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ANALYSIS OF THE RELATIONSHIP BETWEEN CAPITAL STRUCTURE AND PROFITABILITY OF DAIRY ENTERPRISES

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Purpose: The purpose of this article was to assess the impact of capital structure on return on equity (ROE) and to identify its most important determinants on the example of companies in the Polish dairy sector.
Design/methodology/approach: The study uses ratio, statistical and econometric analysis methods (OLS models of cross-sectional data).
Findings: It was shown that as total, long- and short-term debt increases, ROE increases. In addition, cash liquidity and cash cycle were found to have a significantly positive effect on ROE, with cooperative entities generally being less profitable than companies with a different legal form (IOF)**.**
Research limitations/implications: The use of OLS models was due to data availability, which may have negatively affected the estimation results. A full assessment of the sector's profitability problem should be carried out on the basis of panel data, taking into account the application of the GMM method and a different functional form of the relationship.
Practical implications: The dairy sector is characterised by relatively low profitability and the results obtained are a valuable indication that can significantly contribute to improving their efficiency and development opportunities.
Social implications: Increasing the efficiency of dairy processing companies will allow them to adapt more quickly to environmental standards and increase food security.
Originality/value: The study is an important contribution to the discussion as it presents a relatively different approach as to the impact of the regressors used. Furthermore, previous econometric studies in the area of profitability in the Polish dairy sector have not strictly addressed the problem of capital structure formation and the functioning of dairy cooperatives.
Keywords: capital structure, profitability, dairy sector.
Category of the paper: Research article.

1. Introduction

Milk and products of the dairy industry are major food commodities of strategic importance. Poland ranks 3rd in the EU for the production of cream and powdered milk and 4th for butter, yoghurt, dairy drinks and cheese, and is the 5th producer in the world in terms of production volume (ZPPM, 2023). The sector of milk processing and cheese making (PKD 10.51.Z.) generates the highest revenues in the Polish food industry, unfortunately it is also characterised by relatively low profitability (lower by about 4 to 5%). In addition, the demand-supply situation on the domestic market for milk and dairy products, which is mainly conditioned by the general recession, the war in Ukraine and the decline in demand from China, is not conducive to high financial performance. Companies in the dairy industry in 2023 saw revenues fall by 11% to PLN 52.9 billion and net return on sales fall from 2.35 to 0.82%. Despite a 1.7% reduction in FTEs, companies incurred higher wage costs of 7.4%, as a result of an increase in the minimum wage. The high growth rate in the cost of taxes and fees (by 4.3%), as well as the cost of services (by 2.9%) also contributed to the lower profitability. Due to improvements in the energy efficiency of plants, energy consumption expenses in the sector increased by only 0.6% to PLN 1.3 billion (Uchwała Nr 3/2024, KZFPM; GUS, 2024). A major challenge for dairy processing companies in the near future will be the need for high investments to comply with the requirements for: European Green Deal Strategy, Field to Table Strategy, waste and packaging management and ESG reporting. In addition, the additional investment in raising consumer awareness and continuously adapting to consumer preferences, together with the volatility of regulations and prices of energy carriers, will lead to a significant increase in operating costs. As a result, milk processing units are forced to constantly seek competitive advantages (ZPPM, 2023).

An enterprise wishing to survive in a competitive environment must maintain an optimal capital structure, which is most often understood as an appropriate relationship between the size of equity and debt capital (Susan, Winarto, Gunawan, 2022; Gill, Biger, Mathur, 2011; Szymańska, 2009). Among other things, finance theory states that foreign capital allows investments to be made that exceed an entity's own capabilities and can help to speed up operational processes. It is generally a cheaper and more flexible source of financing than equity capital. However, too much foreign capital can lead to an excessive increase in risk and bankruptcy of the entity (Grzywacz, 2021; Jakubczak, 2009).

The problem of shaping an optimal or quasi-optimal capital structure in empirical studies is often analysed from the point of view of improving profitability, which is one of the main objectives of a company and determines its ability to survive in the long term. Unfortunately, to date, the results of research do not make it possible to clearly indicate what is the direction and shape of the relationship between the size of external capital and the level of profitability achieved. Moreover, analysing the literature on the subject, it is possible to come to the

conclusion that the set of main determinants of profitability is still open and that the researcher, when embarking on the analysis, cannot be sure of the direction of the impact of any of the variables (Bereżnicka, Pawlonka, 2014; Alarussi, Alhaderi, 2018).

The aim of this article was to assess the impact of capital structure on the return on equity (ROE) of companies in the milk processing and cheese making sector. The research was conducted using econometric modelling (OLS models). The following research hypothesis was set: *As the level of total, long-term and short-term debt increases, the level of return on equity increases*. The results of the analyses have further identified the key determinants of profitability in the analysed sector and may become valuable guidance for managers and other stakeholders in the future.

The study consists of five sections. The first presents the theoretical and empirical foundations of capital structure research. The second contains a description of the data and methods used. The next presents the results of the research conducted. The last two sections are devoted to discussion and conclusions.

2. Theory and practice of corporate capital structure – a critical review of the literature

2.1. Outline of the theoretical foundations of the relationship between capital structure and corporate profitability in the light of capital structure theory

Theories of capital structure generally describe the determinants that guide a company's managers in choosing a particular size of financing sources. However, some of them, in addition to understanding the function of specific capital, make it possible to formulate preliminary conclusions about the relationship between external capital and profitability. Of course, the most frequently cited theory that has contributed most to the development of science in this area is that of Miller and Modigliani in 1958, 1961 and 1963 (Modigliani, Miller, 1963; Jakubczyk, Lewandowska, 2014). Their definitive insights on the tax effect are an important basis for the leverage theory and the extended substitution theory. The former indicates that the profitability of equity increases when the profitability of all capital (assets, EBIT/Asset) is higher than the rate of interest paid on the debt incurred, and the use of the tax shield (the ability to count interest as a tax expense) further reduces the cost of debt capital. In addition, the theory points out that the cost of equity capital is higher due to the higher risk the owners bear. In effect, the use of foreign capital up to a certain point contributes to lowering the weighted average cost of capital (WACC) (Iwin-Garzyńska, 2009; Tousek et al., 2021). The second states that "the total value of a firm using debt corresponds to the value of a firm financed solely with equity plus the present value of tax benefits and limited agency costs, minus the present value of bankruptcy and agency costs of debt" (Błach, 2009). Bankruptcy and agency costs of debt

arise when a business over-finances itself with debt capital and include, among other things, expenses associated with the bankruptcy and liquidation process, reputational damage, liquidity costs and restrictions on new borrowing and disposition of assets (Trojak, 2014; Miroński, 2005). Increasing debt reduces an entity's free cash flow, which is an incentive to make the most efficient decisions. In this way, the owners of the firm reduce the agency costs of equity, which include, among other things, the costs of monitoring management's actions and incentive programmes (Fosu, 2013; Kołosowska et al., 2019).

