**ANNALS OF THE POLISH ASSOCIATION
OF AGRICULTURAL AND AGRIBUSINESS ECONOMISTS**

received: 16.06.2019
acceptance: 06.08.2019
published: 20.09.2019
JEL codes: G3, G31, G32

Annals PAAAE • 2019 • Vol. XXI • No. (3)

DOI: 10.5604/01.3001.0013.3314

ZBIGNIEW GOŁAŚ

Poznań University of Life Sciences, Poland

IMPACT OF STOCK MANAGEMENT ON THE PROFITABILITY OF MILK PROCESSING COMPANIES

Key words: stock management, return on assets, milk processing

ABSTRACT. This paper analyzes the relationships between the productivity of stocks and the return on assets of milk processing companies. Productivity of stocks was measured as the Days Sales of Inventory (DSI) for materials, intermediate products, work-in-progress, finished products and commodities, and as the DSI for total stocks. The study was based on corporate micro-data from 2007-2016 retrieved from the EMIS database. Based on panel regression models, it was concluded that an improvement in stock management efficiency, measured with the Days Sales of Inventory, is positively correlated to the return on assets of milk processing companies. Although it was considerably shorter in the milk sector than in the entire food industry throughout the study period, it grew longer each year. This evolution means a deterioration in the efficiency of stock management of finished products which, in the long run, may adversely affect the financial performance of milk producers. The parameters of the estimated regression models clearly confirm it is reasonable to reduce DSIs.

INTRODUCTION

Stock levels in companies are determined by numerous varied factors depending on the type of stock [Kempny 1995, Kisperska-Moroń 1995, Kolias et al. 2011]. Stocks of finished products ensure continuous sales, in the absence of which the company may experience such negative developments as: a reduction in sale profits, damage to the company's reputation and a weakening of competitive position. In turn, maintaining stable levels of stock of raw materials can be justified by the need to both ensure cyclical production, potential economies of scale in production and distribution and mitigate the impact of seasonality in supply and demand [Bieniasz, Gołaś 2012, Sierpińska, Wędzki 1997]. Furthermore, maintaining proper levels of stock entails different types of costs such as warehousing, handling and transport costs, insurance, loses of inventory or capital costs (lost profits) resulting from the tying-up of capital in stock. [Bieniasz, Gołaś 2012, Sierpińska, Wędzki 1997]. Thus, financial aspects have a significant impact on stock management.

The importance of effective stock management may also be linked with the stock's considerable share in asset structure. In the majority of companies, stock represents a significant part of both current and total assets. This regularity is a characteristic feature of retail trade companies, for which stock ratios are the highest [Gaur et al. 2005, Kolias et al. 2011]. Stock also accounts for a substantial share of assets in the case of industrial companies. For instance, according to the European Central Bank, in year 2016, in many European countries, the share of stock levels in total assets and current assets was 15% and 30%, respectively [BACH 2019].

The issue of the relationship between the productivity of stock and the financial performance of a company was analyzed in many publications. For example, the indicated issue was discussed in studies validating the impact of improvements in stock management on the financial performance of industrial companies measured with: return on sales [Capkun et al. 2009, Eroglu, Hofer 2011, Koumanakos 2008, Shah, Shin 2007], return on capital, return on assets [Cannon 2008], and the long-term rate of return on shares [Chan et al. 2005]. However, in the majority of listed studies, the relationship between the productivity of stock and the financial performance of a company was only analyzed from the perspective of total stock without taking the structure of analyzed stock levels into account. Noticing this gap, the main purpose of this paper is to examine the causative link between stock management and financial performance, using milk processing companies as an example. This goal was achieved by creating panel regression models. These models allowed the researcher to estimate the strength and direction of impact of the management of stock of materials, intermediate products, work-in-progress, finished products and commodities on the profitability of milk processing companies.

