultural enterprises of the Kharkiv region, according to the criterion of the equity capital maneuverability is the share of working capital in the sources of current assets formation (x_4), solvency of the enterprise (x_1) and the ratio of receivables and payables (x_3).

Checking the model for homoscedasticity showed that the correlation coefficient between the maneuverability of working capital and the residuals of the model ($e = |y - y_x|$) is $r_{ye} = 0,515959$. Since the calculated actual value of the t-criterion (6.78784) is greater than the table value (1.96), the hypothesis of homoscedasticity of the residuals is rejected. That is, the sample is heteroskedastic.

Let's summarize the estimates of the multiple linear correlation-regression model parameters of the equity capital maneuverability ratio for agricultural enterprises of the Kharkiv region in the Table 2.

A multifactor model of the equity capital maneuverability ratio synthesized by a straight-line function as a criterion of financial and economic security of agricultural enterprises of

the Kharkiv region in 2018-2020 ($N = 135$) meets the requirements for the correlation-regression model of interrelated factors system: it has high values of the aggregate correlation and determination coefficients; it was tested for adequacy by Fisher's F-test and average error of approximation; the actual values of Student's t - criteria indicate the statistical significance of four of the seven independent variables included in the model; factors included in the model are not multicollinear.

The sample is homoscedastic, which means homogeneity of observations, constancy of variances of random errors of the model. It has been proven that the most significant factors determining the degree of variation of equity capital are the share of working capital in the sources of the current assets formation, the coefficient of absolute solvency of the enterprise and the ratio of receivables and payables. It has been proven that the most significant factors determining the degree of variation in equity capital are the share of working capital in the sources of the current assets formation, the coefficient of the absolute solvency of the enterprise and the ratio coefficient of receivables and payables.

Forecasting financial stability according to the criterion of the equity capital maneuverability of agribusiness

In the process of establishing the ambiguous influence of factors on the level of financial and economic security of agricultural enterprises, an important component of the analytical basis for its strengthening is the construction and verification of forecasts of its level based on the results of correlation-regression modelling. This complex and responsible stage involves the use of a specific indicators set, criteria and procedures that will provide an objective assessment of the obtained forecast quality and extrapolation of the obtained results for the future.

Based on the calculations, it can be concluded that the constructed model of the equity capital maneuverability ratio is highly accurate. This is evidenced by the mean percentage error $MPE = 7,7991\%$ (less than 10 %) and the Theil coefficient approaching zero ($K_T = 0,1195$). Therefore, the forecasting of the equity capital maneuverability ratio based on financial indicators is qualitative. The bias of the forecast is characterized by relatively small error values. An econometric multivariate model based on financial indicators will not give a biased forecast, so the residuals are random and can be neglected when predicting the equity leverage ratio using the model.

Let's summarize the absolute and relative indicators of the quality of models of the equity capital maneuverability ratio in the Table 3.

Table 3. The Progress Verification of the Equity Capital Maneuverability Ratio in Agricultural Enterprises of the Kharkiv Region.

No.	Factor	Value
1	Mean Absolute Error, MAE	0.3059
2	Root Mean Squared Error, RMSE	0.4969

3	Mean Square Error, MSE	0.2469
4	Sum Square Error, SSE	33.332
5	Mean Absolute Percentage Error, MAPE	30.4595
6	Mean Percentage Error, MPE	-7.7991
7	Theil's coefficient of discrepancy	0.1195
8	Pairwise correlation coefficients between actual and predicted values	0.821

Among the requirements developed by theory and practice for the construction of correlation-regression models, there is a requirement for the analysis of production efficiency degree taking into account the effect of availability factor and the return factor. For this purpose, we compared the units of the population according to the indicators of deviations of the resulting characteristic from the average value ($\hat{y}_{x_{1..n}} - \bar{y}$) and deviations of the resulting characteristic from the values obtained according to the regression equation ($y_i - \hat{y}_{x_{1..n}}$):

$$y_i - \bar{y} = (\hat{y}_{x_{1..n}} - \bar{y}) + (y_i - \hat{y}_{x_{1..n}}) \tag{21}$$

The first component on the right-hand side of the expression is the deviation that arises due to differences in the individual values of the factors in a certain unit of the population from their average values in the population. It is called the factor provision effect. The second component is the deviation that arises due to factors not included in the model, and the deviation of the individual efficiency of factors in a specific unit of the population from the average efficiency of factors in the population, which is measured by the coefficients of conditional pure regression. It is called the return factor effect.

