https://sites.google.com/site/icqqmeas 2015

INVENTORY MANAGEMENT AND ITS IMPACT ON FIRMS' PERFORMANCE: AN EMPIRICAL STUDY IN THE REGION OF EPIRUS, GREECE

Ioannis Ganas[1], Alina Hyz[2]*

[1]Department of Accounting and Finance, Technological Educational Institute of Epirus, Psathaki, 481 00 Preveza, Greece, ganas@teiep.gr

[2]Department of Accounting and Finance, Piraeus University of Applied Sciences, Petrou Ralli & Thivon, 122 44 Egaleo, Greece, alinahyz@teipir.gr

ABSTRACT

The term "inventory" in manufacturing companies refers to the stockpile of the products a firm is offering for sale and the components that make up the product. The assets which firms store as inventory in anticipation of need are raw materials, work in progress, finished goods, stores and supplies. The last asset, normally form a very minor part of total inventory and does not involve significant investment. The major objective of the research presented here is to provide empirical evidence about the effects of inventory management on the profitability of a sample of small and medium enterprises (SME) in the region of Epirus, in Greece. The study covers a time period from 2002 to 2012. We collected data for 612 enterprises. The results of this research showed that there is statistical significance between profitability, measured through gross margin, and inventories management. Moreover, managers can create profits for their companies by handling correctly inventory turnover ratios and keeping each different component (raw materials, work in process and finished goods).

Keywords: inventory, inventory turnover, firm performance, elasticity, small and medium enterprises (SME), financial crisis, Greece

JEL CLASSIFICATION: G31, L25

1. Introduction

During the previous years, increasing attention was devoted to effective inventory management. Excessive inventories are one of the most important problems faced by many companies all over the world. Inventories are engaged primarily funds, usually unproductive, freezing high capital of the company. Inventories also cause an increase in costs associated with their maintenance and service. This is especially important today, when the rising cost of operations and increase competition in the market eliminate companies which are not effective in costs reduction.

In the last years inventory management has become the integral part of all companies. Inventory planning and control attempts to balance the advantages against the disadvantages of holding stock (Bonney, 1994). However, the question of whether inventory reduction has been achieved and whether it has been beneficial to firm's performance have not been subject to systematic investigation in the Greek setting. For the Greek enterprises inventory studies are sparse and there is a lack of research concerning small and medium enterprises sector. Attempting to fill this research gap, this study examines Greek inventories using data from the SME sector in the region of Epirus in Greece. The reason for the selection of small and medium enterprises was the fact that these companies are the basis of the economy of Greece in general. It is also the case of Epirus region, which belongs to one of the least developed regions in the European Union. We assume that improper management of inventories is one of the main reasons behind failures or pure financial performance of many Greek small and medium enterprises. During the period of recession, the inventory management get even more importance due to the firm's financial constraints (Hyz, 2011).

This study hypothesizes that there is a positive relationship between inventory management and firm performance. Proper inventory management will improve the management efficiency, which translates into profit growth. It is obtained by 1/. increasing reliability of business processes in the company guaranteed by a reasonable level and structure of inventory, 2/. increasing the speed of movement of backup, which leads to the liberation of funds (capital) involved in inventories, 3/. lowering inventory costs by reducing their level, improving the structure.

Although the link between operations and finance has been studied extensively, to our best knowledge this is the first study that investigates the relationship between firm level inventory and financial performance using as a sample all sectors of activities in one region. Also, due to the fact that the relationship may differ depending on the discrete components of inventory we analyze also their correlation with financial performance. The study covers ten years period, which we analyze first as a total period and then we divide it in the period prior 2008 and post 2008 using this year of the beginning of the recession in Greece and first year of serious financial constraints for Greek firms. A comparison of our findings with those from previous research provides important implications for managing companies.

The paper is organized as follows: in the next section we briefly review the existing body of literature and summarize major findings. This is followed by the presentation of research methodology where hypotheses are introduced as well as the data sources used in the analysis. The results are presented and discussed in section four. We conclude with further opportunities for research.

