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ANALYSIS OF FINANCIAL PERFORMANCE DETERMINANTS: EVIDENCE FROM SLOVAK AGRICULTURAL COMPANIES

Purpose. *The purpose of the present study is to examine the determinants of the financial performance of the Slovak agricultural companies.*

Methodology / approach. *Bibliometric analysis was applied to analyze the literature, the results of the review were visualized using VOSviewer software. Panel data regression analysis, which was carried out using the GRETL software, was chosen to be the main research method for analyzing the influence of determinants on financial performance measures. 527 Slovak agricultural companies' activity over the period 2015–2019 was chosen as the object of the study. The analysis is carried out based on the publicly available financial information (financial statements, management reports, official company websites) and information available in the "FinStat" database. Regression analysis was performed according to four developed models based on the use of four different dependent variables (Return on Assets (ROA), Net Profit Margin (NPM), Return on Equity (ROE), Return on Sales (ROS)) and 10 independent variables same for all the models (Leverage, Long-Term Debt to Assets, Short-Term Debt to Assets, Debt to Equity, Capital intensity, Tangibility of Assets, Current Ratio, Size, Dummy variable for type of ownership, Dummy variable for legal form). Fixed Effects Method was chosen as an estimate panel data parameter on the base of F-statistics test, Breusch-Pagan test, and Hausman test use.*

Results. *The obtained results confirm the hypothesis about the existence of a distinctive impact of financial performance determinants due to the availability of the specific environment and features typical for the Slovak agricultural sector. None of the independent variables applied has a significant effect simultaneously on Models 1–4. We observed a negative significant impact at the 1 % level of l_Size on ROA and ROE of the Slovak agricultural companies. CapInt also has a negative significant impact on NPM and ROE. DtoE is found to have a positive impact on ROE. The complete lack of influence of AsTang in determining financial performance was revealed. The used dummy variables (DVTO, DVLF) were excluded from the composition of Models 1–4 during the regression analysis due to the availability of exact collinearity.*

Originality / scientific novelty. *The uniqueness of the present study is that we identify the impact of the financial performance determinants specifically for the Slovak agricultural companies considering the specifics of the Slovak agricultural market in the context of the current problems in the sector of the economy being investigated.*

Practical value / implications. *The obtained results can be used to improve the management decisions of the Slovak agricultural companies, to critically evaluate the state policy in the agricultural sector in the Slovak Republic, as well as clarify the recommendations given by various institutions to improve this sector of the economy.*

Key words: *financial performance, financial indicators, management effectiveness,*

agricultural companies.

Introduction and review of literature. With the aim to have complete information about the financial condition of the agricultural companies and to effectively implement strategic goals and tactical management policies, to make effective management decisions, it is necessary to understand the determinants which influence on the financial performance indicators. Identifying of such factors and understanding the directions and the extent of their impact on financial performance, in turn, enable agricultural companies to control the occurrence of risks and minimize their impact, manage the flow of income and expenses, contributing to the achievement of the planned level of profitability more effectively. This is critical in case of the agricultural companies since the risks in agriculture are considerably greater than those in other sectors of the national economy. Therefore, such risks are to be diagnosed and measured accurately, which will contribute to increasing the competitiveness of the agricultural companies (Vavrek et al., 2021). In addition, information about the financial performance determinants is key for capital providers, to be better equipped for making effective investment and loan decisions, which will generally contribute to increasing the efficiency of the capital market.

The problem of analysis of financial performance determinants is especially relevant for the Slovak agriculture companies, taking into consideration that the share of GDP created in agriculture has been constantly decreasing in the recent decades. It has already dropped from 2.2 % in 2015 to 1.76 % in 2020 (Slovakia …, 2022). Such a situation is a consequence of the gradual adaptation of the Slovak agriculture sector to the market economy conditions after 1990, deregulation and reduction of state support, as well as a partly caused by the integration with the EU. Despite the certain permanence in the sphere of agricultural production in Slovakia being observed lately, it is generally characterized by low production per ha and low employment per ha if compared with the EU average. As a result, support in the form of financial subsidies from the state budget of the Slovak Republic and from EU financial institutions (almost 72 %) is actively implemented to stabilize agricultural enterprises (Ministry of Agriculture …, 2022). One of the ways to improve the existing situation is to improve financial management and improve the financial performance of the Slovak agriculture companies based on a comprehensive study of the influence of its determinants. In addition to the practical significance, this problem also has a deep theoretical significance for understanding the development trends of the agrarian companies, seeking a strategy for its financial performance improvement, as well as for drafting measures and identifying the instruments of the agrarian market development in general.

Based on the importance of the problem of determining the extent and direction of the impact of determinants on financial performance of the Slovak agriculture companies, a research hypothesis was formulated. The hypothesis of the present study is that there is a unique impact of financial performance determinants due to the presence of specific conditions and characteristics of the agricultural sector

development in a particular country. Considering this hypothesis, in order to formulate recommendations and ways to improve the financial performance of Slovak agriculture companies, to achieve their long-term development, it is essential to conduct a very specific study ensuring that such national specifics are taken into account.

Considerable attention is paid by the researchers to the issue of discussing the level of impact of various types of factors on the financial performance of companies representing various sectors of the economy. This is justified both by the importance of the role of financial performance measures in the effective management of the activities of enterprises, and by a few factors affecting such indicators, which requires a detailed analysis of the specifics of their influence to be carried out. As noted by Tudose & Avasilcai (2020), the final aim of performance assessment is getting to know the current state of relevance of organizational goals, and the efficiency and effectiveness of their business. Therefore, conducting the study in this research area has a meaningful applied context, which is the possibility of identifying key factors of risk generation and ensuring productivity and formulating recommendations based on them for changing the organizational behavior of companies, adjusting their financial tactics and strategy.

Financial performance improvement for the agricultural companies is studied covered in professional specialized agrarian journals and is characterized by a concrete national (for a specific country or territory) or organizational specificity (for a specific type of agricultural enterprises). The results of the review of the papers devoted to the problems of the analysis of financial performance of agricultural companies in the databases Scopus, Web of Science and Google Scholar, is presented in Table 1.

Table 1

Scientific papers in the area of a study and their citations in academic literature for the period 2018–2022 as of August 01, 2022

Searching phrases	Results found			Sum of the times cited		
	Scopus	Web of Science	Google Scholar	Scopus	Web of Science	Google Scholar
"Financial performance" and "Agricultural companies (other entities)"	393	306	363	2429	2791	1024

Source: compiled by authors using Scopus, Web of Science and Google Scholar data bases.

The analysis of some databases (Table 1) indicates the presence of an impressive number of publications on the financial performance of different types of agrarian entities, the influence of factors, determinants and other specific characteristics, ways to improve financial performance, etc. A significant number of citations of these publications by other authors indicates contribution they make in the development of scientific research in this area. This is also supported by the increase in the number of citations of publications over the recent years.