SOURCE MATERIALS AND METHODOLOGICAL ASPECTS

The literature review presented above suggests that a significant and generally positive relationship exists between stock management efficiency (measured with the Days Sales of Inventory) and financial performance at a company level. This paper verifies the above hypothesis based on 2007–2016 financial reports of 98 Polish milk processing companies, as published in the EMIS database [EMIS 2019]. EMIS includes financial reports of companies from ca. 60 Central and Eastern European, Asian, Latin American, African and Middle Eastern countries. Five ratios for the productivity of stock were used in analyzing the causative links between stock management efficiency and financial performance, namely: DSI for total stock and sub-indexes which take the structure of stock into account, i.e. DSI for materials ($CZM_{j,t}$), DSI for intermediate products and work-in-progress , DSI for finished products ($CZPG_{j,t}$) and DSI for commodities ($CZT_{j,t}$). The ratios were calculated in accordance with the following detailed formulas [Sierpińska, Wędzki 1997, Wędzki 2006]:

$$CZM_{j,t} = \frac{\text{average level } (M_{j,t_p}, M_{j,t_k}) \times 365}{\text{costs of energy and materials consumption}} \quad \text{(days)}$$

$$CZPP_{j,t} = \frac{\text{average level } (PP_{j,t_p}, PP_{j,t_k}) \times 365}{\text{operating costs}} \quad \text{(days)}$$

$$CZPG_{j,t} = \frac{\text{average level } (PG_{j,t_p}, PG_{j,t_k}) \times 365}{\text{operating costs}} \quad \text{(days)}$$

$$CZT_{j,t} = \frac{\text{average level } (T_{j,t_p}, T_{j,t_k}) \times 365}{\text{value of commodities and materials sold}} \quad \text{(days)}$$

$$CZOG_{j,t} = CZM_{j,t} + CZPP_{j,t} + CZPG_{j,t} + CZT_{j,t} \quad \text{(days)}$$

where:

M_{j,t_p}, M_{j,t_k} – value of stock of materials held by a company *j* at the beginning (t_p) and end (t_k) of year *t*,

PP_{j,t_p}, PP_{j,t_k} – value of stock of intermediate products and work–in–progress held by a company *j* at the beginning (t_p) and end (t_k) of year *t*,

PG_{j,t_p}, PG_{j,t_k} – value of stock of finished products held by a company *j* at the beginning (t_p) and end (t_k) of year *t*,

T_{j,t_p}, T_{j,t_k} – value of stock of commodities held by a company *j* at the beginning (t_p) and end (t_k) of year *t*.

In turn, the financial performance of milk companies was assessed with the return on operating assets , calculated as follows:

$$ROA_{j,t} = \frac{EBITDA_{j,t} \times 100}{average\ level\ \left(AOP_{j,t_p}, AOP_{j,t_k}\right)}$$

where:

$EBITDA_{j,t}$ – operating profit + depreciation in company *j* in year *t*,

AOP_{j,t_p}, AOP_{j,t_k} – operating assets (property, plant and equipment + intangible assets + long-term receivables + long-term deferred charges + short-term receivables + stock) in a company *j* at the beginning (t_p) and end (t_k) of year *t*.

Panel regression methods were used, and the parameters of regression equations which address both the DSI for total stock and the separate sub-indexes were estimated in order to determine the strength and direction of impact of stock management on profitability. This procedure allows for the analysis to be carried out at various levels of stock aggregation and thus provides a greater analytical potential. Also, a set of control variables which are generally regarded as important determinants of operational profitability of businesses were used in testing the relationships between financial performance and stock management performance [Cannon 2008, Capkun et al. 2009, Eroglu, Hofer 2011, Gaur et al. 2005, Koumanakos 2008, Shah, Shin 2007]. According to the relevant literature, these are usually variables referring to a return on sales, sales volume, asset value, leverage ratios, asset structure, liquidity, company age and size, and the variability of other various financial indexes.