2. Literature review

In last decades, inventories have been decreased in many firms, but evidence of improved firm performance is mixed. Grablowsky (1984), has compared the inventory management practices of small and large firms and has concluded that small business firms should also use some efficient inventory management techniques for better results. Demeter (2003) found that inventory improvement tends to influence only indirectly the firm's profitability. Gaur at al. (2004), showed that the annual inventory turnover is negatively correlated with gross margin and positively correlated with capital intensity and sales surprise. Chen, et. al. (2005), have found that inventory has reduced considerably over 1981-2000. They found that firms with abnormally high inventories had a poor long term stock return, firms with low inventory showed ordinary returns while the firms having an average inventory had shown good stock returns. Their study uses Tobin's q as a measurement for performance and number of days in inventory as a measurement for inventory management. They found also that raw-material and work in process inventories have declined significantly and finished goods inventory remained steady during this period. Roumiantsen and Netessine (2005), analyse inventories in US companies for the ten years period, and they found that firms operating with more uncertain demand, longer lead times, higher gross margins and lower inventory holding costs have higher inventory levels. Furthermore, larger companies appear to benefit more from economies of scale and therefore have relatively less inventory than small companies. Guar and Kesavan (2007), tried to find out the various factors that could affect the positive or negative relations with

respect to size and sales growth rate with inventory turnover using 353 public listed US retailers for the period 1985-2003. With respect to size, they found strong evidence of diminishing economies of scale. With respect to sales growth rate, they found that inventory turnover increases with sales growth rate, but its rate of increase depends on firm size and on whether sales growth rate is positive or negative. Boute at. al. (2006), have studied the financial impact of inventories in Belgian manufacturing industry, wholesale and retail. The results of the regression analysis are not very clear. They found negative coefficients relationship between the inventory ratio and financial performance (ROA), but these coefficients are only significant in 29% of the cases studied. Also, the analysis of variance showed that companies with a very high inventory ratio have much more chance to be bad financial performers than companies with a very low inventory ratio. Shah and Shin (2007), analyzed sector level data and showed that inventory performance is positively associated with financial performance. Cannon (2008), focuses on assessing the relationship between inventory performance and overall firm performance. He uses firm's annual percentage change in inventory turnover as a measurement for inventory management and return on assets as a measure of performance. He concludes that turnover improvement on average had a slightly negative effect on ROA. Cannon includes also capital intensity in this study and he finds that capital intensive firms tended to be below average with regards to ROA and the variable's presence in the model did not significantly alter the relationship between inventory turnover improvement and ROA over time. Capkun et al. (2009), found a significant positive correlation between inventory performance and measures of financial performance for firms in manufacturing industries. The correlation between the performance of discrete types of inventory and financial performance varies significantly across inventory types. RMI performance has the highest correlation with all financial performance measures. Between WIPI and FGI performance, the former is more highly correlated with gross profit measures while the latter is more highly correlated with operating profit measures.

There have been only a few research papers that investigate the relations between the inventory management and firm performance in Greece. For example, Voulgaris et al. (2000), found that the efficiency of inventory management policy is the main factor of the performance of the Greek firms. They used the financial data of Greek SMEs performance on the basis of a financial ratio analysis using a sample of 143 industrial firms for ten years period. Dimelis and Lyriotaki (2007), using a type of stock-adjustment model augmented with financial and fixed capital variables suggested by the portfolio model, tried to explore any differences in the inventory investment behaviour between domestic firms and firms with foreign ownership (partially or fully) in Greek manufacturing firms as well as between firms of different size. The results suggest that the portfolio model variables improve substantially the performance of the traditional stock-adjustment model in particular among the foreign-owned firms and the group of relatively small in size firms. Statistically significant differences were observed in the parameters of the model between small and large firms, as well as between domestic and foreign-owned firms. Koumanakos (2008), tried to investigate the existence of a possible linear relationship between inventory holdings and accounting based measures of performance for a recent group of Greek manufacturing firms belonging to the food, textiles and chemicals sectors. Results confirm the existence of a robust linear relationship but only in the sector of chemicals. Kolias at al. (2011), attempted to investigate the determinants of inventory turnover ratio for Greek retails firms for the period 2000-2005. It was found that inventory turnover ratio (as a measurement of inventory management) is negatively correlated with gross margin and positively correlated with capital intensity and a measure of sales surprise. It was also estimated that changes in sales ratio bring on bigger changes in the "sales-declined region" than in the "sales increased region".

3. Methodology

We use data from SME in Epirus region. The data was extracted from ICAP database, containing detailed financial reports annuals (income statements and annuals balance sheets) and statistics on Greek companies. This results in a data set of 612 companies split up over 18 sectors. We use the European NACE classification scheme of economic activities. We define three main sectors of economic activities in the region, based on the number of firms and percentage of total sales: wholesale and retail trade, manufacturing and construction. These three sectors represents about 87% of total sales in region and above 58 per cent of total number of firms.

