Effect of inventory management on profitability: evidence from the Polish food industry: Case study

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The effect of inventory management on profitability: evidence from the Polish food industry: Case study

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Abstract: The main purpose of this study is to verify the causative link between inventory performance and profitability of food companies. This was done using the panel data methodology at the level of Polish food industry sub-sectors. The study takes account of the inventory mix, which includes the stocks of raw and other materials, work-in-progress, finished products and commodities. As shown by the analysis, the 2005–2017 period witnessed a decline in the share of inventories in total assets and in current assets. That trend was accompanied by an improvement in inventory management efficiency. The study also found that the days sales of inventory for total stocks clearly tends to become shorter due to a reduction in the days in inventory ratio for materials and finished products. Based on panel regression models, this study demonstrated that an improvement in inventory management efficiency is positively correlated with financial performance, measured as the return on operating assets.

Keywords: food industry; inventory turnover; panel analysis; Poland; return on assets

One of the basis logistic functions of a production company is to manage the inventories which need to be kept due to various reasons strongly correlated with their types. The purpose of keeping stocks of raw materials and work-in-progress is to ensure cyclical production processes, economies of scale and reduction of risks involved in the uncertainty of delivery quantities and times; and to reduce the impact of seasonality in supply and demand. In turn, finished products are kept in stock to ensure continuity of sales; failure to do so results in reduced profits and harms the reputation and competitive position of a company (Kisperska-Moroń 1995; Michalski 2008). However, keeping stocks also involves the need to incur various costs, e.g. warehousing, handling and transport costs, insurance, losses of goods held in stocks, and costs of lost profits resulting from the tying-up of capital in stocks (Kempny 1995; Lozano et al. 2017). This means that in addition to the logistics and demand factors, the financial aspect is of crucial importance to inventory management.

The relevant literature includes a series of papers documenting the considerable impact of inventory performance on corporate financial performance. Most of these studies focus on the efficiency of working capital management and, in addition to examining the profitability impacts of inventory performance, also analyze the impacts of managing other components of working capital, i.e. receivables and payables (Deloof 2003; García-Teruel and Martínez-Solano 2007). In turn, much less studies focus primarily on analyzing the causative link between inventories and financial performance of businesses. While most of them find that extending the days in inventory ratios has a negative impact on financial performance (Cannon 2008; Koumanakos 2008; Capkun et al. 2009; Obermaier and Donhauser 2009; Eroglu and Hofer 2011), some of them do not confirm that relationship or find it to be ambiguous (Vastag and Whybark 2005; Moser et al. 2017; Karim and Nawawi 2018). Furthermore, the analyses of the inventory-performance relationship usually

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took total stocks into account while failing to address their structure. As Eroglu and Hofer (2011) emphasize, the financial performance impacts of aggregated inventories is the combination of impacts of discrete inventory types. Hence, the relative contribution of each of type of stocks also needs to be examined. However, there is dearth of studies that take discrete inventory types into account in the literature (Blinder and Maccini 1991; Balakrishnan et al. 1996; Lieberman et al. 1999; Boute et al. 2008; Capkun et al. 2009; Eroglu and Hofer 2011; Gaur and Bhattacharya 2011; Isaksson and Seifert 2014; Ganas and Hyz 2015; Manikas 2017; Bendig et al. 2018). As a consequence, there is only little knowledge of the impacts of discrete inventory types on corporate financial performance. Therefore, the main purpose of this paper is to verify the causative link between inventory performance and profitability, taking the structure of inventories into account. This was done using the panel data methodology. The study was carried out at sub-sector level in the Polish food industry in 2005–2017.