The system method proposed by Manuel Arellano and Olimpia Bover [1995] and Richard Blundell and Stephen Bond [1998], based on the generalized method of moments, were used to estimate the parameters of dynamic models presented above. This method proves to be particularly useful and effective in the case of a weak correlation between instrumental variables with the explanatory variable, i.e. if the lagged variables are weak instruments for the variables after differencing and if the model is estimated based on a small number of observations over time [Dańska-Borsiak 2009, 2011]. The concept of the system estimator consists of estimating a system of equations, i.e. equations with variables both in level and difference. Structural parameters will be estimated using a dedicated observation matrix which replaces the independent variables correlated to the random effect with adequately defined instruments [Blundell, Bond 1998, Dańska-Borsiak 2009, 2011]. In the case of first-order difference equations and level equations, these are the lagged variables and lagged first differences, respectively [Bal-Domańska 2011]. Models estimated as shown above are assessed with the Sargan test and the Arellano-Bond test [Bal-Domańska 2011, Dańska-Borsiak 2009, 2011]. The Sargan test verifies the suitability of introducing additional instruments (referred to as over-identifying restrictions). The null hypothesis is the absence of correlation between instrumental variables and the random effect. If the correlation does not exist, the model can be found to be specified correctly. In turn, the Arellano-Bond test [Arellano, Bond 1991] is used to verify the hypothesis of autocorrelation of the random effect. In this test, the null hypothesis is the absence of autocorrelation of second-order random effect (AR-2) in first-order difference equations.

IMPORTANCE OF STOCKS. STOCK MANAGEMENT PERFORMANCE IN THE MILK PROCESSING INDUSTRY

Table 1 shows the average level of basic structural indexes of stocks held by milk processing companies and, as a comparison, in the whole food sector in 2005-2017. The analysis suggests that this period witnessed a quite clear favorable trend of reduction in the share of stock in total assets and current assets. Indeed, in the whole food sector, these ratios decreased from 18.09% to 14.13% and from 37.53% to 31.63%, respectively, i.e. at an average annual rate of 2.03% and 1.42%, respectively. Virtually the same (though relatively slower) trend could be observed in the milk processing industry where the share of stock in total assets and current assets went down over the study period from 12.73% to 10.53% and from 27.73% to 23.93%, respectively, i.e. at an average annual rate of 1.57% and 1.22%, respectively. However, note that in the milk processing industry, the importance of stocks (measured as their share in assets) is generally smaller than in the entire food industry. This also means that stock has a much greater impact on financial performance in other sectors of the food industry than in the milk processing sector. Despite these differences, both sectors experienced the emergence of a sustainable positive trend which, however, does not necessarily translate into measurable economic and financial benefits. Firstly, the reduction in stock may result in increasing company value due to a decline in stock costs. Secondly, it can also reduce company value as a consequence of expenditure on unforeseen events. Thirdly, it increases liquidity risk due to a reduction in working capital.

The data shown in Table 1 also suggests a slight but noticeable difference in the internal structure of stock. While materials and finished products are the dominant components of stock in both sectors, they had a greater share in stock in the food sector (38.5% and 39.45%) than in the milk processing sector (33.31% and 36.1%). Therefore, despite these differences, it can be concluded that generally, the efficient management of stock of materials and finished products is crucial for the financial situation of both the entire food sector and the milk processing sector. Note however that in the milk processing sector, the share of these categories of stock followed a different trend than in the entire food industry. Indeed, data in Table 1 suggests that in the milk processing sector, the share of stock of materials went down on an average annual basis (Δ = -2.34%) while the share of finished products followed an upward trend (Δ = 2.38%).