The results of the bibliometric analysis obtained using the VOSviewer software

by the selected key words also supported the above-mentioned conclusion. It was also found that in the context of the study of financial performance of agriculture companies, scientists actively study the problems of environmental management, environmental performance, social effect, and environmental impact on the activity of such companies.

This emphasizes not only the noteworthiness of ensuring the appropriate level of financial efficiency, but also establishing the necessary conditions for ensuring the sustainable development of the external environment of agricultural enterprises (Figure 1).

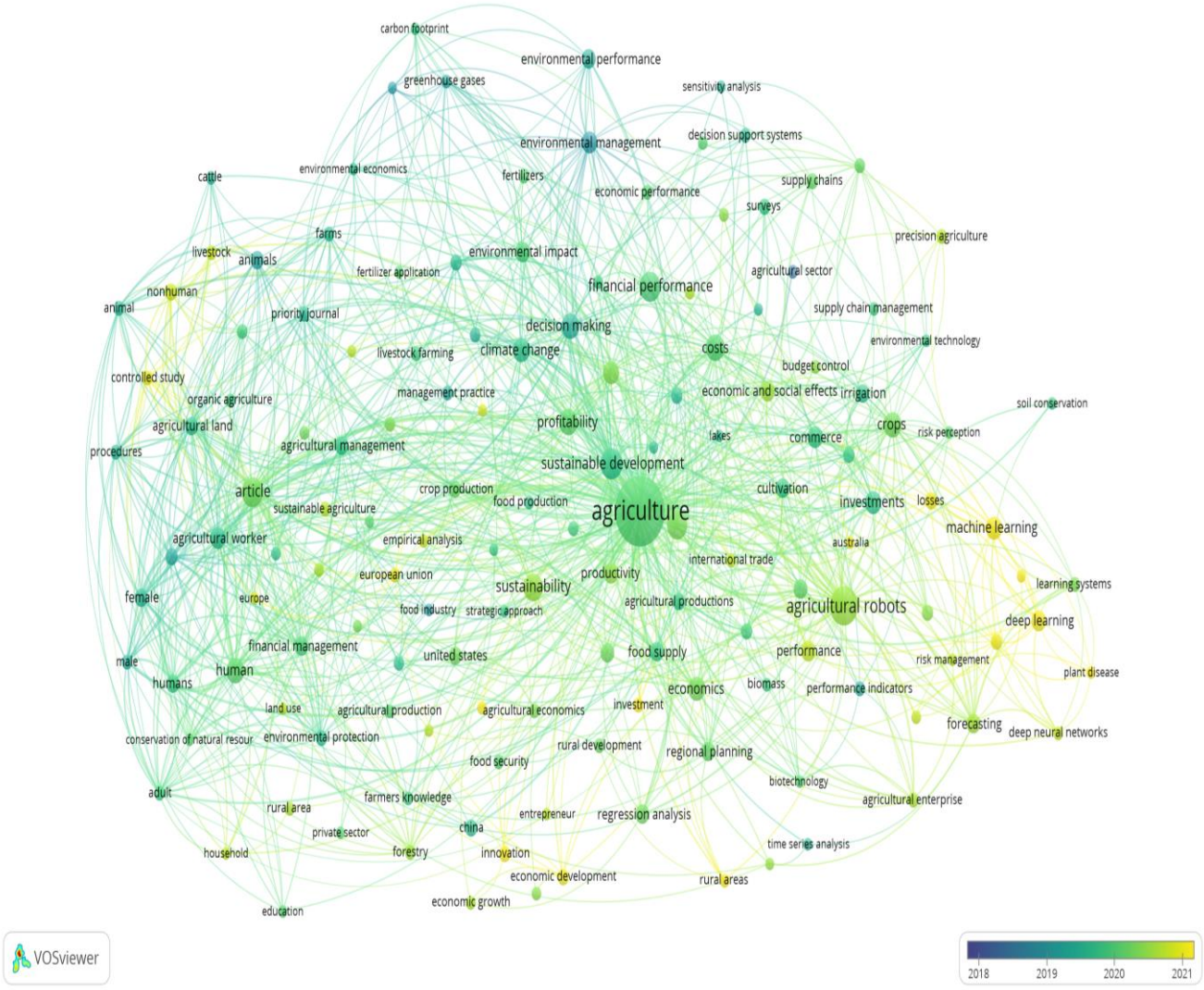

Figure 1. Bibliometric map of publications' keywords on the query "Financial performance" and "Agricultural companies (other entities)" according to Scopus database 2018–2022

Source: compiled by the authors using VOSviewer.

In addition, a recent trend of revealing the role of the technological factor in improving the financial performance of agriculture companies was found, i.e., "smart agriculture", "digital agriculture", "precision agriculture" and "deep learning" (Figure 2).

The authors carry out a direct analysis of the impact of different determinants on

financial performance of agricultural companies in relation to agricultural sector enterprises around the world, in the selected countries, or for individual agricultural enterprises of various types (listed companies, enterprises, cooperatives, farmers, etc.), as well as by conducting a comparative analysis of the activities of enterprises across several countries.