MATERIAL AND METHODS

The analysis of the inventory-performance relationship relied on unpublished data of the Polish Central Statistical Office (CSO 2019) on the financial condition of the food industry and its sub-sectors (4-digit numerical code) identified as per the Statistical Classification of Economic Activities in the European Community (NACE 2008). The study was based on a panel of 27 food sub-sectors analyzed from 2005 to 2017 (22 sub-sectors active in the production of food, 5 sub-sectors active in the production of beverages). This data formed the basis for the regression models which included the days sales of inventory for total stocks ($INVTC_{j,t}$) and the corresponding sub-indexes for stocks of raw and other materials ($RMIC_{j,t}$), stocks of intermediate products and work-in-progress ($WIPC_{j,t}$), stocks of finished products ($FGIC_{j,t}$), and stocks of commodities ($GIC_{j,t}$). The indexes were calculated as follows:

$$RMIC_{j,t} = \frac{average\ level\left(RMI_{j,t_b}, RMI_{j,t_e}\right) \times 365}{costs\ of\ energy\ and\ material\ consumption} \quad (1)$$

$$WIPC_{j,t} = \frac{average\ level\left(WIP_{j,t_b}, WIP_{j,t_e}\right) \times 365}{cost\ of\ goods\ sold} \quad (2)$$

$$FGIC_{j,t} = \frac{average\ level\left(FGI_{j,t_b}, FGI_{j,t_e}\right) \times 365}{cost\ of\ goods\ sold} \quad (3)$$

$$GIC_{j,t} = \frac{average\ level\left(GI_{j,t_b}, GI_{j,t_e}\right) \times 365}{value\ of\ commodities\ and\ materials\ sold} \quad (4)$$

$$INVTC_{j,t} = RMIC_{j,t} + WIPC_{j,t} + FGIC_{j,t} + GIC_{j,t} \quad (5)$$

where: $RMI_{j,t_{b,e}}, WPI_{j,t_{b,e}}, FGI_{j,t_{b,e}}, GI_{j,t_{b,e}}$ – the values of discrete inventory components in sub-sector j at the beginning (t_b) and end (t_e) of year t.

In turn, the return on assets ($ROA_{j,t}$) is the metric used in assessing the financial efficiency of food sub-sectors, and is calculated as follows:

$$ROA_{j,t} = \frac{EBITDA_{j,t} \times 100}{average\ level\left(OA_{j,t_b}, OA_{j,t_e}\right)} \quad (6)$$

where: $EBITDA_{j,t}$ – operating profit + depreciation, $OA_{j,t_{b,e}}$ – operating assets (tangible fixed assets + intangible assets + long term receivables + long-term deferred charges and accruals or long-term prepayments + short-term receivables + inventory).

The hypothesized impact of inventory management on financial performance was verified using the panel data methodology which allows to control and eliminate heterogeneity, avoid the endogeneity problem and the issues related to measurement errors and to time series being not long enough (Hsiao 1985). Model parameters were estimated using the two-step system GMM (Generalized Method of Moments) estimator (Blundell and Bond 1998) with a robust variance estimator (Windmeijer 2005). The models developed were assessed with the Arellano-Bond test (AR-2) and the Hansen test. This was the basis for verifying the hypothesis of autocorrelation in the random effect (which assumes the absence of autocorrelation in second-order random effect), and for checking whether it is justified to introduce additional elements. The null hypothesis is the absence of correlation between instrumental variables and the random effect (Arellano and Bond 1991; Blundell and Bond 1998). The calculations were based on the *xtabond*2 estimator available in the STATA 15 statistical suite.

The parameters of five regression models were estimated in order to test the hypothesized impact of inventory management on financial performance of food sub-sectors:

$$ROA_{j,t} = a_0 + b_1 ROA_{j,t-1} + b_2 RMIC_{j,t} + \\ + \sum_{k=1}^{K} b_k X_{k,j,t} + \left(\alpha_j + \varepsilon_{jt}\right) \quad (7)$$