The application of average absolute forecast errors as criteria for choosing a forecast model showed that the model is acceptable for describing the fluctuation of the equity capital maneuverability ratio for the investigated aggregate of agricultural enterprises of the Kharkiv region. The correlation coefficient of the deviations ranks of two types is:

$$r_{ranks} = 1 - \frac{6 \sum d^2}{n(n^2 - 1)} = 1 - \frac{6 \cdot 353621}{135 \cdot (135^2 - 1)} \tag{22}$$

$$= 1 - \frac{2121726}{2460240} = 0,1376$$

Therefore, the connection between the variation of the factor security and the variation of the return factor is weak and insignificant. This can be evaluated as a positive result, since, together with other criteria, it indicates the reliability of the mathematical description of the changes dependence in the equity capital maneuverability ratio on changes in the financial characteristics included in the model. Thus, the multiple regression model can be used for practical purposes and making predictions.

The applied goal of econometric modelling is the construction of predictive values of the resulting characteristic for certain values of the factors. At the same time, a distinction is made between the expected and the predictive value of the

Table 4. Parameters Probability Estimates of the Correlation-Regression Model of Equity Capital Maneuverability.

Factors	Multiple Determination Coefficient	Conditional Pure Regression Coefficient	The Error of the Conditional Pure Regression Coefficient		Confidence Interval for the Regression Coefficient
			Average	Critical	
	$R^2_{x_p, x_1 \dots x_{p-1} x_k}$	a_i	m_{a_h}	$\Delta_{a_h} = tm_{a_h}$	$a_i \pm \Delta_{a_h}$
x_1	0.32202190	-0.021656	0.0228	0.0446	-0.0217±0.0446
x_2	0.15137646	-0.011461	0.0055	0.0109	-0.0115±0.0109
x_3	0.19142502	-0.007022	0.0093	0.0183	-0.0070±0.0183
x_4	0.37154237	-0.032050	0.0023	0.0044	-0.0321±0.0444
x_5	0.16223722	0.002115	0.0018	0.0035	0.0021±0.04035
x_6	0.44284571	0.011572	0.0038	0.0075	0.0116±0.0075
x_7	0.17725151	-0.001267	0.0010	0.0019	-0.0013±0.0019

* $t_{0.05;127} = 1.9600$

result characteristic. If the values of the factors included in the interval of the initial data are substituted into the constructed correlation-regression model $[x_{\min}; x_{\max}]$ for each specific factor, the obtained value of the result characteristic is called a prediction. If the values of factors that are beyond the range of the original data are substituted into the constructed model $[x_{\min}; x_{\max}]$, then the obtained value is called predictive y_{np} . To ensure the homogeneity of the sample, scientists recommend that the predictive value of the factors does not exceed the range of the original data by more than 30% (Lukianenko & Krasnikova, 1998).

To find the value of the coefficient of multiple determination $R^2_{x_p, x_1 \dots x_{p-1} x_k}$ we will build additional multiple regression models that characterize the dependence of a single factor x_p on all other features included in the model. The calculation of confidence intervals for conditional pure regression coefficients of the multiple correlation-regression model is carried out in the Table 4.

To establish a confidence interval of the predicted value of the equity capital maneuverability ratio as an effective feature of the proposed model, it is advisable to calculate its minimum and maximum values, taking into account the indicators of the critical values of the confidence intervals according to the criteria of maximum and minimum.