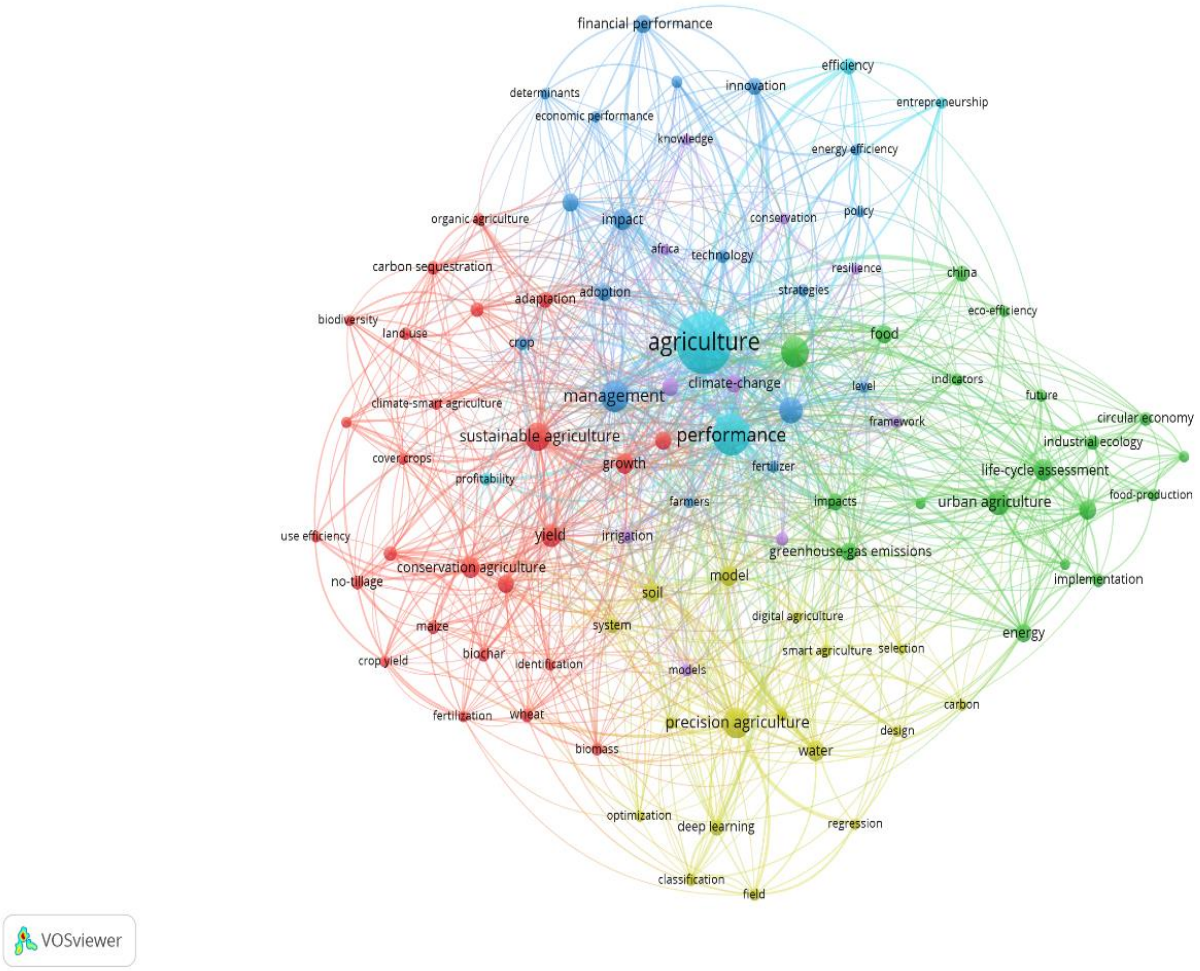

Figure 2. Bibliometric map of publications' keywords on the query "Financial performance" and "Agricultural companies (other entities)" according to Web of Science database 2018–2022

Source: compiled by the authors using VOSviewer.

Thus, Mishra, Wilson & Williams (2009) evaluated the factors that affect the financial performance of new and beginning farmers in the US (New York). Return on Assets (ROA) was chosen by them as a financial performance measure, and operator and spouse characteristics, farm organization and type, farm production, marketing, financial factors, technology and management factors, farm location were independent variables. Applying weighted regression analysis, they established the presence of different effects of the tested factors. In particular, the authors found a positive influence of existing risk management strategies, and the presence of a negative influence of young age and low education of farm operators on financial performance.

Novotná & Volek (2015) looked at the relationship between production factors

and financial performance of Czech agricultural enterprises. Having studied the business activity of 1098 agricultural enterprises for the period 2007–2012, they concluded that those agricultural enterprises with high growth of labor productivity and fixed assets, irrespective of their size, have a positive impact on its financial performance (ROA, ROE). Financial performance of Czech agricultural enterprises, in particular, of organic and conventional farms, also was studied by Hampl (2020). The study of the companies during 2012–2016 showed the significant differences in the overall financial performance of organic and conventional farms. In particular, he found a distinct influence of size and the eco factor on financial performance (ROA, ROS).

Odalo et al. (2016) studied the impact of the only factor – company size – on the financial performance (ROA, ROE, EPS). As a result of the study of listed agricultural companies in Kenya from the period 2003 to 2013 they found positive and significant impact of company size on all three financial performance measures of agricultural companies listed in NSE.

Burja & Burja (2017) scrutinized the relationship between the financial performance and the factors of microeconomic environment of 57 Romanian agricultural holdings from the vegetable sector for the period 2009–2014. They found that the companies' performance (ROIC) is largely affected by financing structure (financial risk) and sales effectiveness (commercial risk). The negative relation between liquidity and financial performance was noticed as well.

Another author Ababiya (2018) investigated the influence of determinant factors on financial performance (Profitability Ratio) of 212 agricultural micro and small enterprises in Hadiya zone (Ethiopia). Having studied the influence of 14 variables using multiple linear regression analysis, it was established that all variables positively influenced on the Profitability Ratio. In particular, the most statistically significant (1 % significance level) is the impact of age of enterprise, amount of initial capital and access to training for the enterprise.

The group of researchers Singh et al. (2019) investigated the determinants which influenced the financial performance (ROA) of 37 agro cooperatives in U.S. during the period 2009–2017 using panel regression analysis and found that the economic policy uncertainty had the most significant negative impact. This indicates the primary role of macroeconomic determinants in ensuring proper financial performance of agro cooperatives in the U.S. Besides, it was established that other regressors, i.e., Size, Leverage and Capital Intensity, also negatively affect ROA, and only Revenue Growth effects positively. Pokharel et al. (2020), while investigating the activities of agricultural cooperatives in the U.S., focused more on analyzing the impact of size and specialization on financial performance. Applying Mean Return on Equity as dependent variable they figured out that ROA, Debt to Asset ratio, Profit margin ratio and Size have statistically significant positive impact on financial performance of U.S. agricultural cooperatives (2005–2014 period).

Another scientific project dedicated to the study of factors affecting the financial performance of Chinese listed agricultural companies is being implemented under the

leadership of J. Xu. In a number of scientific publications, together with other colleagues, it was discovered that financial performance of Chinese agricultural listed companies (ROS, ROA, ROE) for the period 2013–2018 has positive relation with Size, Long-term liability ratio and Sales growth (Liu et al., 2020); Total debt ratio and Short-term debt ratio have a negative impact on financial performance (ROA, ROE) for the period 2013–2019 (Xu et al., 2021); intellectual capital has positive significant impact on financial performance (ROA, ROE) for the period 2013–2019 (Xu & Zhang, 2021).

In the study by Vuković et al. (2022) the impact of key factors on financial performance (ROA) of 460 large European agricultural companies for the 2013–2019 period is investigated. Using regression analysis, they found that Size and Current ratio have positive significant impact on ROA (at the 5 % level), and Debt to Asset ratios and Asset Tangibility have negative significant impact on ROA (at the 5 % level).

The conducted analysis of the studies devoted to the analysis of financial performance determinants for agricultural companies enabled to state the absence of unified set such, as well as the characteristics of their influence (extent and direction) on financial performance measures. The previous research suggests that the same determinant can influence the financial performance of agricultural companies both in a positive and negative way. This indicates the existence of other influential factors of the micro- and macro-external environment, which likely are specific for the agricultural sector of a particular region. In turn, this prevents the management of agricultural companies from making timely and effective financial decisions aimed at increasing the efficiency of their activity.