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$$ROA_{j,t} = a_0 + b_1 ROA_{j,t-1} + b_2 WIPC_{j,t} + + \sum_{k=1}^{K} b_k X_{k,j,t} + \left(\alpha_j + \varepsilon_{jt}\right) \tag{8}$$

$$ROA_{j,t} = a_0 + b_1 ROA_{j,t-1} + b_2 FGIC_{j,t} + + \sum_{k=1}^{K} b_k X_{k,j,t} + \left(\alpha_j + \varepsilon_{jt}\right) \tag{9}$$

$$ROA_{j,t} = a_0 + b_1 ROA_{j,t-1} + b_2 GIC_{j,t} + + \sum_{k=1}^{K} b_k X_{k,j,t} + \left(\alpha_j + \varepsilon_{jt}\right) \tag{10}$$

$$ROA_{j,t} = a_0 + b_1 ROA_{j,t-1} + b_2 INVCT_{j,t} + + \sum_{k=1}^{K} b_k X_{k,j,t} + \left(\alpha_j + \varepsilon_{jt}\right) \tag{11}$$

where: a_0 – constant term; b_{1-k} – regression coefficients; $ROA_{j,t-1}$ – return on operating assets in year t – 1; $RMIC_{j,t}$, $WIPC_{j,t}$, $FGIC_{j,t}$, $GIC_{j,t}$, $INVTC_{j,t}$ – inventory cycles; $X_{k,j,t}$ – set of control variables; ε – random effect; α – group effect (constant over time).

The control variables were selected based on other econometric analyses of the inventory-performance relationship. These studies used different metrics of company size, assets structure, capital intensity, leverage and revenues growth ratios as control variables (Capkun et al. 2009; Eroglu and Hofer 2011; Ganas and Hyz 2015; Alrjoub and Ahmad 2017). Four control variables (in addition to inventory cycles) were used to build the models: $\ln TA_{j,t}$ – logarithmized value of total assets (per company); $SFA_{j,t}$ – share of property, plant and equipment (tangible fixed assets) in total assets:

$$\left(\frac{tangible\ fixed\ assets \times 100}{total\ assets}\right);$$

$$\Delta S_{j,t} \text{ – growth rate of sales proceeds } \left(\frac{(S_t - S_{t-1})}{S_{t-1}}\right);$$

$$ICE_q \text{ – capital leverage ratio } \left(\frac{invested\ capital}{equity}\right).$$

RESULTS AND DISCUSSION

Basic characteristics of inventories in the food industry of selected EU countries. Table 1 presents the basic characteristics of inventories in the food industry of 11 EU countries as at 2017, based on the BACH database (BACH 2019)[1]. According to BACH statistics, the importance of inventories in the food industry varies between the countries. The coefficient of variation (V) suggests that the differences are mainly in the share of inventories in total assets (V = 29.2%) and the days sales of inventory ratio for total stocks (V = 32.7%). Conversely, the differences in the share of inventories in current assets were smaller (V = 17.5%). The variation is mainly due to the levels of the statistics considered in two groups of countries. The first one is composed of France, Portugal and Spain, which reported relatively higher importance and lower productivity of inventories. In the food industry of these countries, the share of inventories in total assets (17.9–24.5%) and in current assets (33.0–41.9%) was above the average level, and the inventory turnover time was ca. two months (54.3–69.6 days), which is relatively long. In turn, the second group was formed by Belgium, Germany and Poland. In the food industry of these countries, the days in inventory ratios for total stocks were con-

Table 1. Basic inventory characteristics in the food industry (NACE C10 + 11) of selected EU countries in 2017

Countries	Share of total inventory (%)		Total days in inventory*
	total assets	current assets	
Austria	15.0	30.9	36.9
Belgium	6.8	19.1	26.3
Czech Republic	11.2	31.6	43.0
Germany	13.1	27.1	28.1
Spain	17.9	33.0	54.3
France	24.5	41.9	68.0
Croatia	15.0	31.0	52.5
Italy	16.4	29.4	57.9
Poland	13.5	29.0	33.0
Portugal	18.3	34.3	69.6
Slovakia	15.7	31.7	39.6
$\bar{x}$	15.1	31.3	46.3
V	29.2	17.5	32.7