The most commonly analysed approach that would point to an inversely proportional relationship between a company's profitability and the amount of debt is the hierarchy of sources of finance theory. Here, it is emphasised that economic agents initially meet their financing needs using internal equity (e.g. profit and depreciation). Then, only when the necessary funds are not available, do they choose, in turn, debt instruments, hybrid securities (e.g. convertible bonds) and equity issues. The main determinant for choosing a particular source of capital in this situation is not the maximisation of the company's value, but the need to submit to the strict discipline shaped by external investors (information asymmetry) (Kędzior, 2019; Sivathaasan et al., 2013, Gajdka, 2002).

A large number of quantitative and statistical studies (47)[1] conducted on the Polish market confirm a statistically significant relationship between capital structure and company size (36), asset structure (33), liquidity (23), non-interest tax shield (19), growth potential (16) and company age (6). The aforementioned variables simultaneously affect a company's financial performance, and the lack of a clear relationship between them further complicates the research problem (Hajduk, 2018). In addition, surveys conducted on the Polish and European market have established that companies, when deciding to engage foreign capital, generally take into account: the flexibility of financing, the credit rating granted, the cost of capital, the interest tax shield and the volatility of profits and cash flows. It is worth noting that many theories of capital structure address the aforementioned determinants in detail, but the volatility and evolution of the economic environment determines the need to look for new theories and to verify those already established (Bancel, Mittoo, 2002; Chojnacka, 2012).

2.2. The relationship between capital structure and profitability in the light of empirical studies

A study by M. Chmielewska conducted on a sample of 20 dairy cooperatives in 2003-2005 showed that units with the highest level of total debt (total liabilities/total assets) were generally characterised by the highest efficiency in the use of assets (ROA) and own fund (ROE). This relationship was identified using ratio analysis and statistical methods for grouping enterprises (Chmielewska, 2007). The positive impact of the total debt ratio on ROA is confirmed, also by G.K. Maina analysing small and medium-sized dairy enterprises in Kiambu

[1] Values in brackets indicate the number of studies found in the Google Scholar database. Keywords: „struktura kapitału" and „capital structure", data available at 09.04.2025.

County. The basic research tool in this case was a linear multivariate regression model, which also established the negative interaction of the amount of long-term debt to equity (Maina, 2014). Research by L. Liu, J. Xu, Y. Shang, on the other hand, indicate an inverse relationship between the level of total debt (-), the size of long-term financing (+), and the size of ROS, ROA and ROE. The econometric model in this situation was based on the financial data of 39 enterprises in China's agricultural sector (Liu, Xu, Shang, 2020). Another example of the positive effect of capital structure (total liabilities/total equity) on the level of ROE is the results of a quantitative analysis obtained by M.H. Syahnur on a sample of food and beverage companies listed on the Indonesia Stock Exchange. The author of the study further found that the amount of debt has a positive and statistically significant effect on the value of the company (market price per share/book value per share) through the return on equity (Syahnur, 2023). K. Mijić and D. Jakšić using a panel data econometric model with random effects also show that as the size of debt increases, the return on assets of agricultural enterprises in Hungary, Romania and Bosnia and Herzegovina increases (Mijić, Jakšić, 2017).

Research by I. Milošev confirms a negative linear relationship between the total debt ratio and the return on assets of companies of the dairy sector in Serbia. The final effect was obtained in this case using the GMM model, and the non-monotonic interaction was tested using the square of the debt assessment. The analysis covered the period from 2017 to 2021 (Milošev, 2023). Similar results were also previously obtained by S. Dakić, K. Mijić and D. Jakšić evaluating the efficiency of the meat, milk and fruit processing sector in Serbia from 2007 to 2015. For this purpose they used a panel model with fixed and random effects (Dakić, Mijić, Jakšić, 2019). Y. Ananiadis, O. Notta, and K. Oustapassidis concluded that companies in the Greek dairy industry that financed their fixed assets to a greater extent with equity (capital and reserves) achieved higher return on assets (ROA). In addition, through the use of the group fixed effects method, they determined that IOFs units in the period from 1990 to 1998 achieved a competitive advantage over cooperative enterprises in this aspect (Ananiadis, Notta, Oustapassidis, 2003).

N.T. Bhutta and A. Hasan while building a model of profitability of sales found that the leverage ratio during 2002-2006 (amount of debt to equity) did not statistically significantly affect the financial performance of Pakistani food companies (Bhutta, Hasan, 2013). Table 1 provides more information on empirical studies on the relationship between capital structure and corporate profitability.