The criteria used for selection of the companies' are two: 1/. European Commission criteria for small and medium enterprises[1], namely: headcount <= 250, turnover <=50 million euro, total balance sheet <= 43 million euro. 2/.

[1] http://ec.europa.eu/enterprise/enterprise_policy/sme_definition/index_en.htm

Data available for ten years continuously. We exclude all firm-year observations without data available on inventories and their components, sales, cost of goods sold, net fixed assets and total assets.

As a result we obtained a balanced panel dataset of 612 firms and a number of 6120 firms-years observations. Since outlier observations can cause problems, we implied standard method of winsorization of the data. For all used variables we replace 5% of the data by the highest and lower, respectively value that is not removed. Outlying observations were removed via 5% winsorization.

The following variables were calculated for the estimation of above purposes in our study:

Inventory turnover ratio. Inventory turnover ratio is velocity of which total inventories (raw materials, work in process and finished goods) converted into sales. This indicator suggests the ability of company to transform inventories in sales (cash or trade receivables) in particular period of time. The lower the number of days the better the inventory management.

$$ITRj,t = \frac{avgIj,t*Days}{CGSj,t} \qquad (1)$$

where: $ITR_{j,t}$ - Inventory turnover ratio for firm j in period t, $avgI_{j,t}$ - Average Inventories for firm j in period t, $CGS_{j,t}$ - Cost of Goods Sold for firm j in period t

Raw material turnover ratio. Raw materials turnover ratio is velocity of which raw materials converted into goods ready for sale. If raw materials turnover ratio is high then company is efficiency converting into finished goods.

$$RMTRj,t = \frac{avgRMj,t*Days}{CGSj,t} \qquad (2)$$

where: $RMTR_{j,t}$ - Raw Material turnover ratio for firm j in period t, $avgRM_{j,t}$ - Average Raw Materials for firm j in period t, $CGS_{j,t}$ - Cost of Goods Sold for firm j in period t

Work in process turnover ratio. Work in progress turnover ratio is velocity of which WIP converted into goods ready for sale. If WIP is high then company is efficiency converting into finished goods.

$$WIPTRj,t = \frac{avgWIPj,t*Days}{CGSj,t} \qquad (3)$$

where: $WIPTR_{j,t}$ - Inventory turnover ratio for firm j in period t, $avgWIP_{j,t}$ - Average Inventories for firm j in period t, $CGS_{j,t}$ - Cost of Goods Sold for firm j in period t

Finished goods turnover ratio. Finished goods turnover ratio is velocity of which finished goods converted into sale. If finished goods turnover ratio is high then company is efficient in managing the finished goods.

$$FGTRj,t = \frac{avgFGj,t*Days}{CGSj,t} \qquad (4)$$

where: $FGTR_{j,t}$ - Inventory turnover ratio for firm j in period t, $avgFG_{j,t}$ - Average Inventories for firm j in period t, $CGS_{j,t}$ - Cost of Goods Sold for firm j in period t

Gross margin. Gross margin indicates the gross profit per union of sale.

$$GMj,t = \frac{Sj,t-CGSj,t}{CGSj,t} \qquad (5)$$

where: $GM_{j,t}$ - Gross Margin for firm j in period t, $S_{j,t}$ - Sales for firm j in period t

$CGS_{j,t}$ - Cost of Goods Sold for firm j in period t

Capital intensity. Capital intensity indicates the rate of long term investment made of firm.

$$CIj,t = \frac{NAj,t}{TAj,t} \qquad (6)$$

where: $CI_{j,t}$ - Capital Intensity for firm j in period t, $NA_{j,t}$ - Net fixed Assets for firm j in period t, $TA_{j,t}$ - Total Assets for firm j in period t

4. Results and Findings

Table 1 presents brief overview of the descriptive statistics of the relevant variables for three main sectors for the ten years period and for two sub-periods. For SMEs, inventories represent on average 33% of total assets and 42% of current assets. In the analysis we focus more on the medians rather than mean due to the fact that means are often influenced by the phenomena of “windows dressing”. In other words accounting data

are influenced by the tendency of accountants to try to help their clients have a good look. Since the level and value of inventories during the examined period serves as collateral for debt in Greek firms. The median of total inventory holdings periods were 82,13 days with the biggest value in manufacturing sector (102,01 days). Our financial performance measure show median Gross Margin for all period 0,23. Another variable, CI, as a measurement of the ability of a firm to use its fixed assets effectively is on average 42%.