The purpose of the article is to examine the determinants of the financial performance of the Slovak agricultural companies.

Materials and methods. *Method.* In the research area of financial performance one of the various studies was conducted by Tudose & Avasilcai (2020), the authors used increasingly complex methodologies, one of which is regression analysis of panel data. This method was chosen for the current study considering the defined purpose of the research, which, in its turn, require the analysis of the influence of determinants, as well as the type of data used for the research (a data panel).

Sample selection. The sample comprises Slovak agricultural companies for the period 2015–2019. To form panel data to be a basis for the regression analysis, publicly available financial information (financial statements, managerial reports, company websites), as well as analytical information from the "FinStat" database, was used. After checking and removing companies with missing data and any inaccuracies, 527 agricultural companies with 2635 observations remained for the further analysis. The sample is formed out of 527 companies selected, which allows obtaining relevant conclusions.

Based on the EU Economic Activity Classification the selected companies belong to the group "Crop and animal production, hunting and related service activities", in particular, to the first three subgroups – "Growing of non-perennial

crops" (cereals (except rice), leguminous crops and oil seeds, rice, vegetables and melons, roots and tubers, sugar cane, tobacco, fibre crops, other non-perennial crops), "Growing of perennial crops" (grapes, tropical and subtropical fruits, citrus fruits, pome fruits and stone fruits, other tree and bush fruits and nuts, oleaginous fruits, beverage crops, spices, aromatic, drug and pharmaceutical crops, other perennial crops) and "Plant propagation".

According to the form of ownership, most of the investigated entities are companies with limited liability (332), 150 are agriculture cooperatives, 41 are joint-stock companies, and the minority (only 4 remaining) are limited partnerships. Based on the type of ownership, the structure of the sample is as follows: private domestic comprise 58.8 % out of all; 26.0 % of the companies are cooperatives; 8.0 % of the companies are of foreign ownership; 6.8 % are international with a predominant private sector; property of the territorial self-government – 0.2 %; and only 0.2 % are the state companies. Some scientists (Xu et al., 2021) investigate the influence of the form of ownership on financial performance of agricultural companies, however, based on the sample of a study, it is impractical to do so due to the availability of only 1 Slovak state company out of 527 being studied.

Variables. Taking into consideration both the previous research conducted (Serpeninova et al., 2022; Lehenchuk et al., of other researchers in this area (Burja & Burja, 2017; Singh et al., 2019; Liu et al., 2020; Xu et al., 2021; Vuković et al., 2022) the following dependent variables for evaluating financial performance of agricultural companies were chosen: 1) Return on Assets; 2) Net Profit Margin; 3) Return on Equity; 4) Return on Sales. To explain the financial performance determinants of Slovak agricultural companies 10 independent variables were used, i.e., Leverage, Long-Term Debt to Assets, Short-Term Debt to Assets, Debt to Equity, Capital intensity, Tangibility of Assets, Current Ratio, Size, Dummy variable for type of ownership, Dummy variable for legal form. The choice of the latter can be justified by the analysis of available research in this area, as well as by considering the financial disclosure structure by the Slovak agricultural companies.

The specifics of the Slovak agricultural market affected the choice of dummy variables. Accordingly, the studies devoted to the issue of financial performance improvement for the agricultural companies, emphasize the wide range of peculiarities in agricultural cooperatives functioning (Singh et al., 2019; Kravčáková Vozárová et al., 2019; Pokharel et al., 2020). As demonstrated by Kravčáková Vozárová et al. (2019), there are disparities in the financial performance of agricultural enterprises according to the legal form. Consequently, financial performance of the Slovak agricultural cooperatives as a specific legal form of enterprises will be influenced by the determinants in a different way. In view of the above, for the purpose of regression analysis, it is suggested to use another dummy variable that will allow to control the influence of the legal form (agricultural cooperative or another form) on the financial performance measure.

Types of selected variables, their calculation, and abbreviations used in this study are summarized below in Table 2.

Table 2

Variables definitions, calculation procedure and their abbreviations

Variable	Calculation procedure	Abbreviation
Dependent Variables		
Return on Assets	Net Turnover / Total Assets	ROA
Net Profit Margin	Net profit / Total Sales	NPM
Return on Equity	Net profit / Total Equity	ROE
Return on Sales	Earnings before interest and taxes / Total Sales	ROS
Independent Variables		
Leverage	(Long-term Debts + Short-term Debts) / Total Assets	Lev
Long-Term Debt to Assets	(Long-term Debts) / Asset	LTDtoA
Short-Term Debt to Assets	(Short-term Debts) / Asset	STDtoA
Debt to Equity	(Long-term Debts + Short-term Debts) / Equity	DtoE
Capital intensity	Total Assets / Total Sales	CapInt
Tangibility of Assets	Fixed Assets / Total Assets	AsTang
Current Ratio	Current Assets / Current Liabilities	CurRat
Size	Logarithm of Total Assets	l_Size
Dummy variable for type of ownership	1 for Slovak companies, 0 for foreign companies	DVTO
Dummy variable for legal form	1 for agricultural cooperative, 0 for another form	DVLF

Source: compelled by authors.

Year-wise means of selected dependent variables (ROA, NPM, ROE, ROS) for the period 2015–2019 for Slovak agricultural companies are presented in Figure 3.