*Due to the lack of detailed information on inventory structure, the total days in inventory ratio was calculated in a simplified manner; $\bar{x}$ – average value; V – coefficient of variation (%)

Source: Own calculation based on BACH (2019)

[1]BACH (Bank for the Accounts of Companies Harmonized) is a database published by the European Central Bank. It includes statistics for non-financial enterprises based in 13 European countries, aggregated at sector (NACE, 2-digit numerical code) level. In an effort to achieve the greatest possible comparability, BACH accounting data is harmonized as per the European accounting directives (ECB 2015). Luxembourg and Denmark were excluded from Table 1 because their 2017 statistics are not published yet.

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Table 2. Basic inventory characteristics in the Polish food industry in 2005–2017 (NACE C10 + C11)

Specification	2005	2007	2009	2011	2013	2015	2017	V	Δ_{RC}
Share in total inventory (%)									
Total assets	16.2	15.9	13.7	13.3	13.9	13.3	13.1	7.92	–1.75
Current assets	34.5	34.5	31.0	30.9	31.8	30.9	29.8	4.92	–1.20
Inventory mix (%)									
Raw materials	38.1	39.1	40.0	41.0	37.4	38.5	39.5	3.10	0.30
Semi-finished and work-in-progress products	11.1	12.2	13.3	13.0	12.8	12.6	12.9	5.79	1.30
Finished products	42.9	40.4	37.8	36.0	38.9	37.7	37.2	5.23	–1.18
Commodities	7.0	7.0	8.1	9.0	9.7	9.5	8.8	12.5	2.01
Inventory cycles in days									
RMIC	21.4	21.9	20.7	19.6	18.5	19.9	18.9	6.33	–0.99
WIPC	3.6	4.0	3.9	3.7	3.8	3.9	3.8	3.75	0.42
FGIC	13.9	13.2	11.1	10.4	11.7	11.5	10.9	9.42	–2.04
GIC	21.8	22.4	20.4	23.2	24.3	24.3	22.6	6.14	0.32
INVTC	60.7	61.5	56.1	56.9	58.2	59.6	56.2	3.87	–0.63

V – coefficient of variation (%); Δ_{RC} – average annual growth rate (%; geometric mean); *RMIC* – raw materials cycle; *WIPC* – semi-finished and work-in-progress products cycle; *FGIC* – finished products cycle; *GIC* – commodities cycle; *INVTC* – total inventory cycle

Source: Own calculation based on CSO (2019)

siderably lower (26.3–33.0 days). At the same time, the share of inventories in total assets (6.8–13.1%) and in current assets (19.1–29.0%) was relatively smaller.

In summary, the basic inventory characteristics illustrated by the example of selected EU countries suggest that inventories differ in importance and productivity. However, the high aggregation level of data included in source materials used (BACH 2019) makes it impossible for the analysis to take the structure of inventories into account. Therefore, this data cannot be used as a basis for determining the different types of inventories, their productivity and, as a consequence, their relationships with economic and financial performance. In view of the above, the next part of this paper presents the findings from a study carried out in the Polish food industry which took the structure of inventories into account and relied on detailed[2] metrics of the duration of inventory cycles for each component of inventories.