Table 1. Structural indexes of stock in the milk processing sector and the food industry in Poland in 2005-2017 [a]

Years	Production of food [%]					
	share of stock in total assets	share of stock in current assets	share of materials in stock	share of intermediate products and products	share of finished products in stock	share of commodities in stock
2005	18.09	37.53	36.69	10.75	44.73	6.85
2007	18.10	37.22	38.01	12.25	41.65	6.96
2009	15.32	33.96	39.33	13.64	38.66	7.43
2011	14.97	32.61	40.84	13.47	36.73	7.92
2013	15.34	33.36	37.52	13.35	39.56	8.37
2015	14.45	32.57	37.54	13.11	38.90	8.76
2017	14.13	31.63	38.77	13.24	37.96	8.53
$\bar{x}$	15.67	33.98	38.50	12.90	39.45	7.96
Δ [%]	-2.03	-1.42	0.46	1.75	-1.36	1.84
V [%]	9.58	6.00	3.38	7.49	5.81	9.56
Operation of dairies and cheese making [%]						
2005	12.73	27.73	38.94	22.27	30.28	7.79
2007	13.62	29.27	32.50	25.88	36.34	4.73
2009	11.02	26.43	35.85	21.57	35.44	6.16
2011	9.61	23.47	34.96	21.43	34.93	7.63
2013	10.50	24.06	31.45	23.10	36.30	8.35
2015	10.82	25.97	30.21	21.58	39.19	7.33
2017	10.53	23.93	29.32	23.52	40.15	5.49
$\bar{x}$	11.21	25.79	33.31	22.78	36.10	6.82
Δ [%]	-1.57	-1.22	-2.34	0.46	2.38	-2.87
V [%]	12.66	8.19	9.04	5.94	7.73	17.19

[a] $\bar{x}$ – average level for 2005-2017, Δ% – average annual growth rate in 2005-2017

V (%) – coefficient of variation

Source: own calculations based on unpublished Central Statistical Office data [GUS 2019]

In turn, in the entire food industry, the share of stock of materials changed slightly (Δ = 0.46%) and remained stable whereas the share of finished products followed a clear downward trend (Δ = -1.36%). These changes obviously had an impact on the assessment of stock management efficiency. More information can be found in Table 2 which shows the differences in and evolution of stock productivity measured with the Days Sales of Inventory (DSI). The first conclusion from this analysis concerns the DSI for total stocks. The replenishment of total stock (*CZOG*) is observed to take place faster in the milk processing sector than in the entire food industry. In the milk sector, it takes about one month (32 days) to replenish stock, compared to over 53 days on average in the food industry. The data below also shows that the management efficiency of total stock did not follow any clear trend. While the DSIs for total stock were progressively shorter, changes took place at a very slow average rate of -0.7% and -0.98% per year in the food industry and the milk processing sector, respectively.

Table 2. Day Sales of Inventory (DSI) in the milk processing sector and the food industry in Poland in 2005-2017 [a]

Years	*CZM*	*CZPP*	*CZPG*	*CZT*	*CZOG*
Production of food [days]					
2005	20.3	3.8	15.7	16.5	56.3
2007	21.1	4.3	14.7	16.7	56.8
2009	20.0	4.4	12.4	15.4	52.2
2011	19.1	4.1	11.3	16.0	50.5
2013	17.9	4.2	12.5	17.3	51.9
2015	18.9	4.2	12.6	18.5	54.3
2017	18.2	4.0	11.6	17.9	51.7
$\overline{x}$	19.5	4.2	12.8	17.0	53.5
Δ [%]	-0.9	0.6	-2.5	0.7	-0.7
V [%]	6.2	4.6	11.0	7.7	4.8
Operation of dairies and cheese making [days]					
2005	10.3	4.2	5.7	13.2	33.4
2007	9.2	5.2	7.3	9.8	31.5
2009	10.6	4.4	7.2	11.6	33.7
2011	8.7	3.8	6.1	10.7	29.3
2013	7.9	4.2	6.6	12.6	31.2
2015	9.1	4.6	8.4	14.5	36.6
2017	7.5	4.5	7.6	10.0	29.6
$\overline{x}$	9.1	4.4	7.0	11.9	32.5
Δ [%]	-2.61	0.60	2.52	-2.27	-0.98
V [%]	10.8	11.1	13.0	12.3	6.7