Table 1.
Empirical studies on the relationship between capital structure and firm financial performance

Positive relationship		
Author of the study	**Research sample**	**Dependent variable (independent)**
Sajnóg (2010)	Industrial companies (including food companies) listed on the WSE	Long-term return on equity ratio, (long-term liabilities/equity)
Namalathasan (2010)	Manufacturing companies in Siri Lanka	Operating profit/net sales (Total liabilities/total assets)
Sandberg, Alnoor, Tiberius (2023)	EU food industry companies	ROE (Total liabilities/equity)
Gill, Biger, Mathur (2011)	NYSE-listed service and manufacturing companies	ROE (Current Liabilities, Non-current Liabilities and Total Liabilities/Total Assets)
Sivathaasan et al. (2013)	Manufacturing companies listed on the CSE (Colombo Stock Exchange)	ROA, ROE (Total liabilities/total equity)
Burja (2011)	Chemical companies in Romania	ROA (Total liabilities/total assets)
Negative relationship		
Blažková, Dvouletý (2018)	Czech food sector (including milk processing)	ROA (Total liabilities/equity)
Pervan, Mlikota (2013)	Food and beverage companies in Croatia	EBITDA/sales revenue (Total liabilities/total assets)
Sensini (2020)	Agri-food SMEs in Italy	Gross operating profit margin (Total liabilities/total assets)
Awan et al. (2024)	Companies in the food and personal care products sector in Pakistan	ROS (Long-term liabilities, total assets)
Le Thi Kim, Duvernay, Le Thanh (2021)	Food sector enterprises in Vietnam	Operating profit/net sales revenue (Total liabilities/total assets)
Kryszak, Guth, Czyżewski (2021)	EU agricultural holdings in FADN	ROA (Total liabilities, total assets)
Gołaś, Paszkowski (2010)	EU farms in FADN	ROE (Invested capital/equity)
Jaworski, Czerwonka (2018)	Companies listed on the WSE	Operating profit/total assets (Total liabilities/total assets × 365)
Non-linear relationship (positive or negative)		
Rey-Ares, Fernández-López, Rodeiro-Pazos (2021)	Spanish companies in the fish canning industry	ROE (Total liabilities/total assets)
Bieniasz, Czerwińska-Kayzer, Gołaś (2008)	Process industry companies	ROE (Invested capital/equity)
Bereżnicka, Pawlonka (2014)	Companies in the meat industry (PKD 10.1)	ROIC (Total liabilities/total assets)
Ma, Renwick, Zhou (2020)	Dairy farms in New Zealand	Dairy gross farm revenue minus total dairy operating expenses (Total liabilities/total assets)
Baran (2017)	Businesses in the service, manufacturing and retail sectors	Net profitability (Total liabilities)
Insignificant relationship		
Susan, Winarto, Gunawan (2022)	Consumer goods companies (including food and beverages) in Indonesia	ROE (Total Liabilities/Equity)
Al-Taani (2013)	Manufacturing companies in Jordan	Profit after tax/turnover (Short- and long-term liabilities/total assets)

Note. Underlined by the authors of this paper.

Source: authors' own elaboration.

The discrepancy in results is determined, inter alia, by the fact that the presented research was carried out on a specific number of companies that operated in different social and economic environments. Furthermore, the use of different dependent and independent variables (including control variables) does not allow uniform conclusions to be drawn even within the same sector. Econometric studies on the profitability of the Polish milk processing sector are rare and, when they are performed, they do not refer in detail to the problem of shaping the capital structure or the way dairy cooperatives operate. A similar situation is found in foreign literature, where the problem of profitability of the food sector is most often considered. Therefore, the identified research niche provides an asumpt for further empirical analysis.

3. Data and Methods

The relationship between capital structure and profitability of the Polish milk processing and cheese making sector (PKD: 10.51 and 10.51.Z) in 2018-2021 was assessed on the basis of data obtained from the EMIS (Emerging Markets Information Service) database. The authors of the study decided to select the units with the largest market share, taking into account the degree of variation in the level of revenue generated. The research material obtained was limited to businesses with sales revenues of more than 40,000 thousand PLN, as a number below this value were characterised by a high decline. In the next step, companies with negative equity and high extreme values of financial ratios were removed from the sample. Care was also taken to ensure that the group did not include entities that had ceased operations in a particular year or were in the process of liquidation. The final research sample for the subsequent periods was 65, 64, 63 and 60 companies.

The estimation of the econometric models was performed on the basis of the classical least squares (OLS) method using cross-sectional data. Their estimated general functional form is presented below:

$$y_i=\alpha_0+\alpha_1 x_{1i}+\alpha_2 x_{2i}+\ldots\alpha_k x_{ki}+\varepsilon_i,\ i=1,2,\ldots n, \tag{1}$$

where:

y_i - *i-th* observation of the endogenous variable,

x_{ji} - *i-th* observation of *the j-th* exogenous variable,

ε_i - random component,

$\alpha_0,\alpha_1\ldots\alpha_k$ - estimated structural parameters of the model,

n - sample size,

k - number of estimated parameters.

The capital structure in the estimated econometric models was represented by an index of total, long- and short-term debt. Table 2 provides a description and construction of the regressors tested. The dependent variable of the econometric model was the return on equity, expressed as the ratio of net profit to equity (equity fund). The analyses did not use lagged effects of the independent variables.

Table 2.
Tested regressors

Variable	Abbreviation	Design
Cash liquidity	IR	$\frac{\text{cash}}{\text{current liabilities}}$
Receivables cycle	Component CCC	$\frac{\text{trade receivables}}{\text{sales revenues}} \times 365$
Stock cycle	Component CCC	$\frac{\text{inventories}}{\text{sales revenues}} \times 365$
Liabilities cycle	Component CCC	$\frac{\text{current liabilities}}{\text{sales revenues}} \times 365$
Cash cycle	CCC	Inventory cycle + receivables cycle - payables cycle
Overall debt ratio	DA	$\frac{\text{total liabilities}}{\text{total assets}}$
Long-term debt ratio	LDA	$\frac{\text{long-term liabilities}}{\text{total assets}}$
Short-term debt ratio	SDA	$\frac{\text{current liabilities}}{\text{total assets}}$
Binary	BIN	1 = dairy cooperatives, 0 = other legal forms of operation.

Note. underlined by the authors of this paper.

Source: Own elaboration based on data from EMIS.

In addition to literature studies, the selection of the best variables was essentially based on the analysis of coefficients of variation, Pearson's linear correlation and Spearman's rank, as well as the application of the stepwise and backward regression methods. The phenomenon of collinearity between variables was assessed using the variance inflation factor (*VIF*). The validity of the models was verified using the Student's t-test, the F-test (assessment of significance of variables), the Doornik-Hansen (1994) test (assessment of normality of distribution), the White test (assessment of heteroscedasticity), and the RESET test and the series test (assessment of functional validity of the model).