Importance of inventories and inventory performance in the Polish food industry. Table 2 presents the basic characteristics of inventories prevailing in the Polish food industry in 2005–2017. The analysis suggests that this period witnessed a quite clear favourable trend of reduction in the share of stocks in total assets and in current assets. Indeed, the respective ratios declined at an average annual rate of 1.75% and 1.20%; as a consequence, the share of inventories in total assets and in current assets went down from 16.2% to 13.1% and from 34.5% to 29.8%, respectively. The data also implies that the study period witnessed moderate though noticeable changes in the inventory mix. The Δ_{RC} ratio suggests that the share of work-in-progress (*WIP*) and commodities (*GI*) followed a weak growth trend, the share of raw and other materials (*RMI*) remained relatively stable while the share of finished products (*FGI*) declined. However, these changes did not essentially affect the inventory mix. Both at the beginning and at the end of the study period, raw and other materials (*RMI*) and finished products (*FGI*) remained the key components of the inventory mix in the Polish food industry, making up 79.5–81.0% (in 2005–2007) and 76.2–76.7% (in 2015–2017), respectively, of the total inventory value. This means these categories consistently play a major role in inventory management. The great importance of managing these very catego-

[2]In the BACH (2019) methodology, the overall inventory turnover ratio is calculated in a simplified way, based on the revenue/inventories relationship. The metrics of inventory management performance, as presented in the methodological section of this paper, are much more precise. As a consequence, the total days in inventory ratio calculated based on these metrics is much longer than when calculated in line with the BACH (2019) methodology.

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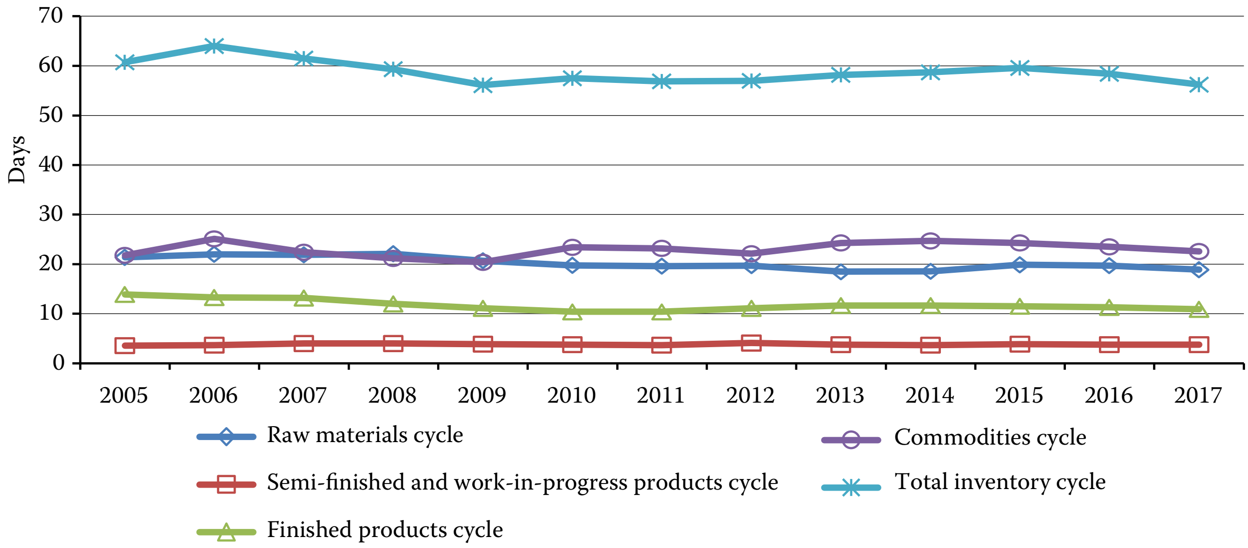

Figure 1. Changes in days in inventory ratios in the Polish food industry over time

Source: Own compilation based on CSO (2019)

ries of inventories is also corroborated by the analysis of inventory cycles which suggests that the days in inventory ratio for raw and other materials (*RMIC*) and for finished products (*FGIC*) was largely determined (up to 52–58%) by the days sales of inventory for total stocks (*INVTC*). What can also be noticed is that the days sales of inventory for total stocks was largely determined by the days in inventory ratio for commodities (*GIC*) throughout the study period. Although commodities had a relatively small share (7–10%) in total inventory value, their replacement cycle was relatively long (20–24 days) and was the strongest determinant (36–41%) of days sales of inventory for total stocks nearly throughout the 2005–2017 period.