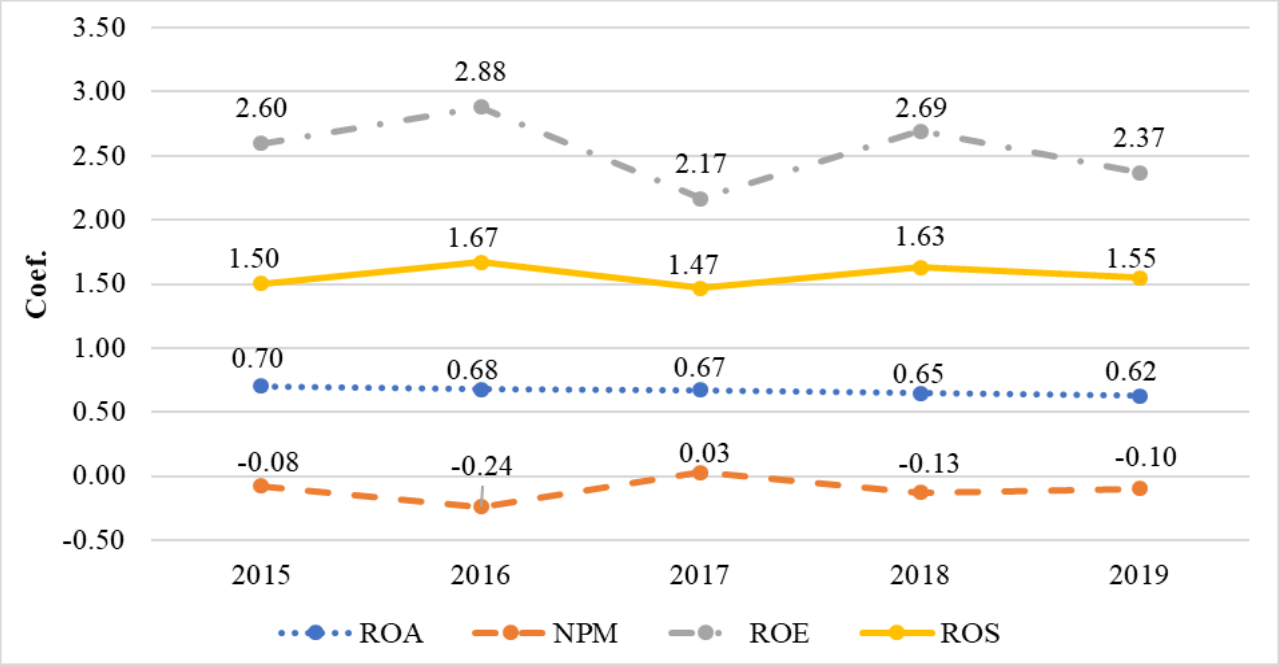

Figure 3. The trend of ROA, NPM, ROE, and ROS during 2015–2019

Source: own elaboration.

Figure 3 shows the trends in changes of the dependent variables ROA, NPM, ROE and ROS over time during the period 2015–2019. The results of analysis enabled to establish that ROE and ROS had the same behavior during 2015–2019, which is characterized by a periodic change in the growth of the average values of

indicators observed in 2016 and 2018, and their decline (respectively, 2017 and 2019). The exactly opposite trend, if compared to ROE and ROS, is found for NPM, where average values decrease in 2016 and 2018 and increase in 2017 and 2019. As seen from the Figure 3, the average values of ROA had a constant general downward trend from 2015 to 2019.

Research models. To analyze the financial performance determinants of the Slovak agricultural companies this study examined four following models (Models 1–4):

Model 1: $ROA_{it} = \alpha + \beta_1 Lev_{it} + \beta_2 LTDtoA_{it} + \beta_3 STDtoA_{it} + \beta_4 DtoE_{it} + \beta_5 CapInt_{it} + \beta_6 AsTang_{it} + \beta_7 CurRat_{it} + \beta_8 l\_Size_{it} + \beta_9 DVTO_{it} + \beta_{10} DVLF_{it} + \varepsilon_{it}$;

Model 2: $NPM_{it} = \alpha + \beta_1 Lev_{it} + \beta_2 LTDtoA_{it} + \beta_3 STDtoA_{it} + \beta_4 DtoE_{it} + \beta_5 CapInt_{it} + \beta_6 AsTang_{it} + \beta_7 CurRat_{it} + \beta_8 l\_Size_{it} + \beta_9 DVTO_{it} + \beta_{10} DVLF_{it} + \varepsilon_{it}$;

Model 3: $ROE_{it} = \alpha + \beta_1 Lev_{it} + \beta_2 LTDtoA_{it} + \beta_3 STDtoA_{it} + \beta_4 DtoE_{it} + \beta_5 CapInt_{it} + \beta_6 AsTang_{it} + \beta_7 CurRat_{it} + \beta_8 l\_Size_{it} + \beta_9 DVTO_{it} + \beta_{10} DVLF_{it} + \varepsilon_{it}$;

Model 4: $ROS\ it = \alpha + \beta_1 Lev_{it} + \beta_2 LTDtoA_{it} + \beta_3 STDtoA_{it} + \beta_4 DtoE_{it} + \beta_5 CapInt_{it} + \beta_6 AsTang_{it} + \beta_7 CurRat_{it} + \beta_8 l\_Size_{it} + \beta_9 DVTO_{it} + \beta_{10} DVLF_{it} + \varepsilon_{it}$,

where *ROA, NPM, ROE, ROS* – dependent variables, $_i$ = entity and $_t$ = time;

α – identifier;

μ – variance introduced by the unit-specific effect for unit *i*;

β – regression coefficient;

Lev, LTDtoA, STDtoA, DtoE, CapInt, AsTang, CurRat, l_Size, DVTO, DVLF – independent variables, $_i$ = entity and $_t$ = time;

ε_{it} – error term.

Results and discussion. *Descriptive statistics and correlations.* Descriptive statistics analysis is shown in Table 3.

Table 3

Descriptive statistics (based on observations 1:1 – 527:5)

Variables	Mean	Median	St. dev.	Min.	Max.	Coef. of var.	Range of var.	Coef. of oscill.*
ROA	0.666	0.526	0.757	7.83e-005	14.7	1.138	14.699	0.221
NPM	-0.104	0.0200	2.41	-84.6	26.4	23.177	111	10.673
ROE	2.55	1.09	7.36	-64.1	73.9	2.890	138	0.541
ROS	1.57	1.26	2.28	-0.105	67.6	1.456	67.705	0.431
Lev	0.644	0.591	0.802	0.000759	16.5	1.246	16.499	0.256
LTDtoA	0.112	0.0249	0.304	-0.00529	7.80	2.720	7.805	0.697
STDtoA	0.189	0.105	0.302	-0.136	6.61	1.593	6.746	0.357
DtoE	3.14	1.08	14.2	-231.0	249.0	4.541	480	1.529
CapInt	12.9	1.86	350.	-23.6	1.79e+004	27.246	23.600	0.018
AsTang	0.530	0.533	0.244	8.32e-005	1.62	0.461	1.619	0.031
CurRat	4.58	1.69	10.9	-105.0	201.0	2.386	306	0.668
l_Size	14.1	14.3	1.46	8.53	18.2	0.104	9.67	0.007

Note. *Range of variation to mean ratio.
Source: calculated via Gretl software package.

After calculating descriptive statistics values for 527 enterprises for the period of 5 years, several conclusions were drawn that characterize the studied sample. Noticeable differences between the minimum and the maximum values of all

dependent variables (ROA, NPM, ROE, and ROS) show that the financial performance levels of agricultural companies are quite distinct. The largest deviations of values were found in DtoE (14.2) and CurRat (10.9). This is to confirm that both agricultural companies those with a high risk for creditors and investors, as well as less risky ones, are included in the studied population. Moreover, these companies have a completely different level of risk of crisis or default due to short-term obligations.