[a] $\overline{x}$ – average level for 2005–2017, Δ% – average annual growth rate in 2005–2017
V (%) – coefficient of variation

Source: own calculations based on unpublished Central Statistical Office data [GUS 2019]

Generally, similar conclusions can be drawn from the analysis of DSIs for particular types of stock. Compared to the food industry, it takes much less time in the milk processing sector to replenish the stock of materials, finished products and commodities. When it comes to intermediate products and work-in-progress, it takes a similar amount of time to replenish the stock in both sectors. However, data in Table 2 suggests that the milk processing sector witnessed a quite noticeable and unfavorable change in the DSI for finished products. Although it was considerably shorter in the milk sector (6-8 days) than in the entire food industry (11-16 days) throughout the study period, it grew longer at an average annual rate of 2.52% (as measured with the ratio used in this paper). This means a deterioration in the efficiency of stock management of finished products which, in the long run, may adversely affect the financial performance of milk producers.

IMPACT OF STOCK MANAGEMENT ON THE PROFITABILITY OF COMPANIES

Dynamic panel regression methods were used, and the parameters of five regression equations which address DSIs for different stock types were estimated in order to determine the strength and direction of the impact of stock management on profitability. Also, the following set of control variables $(x^T_{jt}\beta)$ were used in testing the relationship between financial performance and stock management performance:

$ROS_{j,t}$ – return on sales in company *j* in year *t*,
$WB_{j,t}$ – current ratio in company *j* in year *t*,
$AT_{j,t}$ – logarithmized value of assets in company *j* in year *t*,
$UARZ_{j,t}$ – share of property plant and equipment in assets of company *j* in year *t* (%),
$W_{j,t}$ – logarithmized age of company *j* in year *t*.

The inclusion of the above variables had an effect on the structure and estimation of the following dynamic regression models for the return on operating assets:

$$ROA_{j,t} = \alpha_0 + \gamma ROA_{j,t-1} + x^T_{jt}\beta + CZM_{j,t} + (\alpha_j + \varepsilon_{jt}), \quad j = 1, \dots \dots N, \ \ t = 1, \dots \dots T.$$

$$ROA_{j,t} = \alpha_0 + \gamma ROA_{j,t-1} + x^T_{jt}\beta + CZPP_{j,t} + (\alpha_j + \varepsilon_{jt}), \quad j = 1, \dots \dots N, \ \ t = 1, \dots \dots T.$$

$$ROA_{j,t} = \alpha_0 + \gamma ROA_{j,t-1} + x^T_{jt}\beta + CZPG_{j,t} + (\alpha_j + \varepsilon_{jt}), \quad j = 1, \dots \dots N, \ \ t = 1, \dots \dots T.$$

$$ROA_{j,t} = \alpha_0 + \gamma ROA_{j,t-1} + x^T_{jt}\beta + CZT_{j,t} + (\alpha_j + \varepsilon_{jt}), \quad j = 1, \dots \dots N, \ \ t = 1, \dots \dots T.$$

$$ROA_{j,t} = \alpha_0 + \gamma ROA_{j,t-1} + x^T_{jt}\beta + CZOG_{j,t} + (\alpha_j + \varepsilon_{jt}), \quad j = 1, \dots \dots N, \ \ t = 1, \dots \dots T.$$

where:

$ROA_{j,t}$, $ROA_{j,t-1}$ – return on operating assets in company *j* at time *t* and *t – 1*,
x^T_{jt} – vector of control variables for company *j* at time *t*,
$CZOG_{j,t}$, $CZM_{j,t}$, $CZPP_{j,t}$, $CZPG_{j,t}$, $CZT_{j,t}$ – DSIs for particular stock,
α_j – group effect (constant over time),
$\varepsilon_{j,t}$ – random effect.