4. Results

Finally, in addition to the capital structure indicators, the following regressors entered the models: cash liquidity, cash cycle and the binary variable. Table 3 presents the descriptive statistics of the variables.

Table 3.
Descriptive statistics of the variables

Variable	Measure	2018	2019	2020	2021
ROE [%]	Average	4.13	3.86	5.25	8.09
	Median	2.20	3.38	3.71	6.79
	Standard deviation	5.75	5.6	6.37	7.83
DA [%].	Average	44.6	44.3	43.3	45.7
	Median	44.2	44.6	43.4	45.9
	Standard deviation	17.6	16.5	15.6	15.5
LDA [%]	Average	9.9	10.3	10.7	10.7
	Median	9.8	9.7	9.8	10.5
	Standard deviation	7.31	8.17	8.41	8.05
SDA [%].	Average	34.7	34.0	32.6	35.0
	Median	32.5	33.2	31.9	32.5
	Standard deviation	14.7	13.7	12.4	12.8
IR [multiplicity]	Average	0.59	0.53	0.60	0.60
	Median	0.25	0.27	0.41	0.36
	Standard deviation	0.73	0.62	0.67	0.70
CCC [days]	Average	-1.2	0.35	-0.84	1.6
	Median	-0.5	0.3	-1.0	2.5
	Standard deviation	30.1	24.0	23.00	19.4
Cooperatives	[number of units]	41	39	40	38
Limited liability companies	[number of units]	22	24	22	21
Joint stock companies	[number of units]	2	1	1	1

Note. underlined by the authors of this paper.

Source: Own elaboration using GRETL based on data from EMIS.

The dairy processing sector in 2018 recorded a decrease in revenue of around 1.5% to PLN 33.2 billion, which was mainly determined by the downturn in international markets and resulted in the industry's net profit decreasing by around 18%. The return on equity ratio of the analysed sample in 2018-2019 moved in a positive direction (increase in the median), and the decrease in the average in the last year was due to an increase in the capital base of profitable entities (increase of about 9.3%). Dairy processing companies have successively increased the amount of capital expenditure over the period, which has allowed them to expand their storage and logistics base, and has also contributed to the reduction of environmental costs. A 1.7% increase in labour productivity and improved market conditions in 2019 resulted in the sector's gross profit improving by around 18% (Uchwała Nr 5/2020, KZFPM). The closure of the HoReCa sector, the stoppage of seaborne exports to China, liquidity issues, broken supply chains caused by the COVID-19 pandemic contributed to a temporary lull in the dairy market in 2020. However, the sector did quite well during this period which was conditioned by the fact that dairy industry players produce products characterised by low income elasticity of

demand. The literature indicates that the production level generally of no dairy products fell below 10% and some were characterised by moderate development (growth of 2 to 7%) (Wiza, 2021; Szczepaniak, Ambroziak, Drożdż, 2020). In 2020, net profit increased by around 63% to PLN 776 million. The dairy industry in 2021 faced rising energy, wage and milk prices (13.5% increase in the average purchase price), with higher revenues and profits as a result of high demand. The sector last year increased its revenues by 14.1% and net profit to PLN 860 million. (Wieczorkiewicz, 2022). The increased efficiency of the sector is also evident in the return on equity ratio of the sample analysed as evidenced by an increase in the mean, median and decrease in the coefficient of variation between 2019 and 2021.

The cash liquidity ratio of the analysed sample of companies between 2018 and 2021 indicates that the sector has improved its ability to pay its current liabilities on time (optimal value 0.1-0.3). The share of companies characterised by a lack of liquidity fell from 40.0% to 33.3% during this period. At the same time, the group of units with excessive cash volume increased from 46.2% to 55.0%.

The cash conversion cycle from 2018 to 2021 oscillated around zero and was characterised by high variability. Its length was determined by the fact that most dairy processing products are characterised by high turnover and rapid collection of receivables, and dairy contractors generally receive payment immediately for the food items they sell. In contrast, the high volatility was due to the specific nature of the products manufactured (longer production cycle and shelf life). The longest inventory and receivables cycle was exhibited by companies producing dairy powders. On the other hand, the shortest cycle was obtained by entities that produced liquid milk, buttermilk and kefir, among others. The average cycle length of inventories (between 23 and 25 days) and receivables (between 30 and 31 days) within the entire sector was characterised by a relatively constant level, which is a result of the fact that the sector bases its activities on stable cooperation with suppliers and customers. From 2018 to 2021, the average length of the short-term accounts payable cycle fell from 56 to 51 days, indicating that entities needed more and more working capital during this period and that profitable entities preferred to pay off their liabilities more quickly. The shorter receivables cycle relative to the current liabilities repayment period positively stimulated the sector's financial performance.

The overall indebtedness ratio for the period 2018-2021 indicates that dairy processing units did not make the most of the opportunities to engage in external capital, but were also not exposed to high risk (optimal value 57-67%). In 2018, the share of companies that were not fully leveraged was around 77% and the share of over-indebted units was around 12%. In the subsequent period, the sector's indebtedness status improved as a result of a decrease in the number of over-leveraged and under-leveraged companies by around 3 and 6 percentage points, respectively. From 2020 to 2021, an appropriate financing structure was maintained by 15% of entities and the increase in the overall debt ratio in the last period was due to an increase in the number of highly indebted entities from 6 to 10%.

Long-term debt accounted for the smallest proportion of the sector's sources of finance and had the relatively highest variation, which may indicate that milk processing units are struggling to raise debt. Dairy products generally generate relatively low margins, which causes companies to prefer or be forced to finance themselves with trade credit in order to be able to achieve a minimum level of profitability. The proportion of entities that maintained an appropriate ratio of long-term debt to equity (optimum 50-100%) was 11%, 6%, 51% and 13%, respectively. At the same time, it was observed that only around 2% of entities were over-indebted in the 2018-2021 period. The under-utilisation of long-term liabilities is a negative phenomenon, as this type of financing is more flexible than equity and has a higher level of stability than short-term liabilities. The low long-term debt ratios may mean that processing companies raised finance on relatively favourable terms and did not incur additional bankruptcy costs.