For the variables AsTang and l_Size, the mean value is greater than the standard deviation value. It shows that the data related to these variables has a small distribution. In case of all other dependent and independent variables, standard deviation value is observed to be higher than their mean. This means the existence of a large set of ratios that will characterize the normal distribution curve and will not be outliers. Relatively close values of mean and median for Lev (0.644 and 0.591), STDtoA (0.189 and 0.105), AsTang (0.530 and 0.533) and l_Size (14.1 and 14.3) suggests the occurrence of high level of symmetry in the distribution of range values.

The level of variation has the greatest value for CapInt (2713.1 %), which shows that this indicator has the highest level of variability relative to the sample mean. Since the value of the coefficient of variation for all independent variables, except for l_Size, is greater than 33 %, this indicates a high level of heterogeneity of the studied population. This conclusion is also confirmed by the high values of the coefficient of oscillation for the independent variables. In turn, this indicates the existence of instability in the functioning of the agricultural industry in the Slovak Republic and confirms the need to formulate recommendations for improving the financial performance of agricultural enterprises.

Analysis of correlation matrix (Figure 4) assumes the absence of a multicollinearity problem, since in most cases the value of the correlation coefficient is less than 0.5, or -0.5. The presence of a high value of the coefficient in the Lev / STDtoA ratio is justified by the fact that Short-term Debts are a component of Total company's debts. However, the use of such intercorrelated indicators is permissible in the regression analysis of financial performance determinants, and was previously used in the studies of Xu et al. (2021) & Vuković et al. (2022).

Selection of estimate panel data parameter. With an aim to ensure adequate data processing in the process of regression analysis, it is necessary to choose the most relevant estimate panel data parameter for Models 1–4. As a result of panel diagnostics, in particular, after applying the F-statistics test, F(524, 2100) = 10.0197 with a p-value of 0 was obtained, which is less than 0.05 and indicates the adequacy of the application of the Fixed effects method (FEM). By applying the Breusch-Pagan test for Model 1, according to which chi-square (1) > 2089.67 p-value = 0, which is less than 0.05, the possibility of using the pooled OLS model was refuted and the necessity of using the Random effects method (REM) was determined. However, taking into account the results of the Hausman test (p-value = prob(chi-square (8) > 48.1621) = 9.19885e-008), for Model 1 it is more adequate to use the Fixed effects method (FEM) than REM. Supported by the results of panel diagnostics for Models

2–4 (F-statistics test, Breusch-Pagan test, Hausman test) we obtained similar results, confirming the feasibility of using FEM as an estimate panel data parameter. The use of FEM for panel data regression analysis assumes the presence of different object-specific constants for Models 1–4.

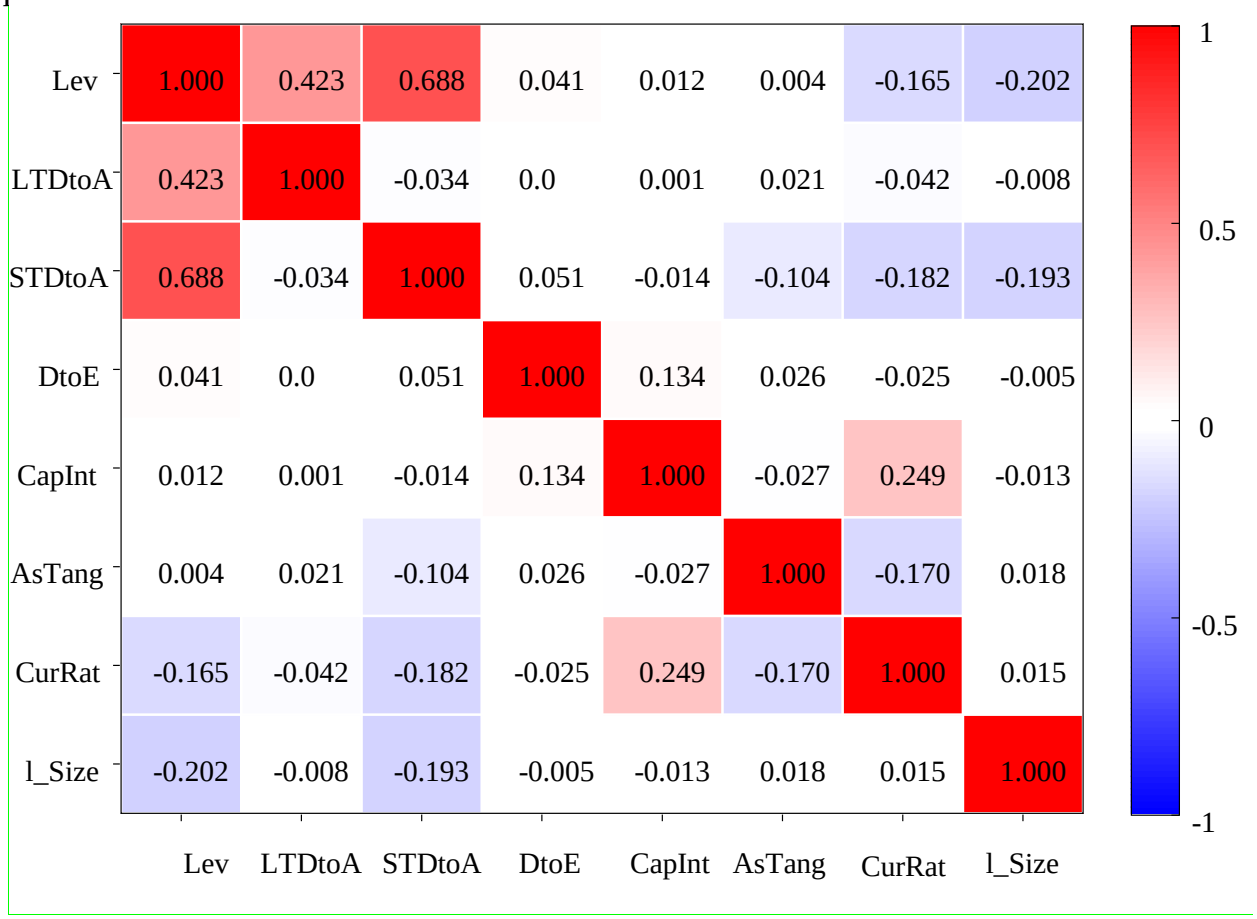

Figure 4. Correlation matrix of independent variables used in Models 1–4

Source: calculated via Gretl software package.