Table 3 presents estimation results for the equations of return on operating assets at a country level. The two-step generalized method of moments was used for that purpose. The Arellano–Bond autocorrelation test clearly shows that moment conditions used in the estimation process are correct for all models. The empirical values of AR-2 indicate that second-degree autocorrelation is not present in the model. Therefore, the instruments used in GMM estimations are adequate. The Sargan test which verifies the suitability of additional instruments also indicates that the model was specified correctly. This is because as shown in Table 3, correlation between instrumental variables and the random effect does not exist in any of the models, which is consistent with the null hypothesis.

Table 3. Parameters of dynamic models of return on operating assets [a]

Variables and statistics	Model 1	Model 2	Model 3	Model 4	Model 5
ROA_{t-1}	-0.019 (0.000)	-0.018 (0.000)	-0.021 (0.000)	-0.019 (0.000)	-0.020 (0.000)
Constant	3.174 (0.003)	3.814 (0.000)	3.424 (0.000)	2.758 (0.003)	4.181 (0.000)
ROS	2.951 (0.000)	2.914 (0.000)	2.927 (0.000)	2.953 (0.000)	2.952 (0.000)
WB	-0.324 (0.015)	-0.302 (0.014)	-0.331 (0.006)	-0.176 (0.034)	-0.227 (0.047)
AT	-0.167 (0.033)	-0.221 (0.002)	-0.158 (0.025)	-0.143 (0.048)	-0.113 (0.043)
UARZ	-8.434 (0.000)	-7.675 (0.000)	-8.725 (0.000)	-7.917 (0.000)	-8.002 (0.000)
W	0.798 (0.000)	0.702 (0.000)	0.756 (0.000)	0.743 (0.000)	0.555 (0.000)
CZM	**-0.021 (0.009)**				
CZPP		**-0.069 (0.000)**			
CZPG			**-0.026 (0.024)**		
CZT				**-0.019 (0.000)**	
CZOG					**-0.031 (0.000)**
AR-2 test	-0.422 (0.672)	-0.429 (0.668)	-0.417 (0.676)	-0.397 (0.691)	-0.423 (0.672)
Sargan test	37.22 (0.323)	36.52 (0.352)	36.59 0.349)	38.28 (0.281)	35.83 (0.382)

[a] values in parenthesis represent the significance level of variables or tests
Source: own calculations

The analysis of structural parameters of the above regression models allows the following conclusions to be drawn:

1. Negative regression coefficients of DSI for materials (*CZM*), DSI for intermediate products and work-in-progress (*CZPP*), DSI for finished products (*CZPG*), DSI for commodities (*CZT*) and DSI for total stocks (*CZOG*) clearly suggest a negative impact of the extension of these periods on the return on operating assets in milk processing companies.

2. Regression parameters for variables corresponding to particular DSIs suggest a similar and quite moderate negative impact of the extension of these periods on the return on assets. A 10-day extension of DSI for materials, finished products and commodities reduced the return on assets by 0.19 to 0.26 percentage points, on average. The extension of DSI for total stock had a comparably strong impact on the return on assets. In this case, the increase in the DSI translated into a decline in the return on assets by ca. 0.31 percentage points.
3. The increase in the DSI for intermediate products and work-in-progress (*CZPP*) had the relatively strongest and negative impact on profitability of milk processing companies. The corresponding regression parameter indicates that the impact of a 10-day increase in the DSI was approximately twice as strong, resulting in a decline of a return on assets by 0.69 percentage points, on average.
4. Changes in other factors, i.e. control variables, had the strongest and most diversified impact on a return on operating assets in the milk processing sector. Also, it is fairly clear that these variables had a much stronger impact on a return on assets than DSIs.
5. The direction of the impact of control variables on a return on assets is logical and largely consistent with other empirical studies which clearly suggest that this category of financial performance is strictly and positively correlated with a return on sales (*ROS*) and business maturity measured as company age (*W*). On the other hand, as also confirmed by the parameters of models developed above, an excessive company size (measured as the value of assets, *AT*); poorly flexible assets characterized by a large share of property, plant and equipment (*UARZ*); and a conservative policy for working capital management (whose characteristics include high liquidity levels, *WB*) are also a barrier to improvement in a return on assets.