In turn, considering the target and pace of changes in the duration of inventory sub-cycles (Table 2, Figure 1), it needs to be emphasized that the favourable trend followed in 2005–2017 by the days sales of inventory ratio for total stocks (*INVTC*, Δ_{RC} = –0.63%) was mostly driven by the reduction of days in inventory ratios for raw materials (*RMIC*, Δ_{RC} = –0.99%) and finished products (*GICFGIC*, Δ_{RC} = –2.04%). Indeed, the inventory cycles for work-in-progress (WIPC) and commodities (*GIC*) did not undergo any major changes in 2005–2017 (Δ_{RC} = 0.42%, 0.32%) and therefore had a marginal impact on the changes in days sales of inventory for total stocks (*INVTC*).

Estimation results for the days-in-inventory/profitability relationship. Because of the generally favourable trends followed by inventory performance figures, as shown in the previous part of this paper, it is somehow natural to ask the question about the nature and strength of relationships between these ratios and financial performance. These relationships were examined using the panel survey methodology and the parameters of 27 sub-sectors of the Polish food industry at class level (4-digit code level) (NACE 2008). The results of the estimation of parameters for panel regression models were preceded by a presentation of descriptive statistics and a correlation analysis.

Considering the descriptive statistics of variables covered by the analysis (Table 3), it can be noted that the greatest variation (*V*) exists in inventory management figures. Indeed, variation is quite pronounced, especially when it comes to days in inventory for intermediate products and work-in-progress (*WIPC*, *V* = 131%) and finished products (*GICFGIC*, *V* = 141%). Moreover, the average value $(\bar{x})$ is greater than the median (Med) for each type of inventory cycle; this reflects a minor left-side asymmetry in the distribution of observations which means that cases with an above-average days in inventory ratio predominate. In turn, there is less variation in other variables, except for the growth rate of sales proceeds (ΔS), which exhibited extreme dispersion (*V* = 749%).

Table 4 presents the Pearson's linear correlation coefficients for all the variables under consideration. The analysis suggests that a negative relationship exists between the return on assets (*ROA*) and days in inventory for all inventory types. However, the relationship is not statistically significant in the case of days in inventory for raw and other materials (*RMIC*).

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Table 3. Descriptive statistics

Statistics	*ROA*	ln*TA*	*SFA*	*ICEq*	ΔS	*RMIC*	*WIPC*	*FGIC*	*GIC*	*INVTC*
$\bar{x}$	15.3	14.8	41.0	2.2	0.1	30.5	4.1	15.7	32.5	82.9
Min	3.2	11.6	8.3	1.3	–1.0	3.6	0.0	1.0	0.1	17.7
Max	35.9	16.6	69.5	7.6	9.6	129.5	35.2	136.1	229.3	302.0
Med	13.9	15.1	39.8	2.0	0.1	27.9	2.4	8.5	27.8	80.4
V (%)	37.8	7.4	25.9	34.9	749.4	61.2	131.3	140.7	77.0	51.5

$\bar{x}$ – mean; Min – minimum; Max – maximum; *V* – coefficient of variation (%); Med – median; *ROA* – return on assets; ln*TA* – logarithmized value of total assets (per company); *SFA* – share of property, plant and equipment (tangible fixed assets) in total assets; *ICEq* – capital leverage ratio; ΔS – growth rate of sales proceeds; *RMIC* – raw materials cycle; *WIPC* – semi-finished and work-in-progress products cycle; *FGIC* – finished products cycle; *GIC* – commodities cycle; *INVTC* – total inventory cycle

Source: Own calculations based on CSO (2019)

Also, data in Table 4 suggests that the return on assets is relatively strongly and positively related to growth in sales proceeds (ΔS) and to assets structure (*SFA*), and is negatively related to company size (ln*TA*) and the leverage ratio (*ICEq*).