Between 2018 and 2020, there was an increase in the number of businesses in the sample with an optimal level of short-term liabilities from 83 to 92% (recommended value 20-60%). In addition, the share of businesses with excessive current liabilities fell from 6 to 3%. In summary, the increase in the average value of long-term debt and the optimisation of the level of short-term financing contributed to an improvement in the capital structure of the analysed group of enterprises.

Estimation of the econometric model was preceded by Pearson correlation and Spearman rank analysis. Table 4 contains the correlation coefficients between the endogenous variable and the exogenous variables for the period 2018-2021.

Table 4.
Spearman's rank correlation between variables for the years 2018-2021

Variable/year	ROE			
	2018	**2019**	**2020**	**2021**
BIN	0.213*	-0.231*	-0.224*	-0.195
IR	0.476***	0.137	0.010	0.263**
CCC	0.151	0.431***	0.352***	0.421***
DA	-0.202	-0.226*	-0.139	-0.205
LDA	-0.129	-0.184	-0.121	-0.110
SDA	-0.189	-0.247**	-0.126	-0.163

Note. The significance levels of the parameters are given in the table: *** - $p < 0.01$, ** - $p < 0.05$, * - $p < 0.1$.

Source: Own elaboration based on data from EMIS.

The correlation between BIN and ROE was mostly negative and statistically significant in 2019 and 2020 at the 10% level. Cash liquidity (IR) showed a positive correlation with ROE throughout the period and was statistically significant in 2018 and 2021 at the 99 and 95% confidence level, respectively. The CCC variable also had a positive correlation and statistical significance at the 1% level from 2019 to 2021. All variables representing capital structure were negatively related to ROE and their relationship was statistically significant only in 2019 for the total debt ratio ($p < 0.01$) and short-term debt ($p < 0.05$).

Table 5 presents information on the estimated cross-sectional data models from 2018 to 2021 for the total debt ratio.

Table 5.
Profitability of equity model from 2018 to 2021 for total debt

Specification	Dependent variable ROE			
	2018	2019	2020	2021
Constant	none	none	none	none
BIN	-0.0503 ***	-0.0454***	-0.0552***	-0.0707 ***
IR	0.0352***	0.0326***	0.0271**	0.0495 ***
CCC	0.00054**	0.00081***	0.00087**	0.00145 ***
DA	0.1133***	0.1029***	0.1566***	0.2071 ***
Uncentred R-squared.	0.5222	0.4823	0.5133	0.7107
Crit. inform. Akaike	-200.355	-197.400	-173.509	-158.650
The p-value for the F-test	2.78e-09	4.08e-08	9.60e-09	1.73e-14
Doornik-Hansen test (p-value)	0.0686	0.1128	0.1617	0.9353
White's test (p-value)	0.1397	0.4202	0.2837	0.1665
RESET test (p-value)	0.0265	0.0632	0.3246	0.8243
Series test (p-value)	0.9005	0.8011	0.8989	0.7945

Note. The significance levels of the parameters are given in the table: *** - $p < 0.01$, ** - $p < 0.05$, * - $p < 0.1$.

Source: Own elaboration using GRETL based on data from EMIS.

The constructed OLS model allowed for a positive impact of cash liquidity and cash cycle at the 95% and 99% confidence level. The total debt ratio was significantly different from zero at the significance level $\alpha = 0.01$, and its parameter confirms that the sector's return on equity increased as debt increased. The zero-one variable indicates that dairy cooperatives generally achieved lower profitability than companies operating under another legal form. The p-value values of the tests indicate that the functional form of the profitability equation has been chosen correctly. The models are also characterised by unidirectional interaction of exogenous variables over the entire period under study.

Further econometric models used the LDA variable. Table 6 presents the results obtained.

Table 6.
Model of return on equity from 2018 to 2021 for long-term debt

Specification	Dependent variable ROE			
	2018	2019	2020	2021
Constant	none	none	none	none
BIN	-0.0537***	-0.0328**	-0.0339*	-0.0563 **
IR	0.0413***	0.0358***	0.0325**	0.0621 ***
CCC	0.00053**	0.00082***	0.00086**	0.00134 **
LDA	0.4471***	0.2801***	0.3794***	0.5952 ***
Uncentred R-squared.	0.5390	0.4089	0.4045	0.6069
Crit. inform. Akaike's	-202.6707	-188.908	-160.803	-140.2629
P-value for F-test	9.64e-10	1.88e-06	2.95e-06	7.94e-11
Doornik-Hansen test (p-value)	0.0619	0.7296	0.7855	0.4680
White's test (p-value)	0.0933	0.1259	0.1418	0.0800
RESET test (p-value)	0.0951	0.0006	0.0998	0.8916
Series test (p-value)	0.3816	0.8011	0.8989	0.4347

Note. The significance levels of the parameters are given in the table: *** - $p < 0.01$, ** - $p < 0.05$, * - $p < 0.1$.

Source: Own elaboration using GRETL based on data from EMIS.

As in the previous model, the control variables did not change the direction of their effect on return on equity. The amount of long-term debt was statistically significant at the 0.99% confidence level and had a positive effect on ROE. The variability of the endogenous variable

was explained in this case by approximately 40 to 60% by the OLS models (exogenous variables) built. The functional relationship in this situation, could also be considered correct.

The last estimated models from 2018 to 2021 use the SDA variable. Table 7 shows the results of the tests carried out. The relationship between the amount of short-term debt and return on equity was found to be positive and statistically significant at the 1% level.