SUMMARY

Compared to the food industry, it takes much less time for milk processing companies to replenish the stock of materials, finished products and commodities. When it comes to intermediate products and work-in-progress, it takes a similar amount of time to replenish stock in both sectors. However, findings from this study suggest that the milk processing sector witnessed a quite noticeable and unfavorable change in the DSI for finished products. Although it was considerably shorter in the milk sector than in the entire food industry throughout the study period, it grew longer each year. This evolution signifies a deterioration in the efficiency of stock management of finished products which, in the long run, may adversely affect the financial performance of milk producers. The parameters of estimated regression models clearly confirm it is reasonable to reduce DSIs. In light of the above findings, accelerating the turnover of each category of stock (and of total stock) has a positive impact on financial performance measured as a return on operating assets.

BIBLIOGRAPHY

Arellano Manuel, Olympia Bover. 1995. Another look at the instrumental variables estimation of error-components models. *Journal of Econometrics* 68: 29-51.

Bal-Domańska Beata. 2011. Ekonometryczna identyfikacja konwergencji regionów szczebla Nuts-2 państw Unii Europejskiej (Econometric identification of convergence in Nuts-2 level regions of European Union member countries). *Acta Universitatis Lodziensis. Folia Oeconomica* 253: 9-23.

BACH (Bank for Accounts of Companies Harmonised). 2019. *The European database of aggregate information on non-financial corporations*. European Central Bank, http://www.bachesd.banque-france.fr.

Bieniasz Anna, Gołaś Zbigniew. 2012. Efektywność gospodarowania zapasami w przemyśle spożywczym (Efficiency of stock management in food industry), *Zagadnienia Ekonomiki Rolnej* 332 (3): 68-88.

Blundell Richard, Stephen Bond. 1998. Initial Conditions and Moment Restriction in Dynamic Panel Data Models. *Journal of Econometrics* 87: 115-143.

Cannon Alan R. 2008. Inventory improvement and financial performance. *International Journal of Production Economics* 115 (2): 581-593.

Capkun Vedran, Arri-Pekka Hameri, Lavrence A.Weiss. 2009. On the relationship between inventory and financial performance in manufacturing companies. *International Journal of Operations & Production Management* 29 (8): 789-806.

Chan Hong, Murray Frank, Owen Wu. 2005. What actually happened to the inventories of American companies between 1981 and 2000? *Management Science* 51 (7): 1015-1031.

Dańska-Borsiak Barbara. 2009. Determinanty TFP według działów przemysłu w Polsce. Dynamiczna analiza panelowa (TFP determinants in Polish manufacturing. Dynamic panel analysis). *Acta Universitatis Nicolai Copernici* 389: 115-124.

Dańska-Borsiak Barbara. 2011. Konwergencja czy dywergencja polskich województw? Zastosowanie dynamicznych modeli panelowych (Convergence or divergence of Polish voivodeships? Analysis based on dynamic panel data model).*Acta Universitatis Lodziensis. Folia Oeconomica* 253: 41-54.

EMIS. 2019. Emerging Markets Information Service. EMIS Professional, https://www-1emis-1com--10000f3m910d4.han3.ue.poznan.pl/php/industries/overview, access: 19.12.2018.

Eroglu Cuneyt, Christian Hofer. 2011. Inventory types and firm performance: vector autoregressive and vector error correction models. *Journal of Business Logistics* 32 (3): 227-239.

