



An empirical analysis of inventory turnover behaviour in Greek retail sector: 2000–2005

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ABSTRACT

In this study we investigate the determinants of inventory turnover. The study is based on an econometric analysis of inventory behaviour using an inventory turnover model. The empirical implementation of the model was conducted on a sample of financial data for 566 Greek retail firms for the period 2000–2005. By employing panel data techniques it was found that inventory turnover ratio is negatively correlated with gross margin and positively correlated with capital intensity and a measure of sales surprise.

Decomposing the variance into its components associated with year, firm and retail segment effects, we found that a substantial amount of inventory turns variability is due to segment-wise effects. Moreover, the inventory turnover reaction to different sales changes was also studied. It was estimated that changes in sales bring on bigger changes when firms operate in sales-declined region. These results are useful in identifying methods and applications to improve inventory performance among firms and over time.

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1. Introduction

Inventories have generally been the most difficult asset to be managed both for merchandising and manufacturing firms. Inventory management incorporates purchasing, financing and selling policies. The implementation of these diverse policies comprises conflicting functional objectives; e.g. the financial manager's effort to minimize the inventory level is contradictory to the goal of minimizing the probability of inventory shortage as marketing manager desires. Inventory management deals, on one hand, by specifying, retaining and controlling the desirable inventory level, and on the other, by minimizing the total inventory cost. In other words, the problem of managing inventories is an optimization problem between overstocking and understocking cost. Shortage of inventory implies unsatisfied demand and sales shrinkage. Excessive inventories may lead to the cost of items storage, taxes and insurance, breakage, spoilage, deterioration and obsolescence and the opportunity cost of alternative capital investment as well.

Moreover, in all firms, except those belonging to the financial and service sector, inventories represent a large proportion of current and total assets. For example, Gaur et al. (2005) report that in 2003, inventories in US retailing represent, on average, 36% of total assets and 53% of current assets. Likewise, our dataset on Greek retailers, during the period 2000–2005, show that inventories represent on average 38% of total assets and 51% of current assets. Generally, as it stems from the relevant literature, investment in inventory represents a significant amount of the total funds available in firms. Furthermore, comparison of inventory turns between firms are often the basis for managerial compensation (Shleifer, 1985). For these reasons inventory management receives great attention from market analysts, bankers and investors.

A financial index that combines the cost of goods sold with inventories is the inventory turnover ratio, defined as the ratio of a firm's cost of goods sold to its inventory level. This index shows how many times inventories are turned over during the accounting year. Hence, inventory turnover ratio can often be used as a comparative measure of inventory performance between firms, or in evaluating the effectiveness of inventory management. To our knowledge, there have been only a few research papers that investigate the determinants of inventory management as expressed by inventory turnover ratio. For example, Gaur et al. (2005) set up a methodology, which combines inventory turnover

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with other performance variables such as the gross margin, capital intensity and sales related variables.

In this study we follow a similar methodology in order to identify the factors that determine inventory behaviour and affect their performance using a large sample of Greek retailing firms operating in the period 2000–2005. Our dataset consists of repeated observations on the same cross section of firms over time drawn from financial data of the firms' annual income statements and annual balance sheets. Econometric analysis is based on the study of Gaur et al. (2005) for the U.S. retail sector. We have further extended this analysis by looking at the sales growth process in association with the inventory turnover ratio.

The results of our econometric analysis confirm the findings of the previous studies as far as the importance of gross margin, capital intensity and sales surprise ratio is concerned. Our model explains 94.10% of the total variation as well as 91.46% of within-firm variation of inventory turnover ratio. Moreover, we estimate the impact of sales growth rate on inventory turns and found that when firms operate in "sales-declined region", sales changes bring on bigger changes to the inventory turnover than in cases where firms operate in "sales-increased region". It was found that a 1% increase in sales growth ratio is associated with an increase in inventory turnover of 0.46% in the former case, and only 0.26% in the latter.

Besides, we investigate the importance of year, firm and segment effects on inventory turnover. By doing so, we find that the variation across segments accounts for 58% of the total variation, while 33% is due to the variation across firms. Finally, we estimated the inventory turnover trend over the entire period examined and found that it varies across firms.