Assumption test results. Aiming at the adequacy test of the suggested in this study Models 1–4 to the collected panel data of agricultural companies three classical assumption tests were used, i.e., Normality, Autocorrelation and Heteroscedasticity. Normality test for Models 1–4 made it possible to determine non-normality of the distribution of errors. For example, for Model 1 for chi-square (2) = 5534.534 p-value = 0, which is less than 0.05, and therefore, the residuals are normally distributed. Applying the Wooldridge test for autocorrelation detected its presence for Models 1 and 4, since the p-values obtained are greater than 0.05 (0.51478; 0.101421), at the same there is its absence for Models 2–3, since the p-values are less than 0.05 (0.038806 and 0.0313246, respectively). Since FEM was selected as estimate parameter for all Models 1–4, the Wald test was applied to check the level of heteroscedasticity. As a result, the existence of heteroscedasticity for Models 1–4 was confirmed, as in all models for the corresponding chi-square (527) p-value = 0 was obtained, in its turn, indicating the presence of heterogeneity of observations and different dispersion random error for all Models 1–4.

For the purpose of eliminating the problems of non-normality of error

distribution, partial autocorrelation (in relation to Model 1 and Model 4) and heteroscedasticity, we propose to apply robust standard errors. To be precise, since we do not know the structure of heteroscedasticity, for large sample size it is advisable to use robust standard errors, which will allow to eliminate the negative impact of outliers. A similar approach is also used in the studies of Ocak & Fındık (2019), Özkan (2022), Serpeninova et al. (2022).

Panel data regression results. Table 4 presents the results of the regression analysis (p-value and level of significance) carried out using FEM. The results show, which of the model regressors significantly influence on the dependent variables, and what is the impact. In table 4, the independent variables DVTO and DVLF proposed for Models 1–4 are missing, as they were removed from their composition due to exact collinearity while evaluating the models using FEM.

Table 4

Model 1–4 (ROA, NPM, ROE, ROS). FEM (Robust standard errors), using the observations 1–2635

Variable	Model 1 (ROA)	Model 2 (NPM)	Model 3 (ROE)	Model 4 (ROS)
Const	0.0001***	0.4102	0.0026***	0.5889
Lev	0.2817	0.3504	0.3139	0.7370
LTDtoA	0.3838	0.9382	0.9952	0.9451
STDtoA	0.6450	0.9694	0.3722	0.5077
DtoE	0.3856	0.2361	<0.0001***	0.1783
CapInt	0.8219	<0.0001***	<0.0001***	0.2392
AsTang	0.8269	0.4930	0.3904	0.1330
CurRat	0.0303**	0.6916	0.0536*	0.1744
l_Size	0.0004***	0.4050	0.0058***	0.2388
LSDV R-squared	0.759793	0.629373	0.679957	0.351470
Within R-squared	0.085175	0.502836	0.496324	0.007952

Note: *Significant at the 10 % level; **Significant at the 5 % level; ***Significant at the 1 % level.

Source: calculated via Gretl software package.

Model 1 (ROA) can be interpreted through the following equation:

$$\hat{y} = 5.81318 - 0.0585255x_1 - 0.112433x_2 + 0.0781087x_3 - 0.000451223x_4 - 2.80577e\text{-}06x_5 - 0.0414539x_6 - 0.00278093x_7 - 0.360796x_8, \quad (1)$$

where $\hat{y}$ – ROA;

x_1 – Lev; x_5 – CapInt;

x_2 – LTDtoA; x_6 – AsTang;

x_3 – STDtoA; x_7 – CurRat;

x_4 – DtoE; x_8 – l_Size.

We can conclude that the regressors such as const, CurRat and l_Size є statistically significant (marked with * in the Table 4). Herewith, the regressors – const and l_Size – have the highest level of significance at the 1 % level, hence significantly influencing on ROA. Accordingly, we can state that ROA of agricultural companies is influenced by their size. And because this impact is an inverse one, businesses with lower size have higher ROA values. For example, if l_Size is

increased by 1, then ROA will decrease by 0.360796. Based on the obtained value of LSDV R-squared for Model 1, it was established that almost 76 % of the variation of ROA can be explained by the variation of the independent variables. The largest share in the total variation among all variables is l_Size, which explains 64.64 % of the variation of ROA and LTDtoA, which explains 5.23 %. Other independent variables explain less than 5 % of the variation of ROA. The value of R-squared shows Model 1 accounts for 8.51 % of the variance which are within the panel units.

Model 2 (NPM) can be interpreted through the following equation:

$$\hat{y} = -2.68633 - 0.335790x_1 + 0.0396243x_2 + 0.0215960x_3 + 0.00145156x_4 - 0.00467558x_5 + 0.350433x_6 - 0.000867961x_7 + 0.189368x_8, \quad \text{…….. (2)}$$

where: $\hat{y}$ – NPM;

$x_1 - x_8$ – the same as in Model 1.

Based on the Table 4, only CapInt has a significant influence on NPM, with a significance level at the 1 % level. As CapInt increases by 1, NPM values decrease by 0.00467558, indicating the presence of an inverse effect. The LSDV R-squared value shows that 62.93 % of the variation of the NPM can be explained by the variation of regressors. The largest share in the total variation among all variables is l_Size, which explains 33.16% of the variation of NPM and LTDtoA, which explains 11.11 %. Other independent variables explain less than 10 % of the variation of NPM.

Model 3 (ROE) can be demonstrated through the following equation:

$$\hat{y} = 25.9517 - 0.874200x_1 - 0.0157958x_2 + 1.65217x_3 + 0.378300x_4 - 0.00183331x_5 - 1.12827x_6 - 0.0213116x_7 - 1.67891x_8, \quad (3)$$

where $\hat{y}$ – ROE;

$x_1 - x_8$ – the same as in Model 1.

The dependent variable ROE is significantly influenced by such regressors as const, DtoE, CapInt, CurRat and l_Size, all of which, except for CurRat, affect the dependent variable with the highest level of significance – at the 1 % level. CapInt, CurRat and l_Size inversely affect ROE. As shown, like in Model 1, an increase in the volume of agricultural companies negatively affects the value of NPM. The LSDV R-squared value shows that 68 % of the variation of the ROE can be explained by the variation of regressors. The largest share in the total variation among all variables is DtoE, which explains 23.02 % of the variation of ROE, l_Size – 17.16 %, STDtoA – 17.03 %, AsTang – 7.34 %. Other independent variables explain less than 5 % of the variation of ROE. The obtained value of R-squared, similar in Model 2, is quite high compared to Model 1, since as much as 49.6 % of the variance within Model 3 panel units account for.

The analysis of Model 4 by applying FEM revealed the absence of regressors that could significantly affect ROS.

The panel data regression analysis results both confirm and deny the conclusions of the previous studies on financial performance determinants of agricultural companies. This proves to be the case for all the studied dependent variables used for the Models in this paper (ROA, NPM, ROE, ROS). This confirms the hypothesis about the existence of a unique influence of financial performance determinants due

to the presence of conditions and features specific for the Slovak agricultural sector.