Gaur Vishal, Marshall Fisher, Ananth Raman. 2005. An econometric analysis of inventory turnover performance in retail services. *Management Science* 51 (2): 181-194.

GUS (Central Statistical Office – CSO). 2019. *Niepublikowane dane finansowe – rachunek zysków i strat oraz bilans przedsiębiorstw w układzie sekcji, działów i klas* (Unpublished financial data: P&L accounts and balance sheets for enterprises grouped by sections, divisions and classes). Warszawa: GUS.

Kempny Danuta. 1995. Koszty zapasów (Inventory costs). *Gospodarka Materiałowa i Logistyka* 7-8: 9-17.

Kisperska-Moroń Danuta. 1995. Czynniki kształtujące poziom i strukturę zapasów w przedsiębiorstwach (Factors determining the structure of inventory in companies). *Gospodarka Materiałowa i Logistyka* 11: 11-20.

Kolias Georgios, Sophia Dimelis, Vasilios Filios. 2011. An empirical analysis of inventory turnover behaviour in Greek retail sector: 2000–2005. *International Journal of Production Economics* 133 (1): 143-153.

Koumanakos Dimitrios. 2008. The effect on inventory management on firm performance. *International Journal of productivity and Performance Management* 57 (5): 355-369.

Shah Rachna, Shin Hojung. 2007. Relationships among information technology, inventory and profitability: an investigation of level invariance using sector level data. *Journal of Operations Management* 25 (4): 768-84.

Sierpińska Maria, Dariusz Wędzki. 1997. *Zarządzanie płynnością finansową w przedsiębio*rstwie (Liquidity management in the enterprise). Warszawa: PWN.
Wędzki Dariusz. 2006. *Analiza wskaźnikowa sprawozdania finansowego* (Ratio analysis of financial statements). Kraków: Oficyna Ekonomiczna.

***

WPŁYW ZARZĄDZANIA ZAPASAMI NA RENTOWNOŚĆ PRZEDSIĘBIORSTW PRZETWÓRSTWA MLEKA

Słowa kluczowe: zarządzanie zapasami, rentowność aktywów, przetwórstwo mleka

ABSTRAKT

Celem artykułu jest przedstawienie związków między produktywnością zapasów a rentownością aktywów przedsiębiorstw z branży przetwórstwa mleka. Produktywność zapasów mierzono długością cyklu zapasów materiałów, półproduktów i produktów w toku, produktów gotowych, towarów oraz zapasów ogółem. Badania przeprowadzono na podstawie jednostkowych danych przedsiębiorstw za lata 2007-2016, pochodzących z bazy danych EMIS. Na podstawie panelowych modeli regresji stwierdzono, że poprawa efektywności gospodarowania zapasami, mierzona długością cykli zapasów, jest pozytywnie skorelowana z rentownością aktywów przedsiębiorstw z branży przetwórstwa mleka. Jednak jak wskazują przeprowadzone badania w przetwórstwie mleka odnotowano wyraźny i negatywny kierunek zmian długości cyklu zapasów produktów gotowych. W branży mleczarskiej cykl ten był wprawdzie w całym analizowanym okresie znacząco krótszy niż ogółem w produkcji artykułów spożywczych, jednak w badanych latach wydłużał się. Ten kierunek zmian wskazuje na pogarszanie się efektywności zarządzania zapasami produktów gotowych, co w dłuższej perspektywie może skutkować negatywnymi zmianami w efektywności finansowej przedsiębiorstw przetwarzających mleko. Celowość skracania cykli zapasów w branży mleczarskiej jednoznacznie potwierdzają parametry oszacowanych modeli regresji.

AUTHOR

ZBIGNIEW GOŁAŚ, PROF. DR HAB.
ORCID: 0000-0002-6921-6008
Poznań University of Life Sciences
Department of Finance and Accounting
28 Wojska Polskiego St., 60-637 Poznań, Poland