Table 7.
Return on equity model from 2018 to 2021 for short-term debt

Specification	Dependent variable ROE			
	2018	**2019**	**2020**	**2021**
Constant	none	none	none	none
BIN	-0.0398***	-0.0376***	-0.0417**	-0.0510 ***
IR	0.0338***	0.0307***	0.0229*	0.0434 ***
CCC	0.00049**	0.00079***	0.00090**	0.00156 ***
SDA	0.1213***	0.1181***	0.1823***	0.2359 ***
Uncentred R-squared.	0.4633	0.4500	0.4703	0.6653
Crit. inform. Akaike's	-192.782	-193.528	-168.180	-149.907
P-value for F-test	8.66e-08	2.35e-07	1.07e-07	9.62e-13
Doornik-Hansen test (p-value)	0.0512	0.1971	0.1095	0.5180
White's test (p-value)	0.1703	0.4493	0.0962	0.1982
RESET test (p-value)	0.0723	0.0257	0.3509	0.2239
Series test (p-value)	0.9005	0.8011	0.0987	0.7946

Note. The significance levels of the parameters are given in the table: *** - $p < 0.01$, ** - $p < 0.05$, * - $p < 0.1$.

Source: Own elaboration using GRETL based on data from EMIS.

Control variables maintained direction of interaction and significance in all capital structure models. Analysing Akaike's information criterion, in general, the estimates using the total debt ratio carried the greatest information capacity.

5. Discussion

The econometric research carried out made it possible to establish that dairy cooperatives in 2018-2021, on average, achieved a lower return on equity (share fund) in relation to enterprises operating under a different legal form (limited liability companies and joint stock companies). This phenomenon, according to the authors, is mainly determined by the fact that social entrepreneurship pursues the premises of humanistic management to a greater extent (Zimnoch, 2018). The research of M. Wasilewski and M. Ganc emphasises that the low results in the level of profitability of dairy cooperatives are the result of the fact that the goal of dairy cooperatives is not to maximise profitability, but to meet the economic, social and cultural needs of its members (Wasilewski, Ganc, 2016). The specific relationship in which the shareholder is both owner and user makes it possible for them to count on, among other things, benefits in the form of higher prices for their products, lower input prices and better distribution channels (Ziętek-Kwaśniewska, Zuba-Ciszewska, 2022; Parliament, Lerman, Fulton, 1990).

Furthermore, as A. Gentzoglanis argues, cooperatives often provide services and goods to local communities whose market value is difficult to estimate. This includes, for example, educational programmes (Gentzoglanis, 1997). Social entrepreneurship can provide a hedge against various risks through contingency pricing and income insurance, which has high costs (Staatz, 1987).

The literature indicates that cooperative managers often fail to recognise the cost of equity capital and tend to over-invest in fixed assets and are subject to moral hazard (over-investment in external capital) due to sharing and mutual responsibility towards risk (Gentzoglanis, 1997; Ravenscraft, Scherer, 1987). The lower profitability at the ROE level in this case may be due to the fact that the cooperatives in the analysed group maintained on average a higher ratio of fixed assets to sales revenue and total assets. Given the constructed econometric model and the magnitudes of the debt ratios, there was no moral hazard phenomenon in the study group. Non-cooperative entities were characterised by a longer run-off of trade receivables, which is in line with the results of K. Ziętek-Kwaśniewska and M. Zuba-Ciszewska, who concluded that such a condition positively stimulated their financial performance (Ziętek-Kwaśniewska, Zuba-Ciszewska, 2022). A similar result in terms of profitability is also attested by a study by R.A.M.E. Soboh, A. Oude Lansink and G. Dijk performed on a sample of European dairy cooperatives (Soboh, Oude Lansink, Van Dijk, 2011).

Research by Z. Lerman and C. Parliament do not confirm that social dairy enterprises are less profitable than investor firms (IOF). In this case, the dairy cooperatives were not characterised by an excessively high commitment of capital to fixed assets and maintained a higher level of short-term liabilities and trade receivables. Moreover, the business environment and financial analysis standards in the United States forced cooperative entities to pursue the same goals as IOF entities (Lerman, Parliament, 1990). Furthermore, studies by C. Parliament, Z. Lerman and J. R. Fulton did not show a very high involvement of foreign capital among dairy cooperatives in the U.S. (Parliament, Lerman, Fulton, 1990). A. Gentzoglanis, on the basis of dairy industry players in Canada, also observed no statistically significant difference in profitability between cooperatives and IOFs (Gentzoglanis, 1997).

The positive impact of cash liquidity means that the sector under study had an appropriate cash management policy during the period under review. Enterprises may deliberately maintain a high cash balance in order to secure the continuity and profitability of production and supply. Moreover, the priority nature of obligations to suppliers of dairy raw material in cooperatives and the fairly stable cooperation of farmers with IOF forces processing enterprises to have high cash reserves. In addition, the low profitability of the sector's sales means that profit contributes little to the financing of day-to-day operations.

S. Dakić, K. Mijić and D. Jakšić studying dairy processing entities in Serbia using the OLS model of panel data with random effects found that as the size of the quick liquidity ratio increases, the ROA return on assets increases. In this case, the mean and median values of the tested regressor were at similar levels as in the analysed group of companies (Dakić, Mijić,

Jakšić, 2019). M. Zuba, analysing dairy cooperatives, also found that as liquidity increases, return on assets increases. In this study, the strength of the relationship was stronger for current liquidity (CR) and quick liquidity (QR) ratios, and positive and not statistically significant for immediate liquidity (Zuba, 2010). M. Ganc also found that liquidity is an important determinant of the profitability of cooperatives and observed that units with the highest current liquidity ratios (2.0-4.5) achieved the relatively best profitability of assets and capital (Ganc, 2018). M.H. Syahnur using Sobel test with indirect effect obtained a significant and positive effect of the current liquidity ratio on the ROE of food and beverage units. He concluded that relatively high liquidity is indicative of a company's financial strength and promotes the raising of necessary capital (Syahnur, 2023). The positive correlation between current, quick and cash liquidity ratios is also indicated by the research of O. Durrah et al. who determined that liquidity in the food sector is an important factor in ensuring continuity of production (Durrah et al., 2016). A positive relationship between liquidity and profitability is also shown by studies conducted in the agricultural business sector, thus highlighting the importance of opportunity costs (Liu, Xu, Shang, 2020; Mijić, Jakšić, 2017; Jelena et al., 2018). According to the authors of the study, an adequate amount of cash is the most important aspect of the liquidity policy of dairy processing enterprises. This is due to the fact that the management policy of inventories, receivables and short-term liabilities in the sector is essentially shaped by a relatively inflexible production cycle and relatively low bargaining power towards suppliers and customers.