Table 2 shows the correlation matrix of the model's variables based on Pearson correlation for total inventories and their components in all surveyed SMEs and three main sectors. The results of the correlation analysis for all sectors show that the number of days inventory turnover (total and its components) negatively relates to the dependent variable gross margin. It is also a case for manufacturing and wholesale and retail trade sector. Although there is absence of a significant relation for raw materials days turnover and work in progress. It is interesting to note a significant negative relation for finished goods in the case of construction sector. It should be noted yet that correlations of gross margin differs between three analyzed sectors. The control variables: capital intensity show a positive relation on the dependent variable. It means that managers of firms can create value by keeping the levels of inventories to a reasonable minimum. It also may imply that higher capital intensity causes greater value and reduction in inventories. In order to shed more light on the relationship between inventory management and firm's profitability, we use the following regression analysis, where we examine the endogenous variable which is gross margin against five exogenous variables.

$$GM_{j,t} = a + \beta_1 I_{j,t} + \beta_2 CI_{j,t} + \varepsilon \qquad (7)$$

where: j is representing the firm and t is the year, a is the regression constant, β_1, β_2, are the coefficients of $I_{j,t}$, $CI_{j,t}$, respectively. $I_{j,t}$ is the number of days inventory total or their components of firm j in the year t, $CI_{j,t}$ - capital intensity of firm j in the year t, ε indicate the error term for the observations of firm j in the year t.

This regression equation indicates that there is negative relationship between inventory management measurements and profitability, which is consistent with the view that a decrease in the inventory measurements will generate more profits for firms. This result is highly significant.

Table 1. Descriptive Statistics Analysis (5% winsorization, 6120 firms-years observations)

	Mean				Median				St.Dev.			
	Manufacturing (C)	Wholesale (G)	Construction (F)	Total	Manufacturing (C)	Wholesale (G)	Construction (F)	Total	Manufacturing (C)	Wholesale (G)	Construction (F)	Total
2002-2011												
GM	0,21	0,21	0,25	0,29	0,19	0,20	0,20	0,23	0,22	0.13	0,16	0,20
ITR	174,12	155,44	211,11	159,35	102,01	94,62	100,90	82,13	201,63	181,30	177,65	123,89
RMTR	52,77	17,20	31,55	36,84	31,40	1,12	7,99	14,79	58,53	38,19	27,89	13,43
WIP-TR	82,21	36,17	227,02	198,69	51,04	19,87	109,54	96,75	94,90	45,32	59,16	76,56
FGTR	126,23	144,87	114,78	28,80	60,39	88,86	29,43	6,60	169,16	162,92	123,65	114,76
CI	0,47	0,28	0,29	0,45	0,45	0,23	0,22	0,42	0,24	0,22	0,34	0,25

Table 2. Correlation matrix (all sectors)

	GM	ITR	RMTR	WIPTR	FGTR	CI
GM	1					
ITR	-.046**	1				
RMTR	-.024*	.521**	1			
WIPTR	-.035*	.917**	.147*	1		
FGTR	-.099**	.881**	.175**	.311	1	
CI	.160**	-.186	-.008	-.025	-.182**	1
Manufacturing(C)						
	GM	ITR	RMTR	WIPTR	FGTR	CI
GM	1					
ITR	-.360**	1				

RMTR	-.029	.525**	1			
WIPTR	-.003	.713**	.252*	1		
FGTR	-.396**	.868**	.112**	.285*	1	
CI	.183**	.190*	.006	.144*	.168**	1
Wholesale (G)						
	GM	ITR	RMTR	WIPTR	FGTR	CI
GM	1					
ITR	-.332**	1				
RMTR	-.083	.525**	1			
WIPTR	-.354	.626*		1		
FGTR	.380**	.971**	.175**	.142*	1	
CI	.040	-.003	.265**	.068*	-.024	1
Construction (F)						
	GM	ITR	RMTR	WIPTR	FGTR	CI
GM	1					
ITR	-.227*	1				
RMTR	-.228*	.424**	1			
WIPTR	-.032	.945**	.159	1		
FGTR	-.238**	.694**	.011	.311	1	
CI	.331**	.140**	.091*	.057**	.069*	1

Note: Variables are defined at the beginning of this section. For every pair of variables, the table provides the Pearson's correlation coefficient, t-Statistic (* p-value<0,1; ** p-value<0,05; *** p-value<0,01)

5. Conclusions - Directions for Further Research

This study is an attempt to investigate the inventory management of small and medium enterprises in the region of Epirus, Greece. The following measures were used in this study: (1) Inventory Turnover Ratio (2) Raw Material turnover ratio, (3) Work in process turnover ratio, (4) Finished goods turnover ratio. (5) Gross margin, (6) Capital intensity. This study was conducted on a sample of financial data for 612 firms over the ten years period. By employing correlation and regression techniques the impact of inventory management and firm's profitability was found to be significantly negative. This could lead us to the conclusion that less profitable firms have worst inventory management measures. Therefore, managers can create profits for their companies by managing efficiently the inventories and their components' measures, leading to an optimum level. The study can be extended by adding more regions or countries, more years and more variables.