Our results are useful in operation and financial management and could help managers make aggregate level inventory decisions as well as identify the causes of differences in inventory turns between firms and over time. It should be noted that the present panel data econometric study is the first in the Greek literature on inventory behaviour and the results coming from it can stimulate future research into possible ways of effective inventory management.¹

The remainder of this paper is organized as follows. In Section 2, a review of the relevant literature is presented and the determinants of inventory turnover ratio are discussed. In Section 3, the dataset is explained and a number of descriptive statistics are given. The econometric model is specified in Section 4, while Section 5 contains the main findings. In Section 6 we discuss the implications of our results for operating and financial strategies as well as the limitations of our study. We conclude the paper in Section 7 showing directions for future research.

2. Literature review

Over the past decades, especially after the development of Japanese inventory management systems (e.g. just-in-time process), it has been argued that successful inventory management, mostly in the manufacturing sector, is associated with the reduction of inventory level. Chen et al. (2005) conclude that the inventory holding period of American manufacturing firms had been reduced from 96 days to 81 days between 1981 and 2000. The average rate of inventory holding period was 2% per year. In addition, according to their study, the greatest reduction, 6% per year, was found for work-in-process inventory. Raw materials declined by about 3% while finished-goods inventories

did not decline. In fact, in certain sectors (leather, drugs and tobacco industries) finished-goods inventories had increased. Rajagopalan and Malhotra (2001) mentioned that, from 1961 to 1994, raw materials and work-in-process inventory of U.S. manufacturing firms had been reduced. During the same period there were no significant trends in finished-goods inventories.

To evaluate inventory management it is desirable to obtain appropriate performance measures. An accounting based performance variable is the inventory turnover ratio. To our knowledge a few empirical studies (e.g. Gaur et al., 2005; Roumiantsev and Netessine, 2007) investigate inventory management efficiency with a focus on accounting concepts considering that balance sheet and income statement may adequately categorize some activities related to operation and financial management. Gaur et al. (2005) conclude that inventory turnover varies widely across firms and over time. For this reason "...inventory turns should not be used, per se, in performance analysis". Instead, an empirical model could be used that combines the inventory turnover ratio with appropriate explanatory variables.

Empirical estimates have shown that inventory turnover ratio is negatively correlated with gross margin and positively correlated with capital intensity (Gaur et al., 2005). The negative correlation can be explained through the classical newsboy model² according to which an increase in gross margin implies an increase in the inventory level and, consequently, a decrease in inventory turns. Roumiantsev and Netessine (2007), analyzing a sample of 722 public US companies for the period from 1992 to 2002, found empirical evidence that firms operating with higher gross margins have higher inventory levels, thus lower inventory turns.

Furthermore, inventory turnover can be indirectly related to gross margin because of the impact of other factors like price, product variety and length of the product life cycle (Gaur et al., 2005). According to the demand theory, an increase in price reduces the volume of demand and increases its variability so that inventory level is being increased. In terms of product variety, according to both Lancaster's (1990) and Chamberlin's (1950) demand models, higher variety leads to an increase in consumer's utility either because the consumer easily spots the good he prefers through a wide variety, or because she has a built-in preference for variety, respectively, (Gaur et al., 2005). An increase in consumer's utility explains the increase in price which in turn increases gross margin.

In relation to the length of the product life cycle, short length implies rapid and repeated changes in product characteristics with a view to fulfilling the consumer's preferences (Pashigian, 1988) which justifies higher price level and thus increasing gross margin. Moreover, for those products with short life cycle the availability of historical datasets is limited to a few years' period. Consequently, the accuracy of demand forecasts is small which implies high demand uncertainty requiring a higher level of safety stocks, and as result a decrease in inventory turns.

Furthermore, gross margin is associated with stockout costs. These include both lost profits from the immediate order because of cancellations, and long-run costs if stockouts reduce the likelihood of future orders. In practice, customers do react substantially and negatively to poor service (e.g. stockouts), which may lead them to switch retailers on subsequent trips

¹ For a recent cross-sectional econometric study on Greek inventories see Dimelis and Lyriotaki (2007).

² Fundamental stochastic inventory model, in which it is assumed that the demand is a random variable, normally distributed with mean μ and standard deviation σ . According to the newsboy model (or news vendor model) the optimum size of the quantity order S can be determined from the equation. $\rho\left(\frac{S-\mu}{\sigma}\right) = \frac{c_u}{c_u+c_0}$, where c is the cost per unit of unsatisfied demand and c_0 the cost per unit of positive inventory remaining at the end of the period (see, e.g. Axsater (2006) pp. 114–116).

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