Table 5 presents the parameters of five *ROA* models. The second-order autocorrelation (AR-2) test results presented in the Table 5 show that moment conditions used in the estimation process are correct ($P = 0.246–328$). The models' specification was also validated using Hansen's *J*-test, which found that no correlation exists between instrumental variables and the random effect ($P = 0.623–0.693$). The analysis of parameters of regression models suggests that inventory cycles (*WIPC*, *FIGC*, *GIC*, *INVTC*) other than the days in inventory ratio for raw and other materials (*RMIC*) prove to be statistically significantly and negatively related to the return on assets. Also, considering the values of regression parameters of these cycles, it can be noticed that they clearly differ from one another in the impact they have on *ROA*. In the light of those coefficients, increasing the days in inventory for intermediate products and work-in-progress has the strongest (and negative) impact on *ROA* (Model 2). Indeed, a one-unit increase in that cycle resulted in a reduction of *ROA* by 0.113 percentage points, whereas an increase in days in inventory for finished products (Model 3) and commodities (Model 4) drove a decline in *ROA* by 0.013 percentage points (*FGIC*) and 0.018 percentage points (*GIC*). This means that increasing the *WIPC* had a 6 to 9 times greater negative effect on *ROA* than increasing the *FIGC* and *GIC.* The parameters of Model 5 (which includes *INVTC*, the aggregated inventories), too, suggest that financial benefits can be derived

Table 4. Correlation matrix (Pearson's correlation coefficients)

	ROA	ln*TA*	*SFA*	*ICEq*	ΔS	*RMIC*	*WIPC*	*FGIC*	*GIC*	*INVTC*
ROA	1.000	–	–	–	–	–	–	–	–	–
ln*TA*	-0.113^{*}	1.000	–	–	–	–	–	–	–	–
SFA	0.304^{***}	-0.198^{***}	1.000	–	–	–	–	–	–	–
ICEq	-0.198^{***}	–0.075	-0.203^{***}	1.000	–	–	–	–	–	–
ΔS	0.405^{***}	0.239^{***}	–0.069	0.150^{***}	1.000	–	–	–	–	–
RMIC	–0.048	-0.381^{***}	-0.243^{***}	0.003	–0.096	1.000	–	–	–	–
WIPC	-0.212^{***}	0.059	-0.246^{***}	0.048	–0.051	0.075	1.000	–	–	–
FGIC	-0.125^{*}	0.028	-0.248^{***}	-0.129^{**}	0.119^{**}	–0.038	0.422^{***}	1.000	–	–
GIC	-0.120^{*}	-0.202^{***}	-0.151^{***}	0.155^{**}	0.132^{**}	0.059	0.182^{***}	0.134^{**}	1.000	–
INVTC	-0.131^{*}	-0.261^{***}	-0.352^{***}	0.033	0.092	0.454^{***}	0.485^{***}	0.629^{***}	0.709^{***}	1.000

Significance levels: $^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$; *ROA* – return on assets; ln*TA* – logarithmized value of total assets (per company); *SFA* – share of property, plant and equipment (tangible fixed assets) in total assets; *ICEq* – capital leverage ratio; ΔS – growth rate of sales proceeds; *RMIC* – raw materials cycle; *WIPC* – semi-finished and work-in-progress products cycle; *FGIC* – finished products cycle; *GIC* – commodities cycle; *INVTC* – total inventory cycle

Source: Own calculations based on CSO (2019)

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Table 5. Parameters of return on assets (ROA) models