Acknowledgements

This research has been co-financed by the European Union (European Social Fund – ESF) and Greek national funds through the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program ARCHIMEDES III, "Investing in knowledge society through the European Social Fund".

References

[1] Bonney, M.C. (1994), Trends in inventory management, International Journal of Production Economics, Vol. 35, pp. 107-114.

[2] Boute, N. R., Lambrecht, M.R., Lambrechts, O. and Sterckx, P. (2007), An analysis of inventory turnover in the Belgian manufacturing industry, wholesale and retail and the financial impact on inventory reduction, KBI 0725, Department of Decision Sciences and Information Management, Faculty of Economics and Applied Economics, Katholieke Universiteit Leuven, [Online], Available at: https://lirias.kuleuven.be/bitstream/123456789/175504/1/KBI_0725.pdf

[3] Cannon, A.R. (2008), Inventory Improvement and Financial Performance, International Journal of Production Economics, Vol. 115, pp. 581-593.

[4] Capkun, V., Hameri, A.-P. and Weiss, L.A. (2009), On the relationship between inventory and financial performance in manufacturing companies, International Journal of Operations & Production Management, Vol. 29, No. 8, pp. 789-806.

[5] Chen, H., Frank M., and Wu, O. (2005), What actually happened to the inventories of American companies between 1981 and 2000? Management Science, Vol. 51, No. 7, pp. 1015-1031.

[6] Dimelis, S.P., and Lyriotaki, M.-N. (2007), Inventory Investment and Foreign Ownership in Greek Manufacturing Firms, Journal of Production Economics, Vol. 108, pp. 8–14.

[7] Gaur, V. and Kesavan, S. (2008), Retail Supply Chain Management, in N. Agrawal, S. Smith (Eds.), The effects of Firm Size and Sales Growth Rate on Inventory Turnover Performance in U.S. Retail Services, pp. 25-52, Springer

[8] Gaur, V. and Kesavan, S. (2008). The Effects of Firm Size and Sales Growth Rate on Inventory Turnover Performance in the U.S. Retail Sector, in N. Agrawal and S. Smith (eds), Retail Supply Chain Management, pp. 25-52, Kluwer Publishers.

[9] Gaur, V., Fisher, M. and Raman, A. (2005), An Econometric Analysis of Inventory Turnover Performance in Retail Services, Management Science, Vol. 51, pp. 181-194.

[10] Grablowsky B. (1984), Financial management of inventory, Journal of Small Business Management, Vol. 122, No. 3, pp. 59-65.

[11] Guariglia, A. and Mateut, S. (2010), Inventory investment, global engagement, and financial constraints in the UK: Evidence from micro data, Journal of Macroeconomics, Vol. 32, No 1, pp. 239-250.

[12] http://ec.europa.eu/enterprise/enterprise_policy/sme_definition/index_en.htm

[13] Hyz, A. (2006), The Development of Entrepreneurship and Small Business in Poland, Festschrift in honour of professor Maria Negreponti – Delivani, University of Macedonia, Economic and Social Sciences, Thessaloniki, pp. 37-61.

[14] Kolias, G.D., Dimelis, S.P. and Filios, V.P. (2011), An Empirical Analysis of Inventory Turnover Behavior in the Greek Retail Sector: 2000-2005, International Journal of Production Economics, Vol. 133, No. 1, 143-153.

[15] Koumanakos, D. (2008), The effect of inventory management on firm performance, International Journal of Productivity and Performance Management, Vol. 57, No. 5, pp.355 - 369.

[16] Krishnankutty, R. (2011), Panel Data Analysis on Retail Inventory Productivity, The Economic Research Guardian, Vol. 1, No. 1, pp. 15-23.

[17] Voulgari, F., Doumpos, M, and Zopounidis, C. (2000), On the evolution of Greek industrial SME's performance via multicriteria analysis of financial ratios, Small Business Economics, Vol. 15, pp. 127-136.