The first regression equation of the equity capital maneuverability ratio is calculated according to the minimum (the lower limit of the confidence interval) of the regression coefficients:

$$y_{\min a_p} = -0,0663\bar{x}_1 - 0,0223\bar{x}_2 - 0,0253\bar{x}_3 - 0,0365\bar{x}_4 - 0,0013\bar{x}_5 + 0,0041\bar{x}_6 - 0,00,32\bar{x}_7 + 3,585415. \tag{23}$$

By substituting the average values of the factor characteristics into the equation of the correlation-regression model, we

obtained the value of the equity capital maneuverability ratio, which will be the lower limit of the confidence interval:

$$y_{\min a_p} = 0,6376198 \approx 0,638\% \tag{24}$$

The second regression equation of the equity capital maneuverability ratio is calculated by the maximum of the coefficients of the conditional pure regression:

$$y_{\max a_p} = 0,023\bar{x}_1 - 0,0006\bar{x}_2 + 0,0113\bar{x}_3 - 0,0276\bar{x}_4 + 0,0056\bar{x}_5 + 0,0191\bar{x}_6 + 0,0007\bar{x}_7 + 3,585415. \tag{25}$$

$$y_{\max a_p} = 1,93330914 \approx 1,933\% \tag{26}$$

Thus, with a probability of 0.95, it can be assumed that the forecast values of the equity capital maneuverability ratio for agricultural enterprises of the Kharkiv region, calculated according to the constructed financial econometric model, can range from "0.638" to "1.933":

$$y_{x_1 \dots n} \in [0,638; 1,933] \tag{27}$$

This level of equity capital maneuverability indicates the ability of business entities to place funds raised from other sources of financing in the assets of the enterprise in such a way that as much as possible ensures financial stability, efficiency of production and economic activity, which is the key to strengthening economic security.

CONCLUSIONS

Among the complex of management components of financial and economic security of agrarian enterprises, an important place is given to accounting and analytical support, with the help of which cause-and-effect relationships between economic life and management decisions are identified. In the conditions of increased risks, threats and uncertainty of con-

ditions, the basis for developing measures to strengthen the financial and economic component of economic security using econometric methods is the stochastic approximation of indicators and the establishment of cause and effect relationships between financial and economic security and indicators of financial stability, business activity, solvency and profitability.

A multifactor econometric model of the dependence of equity capital maneuverability ratio on the coefficient of absolute solvency, the level of agricultural activity profitability, the coefficient of the receivables and payables ratio, the share of working capital in the sources of the current assets formation, the turnover ratio of receivables and payables, the turnover ratio of production stocks, synthesized according to the equation of a straight line, which was calculated based on the indicators of 135 agricultural enterprises of the Kharkiv region, made it possible to share the influence of a complex of factors, to analyse different aspects of a complex system of interrelationships.

The scientific novelty of the study is the development of a correlation-regression model of equity capital maneuverability ratio and confidence interval values for conditional pure regression coefficients. This made it possible to establish reserves for strengthening financial stability for the studied agrarian enterprises, among which are the following: an increase in the share of working capital in the sources of current assets formation (the share of the factor in the total variation is 28.4%), an increase in the level of solvency of enterprises (20.5%); ratio optimization of receivables and payables (12.4%) and others. This is a powerful analytical basis for the financial management of enterprises and the development of measures to strengthen financial stability at the tactical and strategic levels. The practical value of the obtained results lies in the ability to predict, verify and establish with the help of the built model the optimal contours of the level of equity capital maneuverability ratio of agricultural enterprises in the range of 0.638-1.933. Within these contours the appropriate level of financial stability and efficiency of production and economic activity is formed, which is the key to strengthening the financial and economic security of agribusiness.

The conducted research contains a number of limitations that affect the results and conclusions. First, correlation-regression analysis, like any methodological technique, has its conditions and limits of application. The probabilistic nature of the conclusions is determined by the transitivity of cause-and-effect relationships in socio-economic phenomena, which means that factor and result characteristics are not directly related. Intermediate factors may not be taken into account in the analysis. Therefore, the goal of the correlation method is to maximally eliminate the intrafactorial (random) interaction and reliably assess the influence of the main factors on the result. Thus, any scientific truth is relative. Secondly, the proposed methodological approach was tested on the materials of large and medium-sized agricultural enterprises of the Kharkiv region, which have an average level of specialization. In this regard, the obtained results cannot be fully used by small enterprises or highly specialized enterprises. Thirdly, the indicator of the equity capital maneuverability is quite common in the practice of financial analysis

and financial management, but it cannot fully characterize the level of financial and economic security of a business, but is only a component of a comprehensive analysis and its management.

The prospects for further research remain the substantiation of directions for analytical management of agrarian enterprises' economic security in conditions of uncertainty using the tools of stochastic analysis.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest

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