Z. Gołaś, studying the Polish milk processing and cheese making sector in 2008-2017 using econometric modelling, found that as the ratio (CR) increased, the ROA of small and medium-sized enterprises decreased. In contrast, the relationship between current liquidity and ROA for large units was positive and not statistically significant (Gołaś, 2020). The inverse relationship in the present study may therefore have resulted from the fact that the OLS model built included medium and large enterprises. The non-significance of current liquidity could furthermore have been determined by the fact that the ability to convert inventories into cash in dairy processing units depends on many determinants (e.g. changes in demand, type of assortment). A negative relationship between the CR ratio and ROA is also indicated by studies by Z. Gołaś, A. Bieniasz and D. Czerwińska-Kayzer performed on a sample of EU food and beverage companies. However, the authors, building the ROE model, did not obtain a statistically significant relationship between the current liquidity ratio (Gołaś, Bieniasz, Czerwińska-Kayzer, 2011).

According to the authors of the study, the positive effect of the cash conversion cycle on ROE was mainly shaped by the cycle of receivables (positive relationship) and short-term liabilities (negative relationship). The positive relationship between CCC and ROE is also confirmed by analyses of Pearson's linear correlation coefficients performed by M. Zuba on a sample of Polish dairy cooperatives. In this study, the author found that profitable entities prefer to repay their liabilities faster (Zuba, 2010). K. Lyroudi and Y. Lazaridis using an identical method on a sample of Greek food companies identified a statistically significant relationship between the cash cycle and ROI (Return on Investment) and NPM (Net Profit

Margin) (Lyroudi, Lazaridis, 2000). E.C. Akdoğan, D.T. Dinç building a profitability model of Turkish food and beverage companies also found that as the cycle increases, profitability as measured by Tobin's q ratio increases. At the same time, they stressed that higher levels of inventory and receivables can translate into higher sales and do not expose the costs associated with production downtime. Moreover, they determined that in a turbulent environment the benefits of high NWC levels increase faster than the costs of maintaining them (Akdoğan, Dinç, 2019). P.D.P. Thapa believes that similar relationships exist, also in a group of food companies in the USA (Thapa, 2013).

The negative impact of the cash conversion cycle is confirmed by Z. Gołaś examining the milk processing and cheese making sector in Poland, although the impact of the accounts receivable cycle on ROA was found to vary depending on the size of the enterprise (Gołaś, 2020). A similar relationship between CCC and ROA in a group of Spanish cheese companies was obtained by S. Fernández-López, D. Rodeiro-Pazos and L. Rey-Ares. The negative relationship between the cash cycle and profitability is confirmed, also by A. Bieniasz, Z. Gołaś, D. Czerwińska-Kayzer and H. Özkaya, S. Yaşar and M. Ahmadi, I.S. Arasi, M. Garajafary studying food sector units. In addition, they found that shorter payment terms may increase profitability due to the fact that late-paying firms incur higher financing costs (Fernández-López, Rodeiro-Pazos, Rey-Ares, 2020; Gołaś, Bieniasz, Czerwińska-Kayzer, 2011; Özkaya, Yaşar, 2023; Ahmadi, Arasi, Garajafary, 2012). The use of cross-sectional data in this study may have significantly affected the estimation results. It should be noted that companies with longer inventory cycles producing, for example, dairy powders and ripened cheeses due to their high degree of processing generally generate higher margins, and the longer shelf life allows them to buy larger quantities of milk.

The positive effect of individual sources of financing on the level of return on equity suggests that dairy processing companies have kept their debt at relatively reasonable levels over the 2018-2021 period, allowing them to enjoy positive leverage. M.H. Syahnur emphasises that the use of debt in the food sector allows companies to benefit from various tax and other cost savings. Moreover, he adds that entities that finance themselves exclusively with equity sacrifice potential profits and limit their flexibility. A. Sajnóg argues that the effect of engaging in long-term financing is to increase the risk of equity, which mobilises companies to make the most efficient decisions (agency costs). K. Mijić and D. Jakšić and L. Liu, J. Xu and Y. Shang also highlight the tax benefits and believe that, according to signalling theory, higher debt can inform about the strength of the firm and greater opportunities for growth (Syahnur, 2023; Sajnóg, 2010; Mijić, Jakšić, 2017; Liu, Xu, Shang, 2020). This econometric model shows that a change in long-term debt, which is a more expensive source of financing, results in a relatively greater increase in return on equity than a change in short-term debt. Taking into account the capital structure of the sample group and their low margins, it can be concluded that only profitable entities were able to use bank loan financing, while less profitable ones had to save their situation by using cheaper sources of financing. Research by M. Chmielewska indicates

that the highest level of general indebtedness was found in cooperatives with the highest sales profitability ratio (Chmielewska, 2007). This situation may, also, be due to the fact that in the research sample the majority of units were dairy cooperatives, which offer better prices to their suppliers. Furthermore, trade payables do not generate a tax shield.

I. Milošev, examining medium and large enterprises in the dairy sector in Serbia, indicated an inverse relationship between the size of total debt and ROA. The discrepancy in this case may have been due to the fact that the average size of liabilities to total assets of Serbian companies was about 11 p.p. higher than the group of units studied, and the low margins of the sector mean that a small increase in debt can cause a significant decrease in profitability. Similar results were obtained by S. Dakić, K. Mijić and D. Jakšić when analysing the profitability of assets of units in the food sector of Serbia. The difference in the level of overall debt this time was about 19 percentage points (Milošev, 2023; Dakić, Mijić, Jakšić, 2019). In addition, the Serbian food sector, due to its different economic and environmental environment, is characterised by a different level of risk, which simultaneously affects the cost of raising foreign capital. I. Blažková and O. Dvouletý also note that Czech food sector entities are heavily indebted (average debt-to-capital ratio of 12.35), and this situation leads to a deterioration of their competitive position and contributes to a decrease in their credibility (Blažková, Dvouletý, 2018). Their study also included smaller entities, which are exposed to higher bankruptcy costs and may obtain financing on less favourable terms. It is worth mentioning that this study explained the change in ROE, and as confirmed by Z. Tousek et al., debt can lead to a deterioration in return on assets, but can also have a positive effect on return on equity at the same time (Tousek et al., 2021).