Variables and tests	Model 1	Model 2	Model 3	Model 4	Model 5
ROA_{t-1}	0.284 (0.029)	0.273 (0.037)	0.319 (0.027)	0.282 (0.018)	0.308 (0.006)
ln*TA*	–0.761 (0.037)	–0.789 (0.036)	–0.762 (0.041)	–0.855 (0.010)	–0.959 (0.014)
SFA	0.107 (0.024)	0.079 (0.039)	0.090 (0.022)	0.091 (0.031)	0.086 (0.042)
ICEq	–0.967 (0.015)	–0.960 (0.004)	–1.012 (0.009)	–0.942 (0.014)	–1.054 (0.008)
Δ*S*	0.266 (0.000)	0.269 (0.000)	0.254 (0.000)	0.279 (0.000)	0.266 (0.000)
RMIC	–0.003 (0.883)	–	–	–	–
WIPC	–	–0.113 (0.002)	–	–	–
FGIC	–	–	–0.013 (0.028)	–	–
GIC	–	–	–	–0.018 (0.016)	–
INVTC	–	–	–	–	–0.015 (0.023)
Constant	19.4 (0.018)	21.6 (0.001)	19.9 (0.001)	22.1 (0.000)	24.9 (0.000)
AR-2	–1.15 (0.250)	–1.15 (0.251)	–0.98 (0.328)	–1.16 (0.246)	–1.02 (0.306)
J-Hansen	11.8 (0.693)	12.7 (0.623)	11.9 (0.681)	12.0 (0.677)	12.0 (0.678)
Instruments			22		
Observations			286		
Groups			27		

The values in brackets indicate the level of significance of the variables or tests; AR-2 is a serial correlation test of second order using residuals of first differences, asymptotically distributed as $N(0,1)$ under null hypothesis of no serial correlation; Hansen's *J*-test is a test of over-identifying restrictions distributed asymptotically under null hypothesis of validity of instruments such as *Chi*-squared

ROA – return on assets; ln*TA* – logarithmized value of total assets (per company); *SFA* – share of property, plant and equipment (tangible fixed assets) in total assets; *ICEq* – capital leverage ratio; Δ*S* – growth rate of sales proceeds; *RMIC* – raw materials cycle; *WIPC* – semi-finished and work-in-progress products cycle; *FGIC* – finished products cycle; *GIC* – commodities cycle; *INVTC* – total inventory cycle

Source: Own calculations based on CSO (2019)

from reducing the inventory cycles. Accordingly, a one-unit increase in *INVTC* resulted in reducing the return on operating assets by ca. 0.015 percentage points.

In all models developed, several control variables were also found to be statistically significantly correlated with the return on assets. In the light of Table 5 data, the return on operating assets is positively related to the assets structure defined by the share of property, plant and equipment (*SFA*) and to growth in sales proceeds (Δ*S*). Conversely, company size measured as the value of assets (ln*TA*) and an aggressive financial policy reflected by the capital leverage ratio (*ICEq*) have an adverse effect on *ROA*.

CONCLUSION

Corporate financial performance is determined by a number of diverse factors. These include the inven-

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tory management policy, which is designed to set a reasonable level and structure of stocks, in both logistical and financial terms. However, in economic practice, inventory management strategies differ strongly from one another due to various reasons, including the inventory management methods in place (e.g. Just in Time, Lean Management, Vendor Managed Inventory), the type of business, company size, and industry. Therefore, both the direction and strength of impact the inventories have on financial performance can vary across enterprises.

Studies based on the example of Polish food sub-sectors demonstrated that statistically significant causative links exist between days in inventory and financial performance. Based on the regression models developed, it was demonstrated that increasing the days in inventory has a negative effect on the return on operating assets. The analyses carried out in this paper also proved the usefulness of taking the inventory mix into account. Although the studies found that different inventory components had the same direction of impact on the profitability of food sub-sectors, they also demonstrated that increasing the days in inventory ratios for intermediate products and work-in-progress had the greatest (and negative) impact on profitability. Indeed, increasing these inventory cycles was much (6–9 times) more determinant for *ROA* than an increase in days in inventory for other stocks.

In summary, this study found that the rationalization of inventory management can be a significant driver of improvements in the financial performance of food enterprises and, therefore, can contribute to generating value for the owners.

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