According to the results, the general (Lev) and partial indicators (LTDtoA, STDtoA) characterizing the ratio of debts to assets of agricultural companies do not have a significant impact on all four used indicators characterizing financial performance. These findings contradict the results of studies stated by Liu et al. (2020), Xu et al., (2021), Vuković et al. (2022), where on the contrary a significant positive effect on such indicators was found. It can be concluded that search for the optimal capital structure should not be considered as an important task for management from the standpoint of improving the financial performance of the Slovak agricultural companies.

In the previous papers, the authors emphasize the decisive role of intellectual capital and intangible assets in ensuring the financial performance of companies (Xu & Zhang, 2021; Vuković et al., 2022; Lehenchuk et al., 2022; Zavalii et al., 2022), claiming a positive significant relationship between the indicators. However, the results obtained in our study indicate that AsTang does not have a significant impact on the independent variables of Models 1–4, which proves the lack of significant impact of intangible objects on the financial performance of the Slovak agriculture companies.

There is also a discordancy between the results of our study and those views of some authors (Burja & Burja, 2017; Vuković et al., 2022), who established the presence of positive significant impact of CurRat on financial performance. The obtained results confirmed the significant impact of CurRat only on ROA and ROE, however, this impact was negative. For this reason, improving the liquidity of Slovak agriculture companies will not lead to an improvement, but on the contrary, to a worsening of its financial performance. In relation to the size of the enterprise, a similar effect on the financial performance of Slovak agriculture companies was found as well. Odalo et al. (2016), Pokharel et al. (2020), Liu et al., (2020), Vuković et al. (2022) determined the positive significant impact of the agricultural companies' size on financial performance, however, we can observe that l_Size influence negatively on ROA and ROE. The above conclusion is meaningful for critical assessment of state policy in the agrarian sphere in the Slovak Republic. To be more specific, it questions the recommendations of the compilers of the Report on Agriculture and Food Sector in the Slovak Republic for 2020 (Report …, 2021). The document sets up a need to build vertical structures and support land consolidation in the Slovak Republic, which will certainly lead to an increase in size of agricultural enterprises and will have a negative impact on their financial performance as can be concluded from our findings.

Conclusions. The purpose of this study was to examine financial performance determinants of 527 Slovak agricultural companies over the period 2015–2019. In order to objectify the results and test the research hypotheses, panel data regression analysis was applied in the study. Such research is especially relevant in the context of the need to enhance the quality of financial management as well as improve the financial performance of the Slovak agriculture companies.

The study was based on the use of regression analysis to test four models presenting the relationships between financial performance measures and its determinants (regressors). Return on Assets, Net Profit Margin, Return on Equity and Return on Sales were selected as dependent variables that characterize financial performance. Ten independent variables, i.e., Leverage, Long-Term Debt to Assets, Short-Term Debt to Assets, Debt to Equity, Capital intensity, Tangibility of Assets, Current Ratio, Size, Dummy variable for type of ownership, Dummy variable for legal form, were chosen to explain each of four financial performance measures as determined.

Applying F-statistics test, Breusch-Pagan test and Hausman test the feasibility of FEM as estimate panel data parameter for Models 1–4 has been determined. Having found the incomplete adequacy for Models 1–4 to the generated data assumed from the Normality test, Autocorrelation test and Heteroscedasticity test via GRETL software package, the necessity of applying robust standard errors has been substantiated to eliminate negative impact of outliers.

The obtained results of panel regression analysis showed that the various determinants had significant impact on the different financial performance measures. None of the determinants had a significant effect simultaneously for all formulated Models (1–4). Analysis of the Model 4 did not reveal any significant factors influencing ROS. Such results partially contradict the conclusions of the previous studies and confirm the proposed hypothesis about the existence of a unique influence of financial performance determinants due to the presence of specific conditions and features inherent in the Slovak agricultural sector.

As the study showed, l_Size has negative significant impact on ROA and ROE at the 1 % level ROA and ROE of Slovak agricultural companies. Therefore, an increase in the size of such enterprises will lead to a decrease in the financial performance measures. CapInt also has a negative significant impact on NPM and ROE. Accordingly, the greater the capital intensity of an agricultural enterprise gets, i.e., the ability to provide the appropriate level of income due to availability of a certain amount of assets, the smaller the related financial performance measures are. In consequence, managers of agricultural enterprises should contribute to the development of "non-capital-intensive" for agricultural companies to enhance the values of NPM and ROE.

Another finding of the paper is that DtoE has a significant positive impact on ROE. This means that the greater the ability of agricultural companies to cover all debts with its shareholder equity, the more it improves ROE. As follows, managers of agricultural companies should be more cautious about attracting additional credit funds for the development of the business activities as it will lead to a negative impact on ROE values. Accordingly, it is crucial to find other ways of financing company's activities either at the expense of investors' funds or subsidies from the state or European financial institutions.

Despite the recent development of the knowledge economy and active use of modern technologies in the agricultural sector, the results of the study related to the

role of AsTang in ensuring financial performance showed that intangible assets are not key for the Slovak agricultural companies. Another reason justifying such results may lay in the high level of conservatism within the current accounting system framework regarding the recognition of intangible assets. As a result, a significant part of technological innovations of agricultural enterprises remains "outside" of financial reporting, not being an object for analysis by scientists and, logically, distorting the results of the empirical research.

The use of dummy variables (DVTO, DVLF) did not provide for detecting the influence of qualitative variables, i.e., type of ownership, legal form on financial performance of Slovak agricultural companies. Due to the presence of exact collinearity, the dummy variables (DVTO, DVLF) were excluded from the regressors of Models 1–4.

In general terms, the results of the study can serve as an empiric framework for making recommendations on how to enhance the financial performance of Slovak agricultural companies, to ensure the quality and competitiveness of agricultural production on the European market and domestically.

The study has three limitations to be considered for the objective evaluation of its findings. The first limitation is the sampling period, which covers only 5 years, from 2015 to 2019. However, to obtain more accurate results of panel data regression analysis it is possible to expand the sampling period. The second limitation is a list of independent variables, restricted by financial reporting structure of the Slovak agricultural companies. However, the potentially useful information can be gathered by conducting additional observations, as well as supplemented if requested by the specific independent variables, proven to be the case of ROS, where all Model 4 regressors didn't have any significant impact. The third limitation concerns sample size, as not all the Slovak agricultural companies were included in the study. This situation was caused by companies not disclosing all the necessary data for the period 2015–2019 or some companies had a limited period of functioning (were established after 2015 or liquidated during of the period).

Prospects for further research are conducting comparative studies of the influence of different groups of factors on the financial performance of agrarian companies in different countries. In particular, for countries that are at the same phase of agricultural market development and have similar institutional conditions for the functioning of enterprises, which will allow conducting such comparative studies.

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