6. Conclusions

The studied group of dairy processing companies in 2018-2021 achieved increasingly better financial results in terms of return on equity and increased their ability to pay the most mature liabilities. On the other hand, the optimisation of the short-term debt structure and the increase in long-term debt in the industry contributed to a reduction in the cost of capital and the risk of insolvency. In addition, the cash conversion cycle and its components attest to the fact that dairy processing companies have not experienced major disruptions in the area of core operational processes and have skilfully exploited the market situation to increase sales revenue.

The research carried out established that cash liquidity, cash conversion cycle and capital structure are important determinants of the profitability of equity capital of dairy processing units. In addition, the econometric model built indicated that dairy cooperatives are generally less profitable than IOF enterprises.

In order to increase profitability, it is recommended that dairy cooperatives (1) pay special attention to the efficient use of fixed assets, (2) have a more liberal receivables policy, (3) maintain a relatively higher level of cash than IOFs, which will allow them to maintain their ability to pay their obligations to milk suppliers on time. The positive impact of cash liquidity indicates that the sector units were not overinvested during the period and that adequate cash is the most important element determining their security. Dairy processing companies should strive to lengthen their cash conversion cycle in order to increase sales revenue and reduce opportunity costs, which play an important role during a volatile environment. In addition, companies producing goods with a short shelf life should pay particular attention to their accounts receivable policy, as a cycle that is too short can expose them to high losses. Taking into account changes in foreign demand, rising energy prices, interest rate uncertainty, the possibility of rising inflation, US customs policy related to possible tariffs on agri-food products and EU retaliatory sanctions), the war in Ukraine and higher working capital requirements, the dairy industry should increase or maintain existing levels of cash liquidity. The positive impact of overall long- and short-term debt means that companies have deployed external capital in a way that does not expose them to excessive bankruptcy costs and allows them to benefit from leverage and the tax shield. Capital structure is an important issue in shaping the efficiency of dairy cooperatives, as the use of long-term debt can reduce the mismanagement of fixed assets. On the other hand, however, these units are prone to moral hazard, which may exacerbate their inefficiency (low impact of external capital on reducing agency costs). The average annual interest rate on long-term loans to non-financial corporations from 2018 to 2021 was 3.9%, 3.9%, 3.0% and 2.6% with the average WIBOR 1Y (3M) rate at 1.84% (1.71%), 1.86% (1.72%), 0.73% (0.67%) and 0.73% (0.54%), respectively. In 2024, the figures in question were 7.9% and 5.8% (5.86%), and NBP forecasts indicate that WIBOR 3M will fall to 5.37% in 2025-2027. Currently, the NBP reference rate is 5.00% with CPI (y/y) at 3.9%. In 2027, on the other hand, the rate is estimated to reach a value in line with the Central Bank's target of around 2.4% (y/y), which does not mean that the price level in the economy will not increase. Factors dampening future price growth include weakening wage growth, low demand pressures and limited import price growth. The driving determinants will mainly be regulatory action on energy carrier prices and high price dynamics of administered services (NBP, 2025; GPW Benchmark, 2025). Taking into account the aforementioned aspects and delays in the impact of the NBP's monetary policy, one should not expect a diametrical drop in interest rates. Units of the milk processing sector (due also to low margins) should maintain the current capital structure and aim to increase the share of long-term liabilities in a situation where the NBP's inflation target is fixed. Long-term debt is a more stable source of financing than short-term sources. Financing a higher working capital requirement solely with short-term capital in order to increase profitability and maintain the continuity of core operational processes in a turbulent environment can be counterproductive. Especially in the situation of dairy processing units, which are characterised by a high proportion of fixed assets and

a relatively rigid cash cycle. Unfortunately, it will not be possible to perform this task if the sector does not improve the operational profitability of sales in the future. Concentration of processing, in addition to achieving economies of scale, which studies indicate have a much better impact on dairy cooperatives, will additionally enable companies to obtain the necessary external capital at relatively more favourable conditions. The milk processing industry can also increase its profitability by, inter alia, reducing the range of products (higher specialisation and product quality), promoting dairy products more on non-European markets and developing dairy wholesalers and company shops.

The nature of the study and the research sample used were heavily dependent on the completeness and availability of data so the conclusions presented may not be appropriate for other dairy processing units and the use of cross-sectional data may have biased the estimation results particularly for the cash conversion cycle. The use of cross-sectional-temporal data would have significantly positively influenced the degree of explanation of the problem profitability due to the possibility of more explanatory variables including macroeconomic variables (e.g. GDP, inflation, rates interest). In addition, the use of panel regression with *fixed effects models* would enable the problem of to be solved company-specific effects, but would allow not for the introduction of artificial variables (e.g. legal form of business). *Random' effects models* were a better solution in this situation, but their applicability is justified mainly in the case of different types of businesses, where the estimation of specific group effects is less relevant. It should also be noted that profitability can drive many explanatory variables, which often include, for example, capital structure or company size. Therefore, in order to address the endogeneity of the independent variables, it would be appropriate to consider also using the GMM estimation (*Generalised Method of Moments*) method, which will be the subject of future studies. Furthermore, an important issue for further research is to consider a different functional form of the relationship, e.g., the square of the debt assessment. The present study, in the authors' opinion, despite its limitations, is nevertheless an important voice in the discussion, as it presents a relatively different approach as to the impact of the used independent variables on the profitability of equity capital of the Polish milk processing sector. Therefore, this area still remains an open topic and requires further research.

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