On the Relationship between Inventory Turnover Performance and Capital Intensity and Sales Growth
Evidence from the Listed Companies at Ho Chi Minh Stock Exchange

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ABSTRACT

Inventory turnover varies broadly across many companies and over time. This variation is useful for analyzing an inventory turnover performance and working capital management. By conducting a panel data of 179 Vietnamese companies listed in Ho Chi Minh Stock Exchange (HOSE) during the period of 2006-2011, we perform an empirical study with the fixed effect methodology to investigate the correlation of inventory turnover with capital intensity and sales growth. We find that both capital intensity and sales growth have a positive impact on inventory turnover. We also split two datasets based on firms in the real estate industry and in other industries. We only find that both gross margin and firm size are negatively correlated with inventory turnover in the dataset of firms in other industries. In general, our results are consistent with the previous studies of United State retailers. We also consider the time-trend to examine impacts of these factors. The results show that on average, firms with bigger investment in capital assets have achieved higher inventory turnover, but inventory turnover becomes worse as the time goes on.

Keywords: inventory turnover, capital intensity, sales growth.

1. INTRODUCTION

The total inventory value of all Vietnamese companies in every sector has been a big concern until recently. For example, during the first six months of 2012, a survey of more than 70 listed real estate companies in Vietnam shows that the total inventory value was approximately US$3.1 billion (source: CafeF on Sep. 17, 2012). Moreover, according to General Statistics Office of Vietnam (GSO), up to Aug. 1, 2012 the inventory index of manufacturing and processing industries increased by 20.8% compared to the same period last year. Because of this significant inventory value, many local companies have focused on how to improve efficiently the inventory management processes as well as to create better systems to reduce inventory levels. In academic circles, many authors are interested in investigating which determinants relate to inventory productivity of Vietnamese enterprises. However, there are limited empirical studies on these topics because of unavailable datasets. To our knowledge, factors influencing on inventory productivity have not been studied systematically in Vietnam. Therefore, the question on how to judge performances in inventory productivity remains unanswered.

Inventory turnover (henceforth called "turns"), the ratio of a firm's cost of goods sold to its average aggregate value of inventory, is commonly used to measure performance of inventory managers. In general, a good (poor) number of inventory turns is relative to what is being achieved at various stages across a firm and what is the industry norm. Therefore, within the same industry, a company with good supply chain management has more inventory turns than a company that does not (Russell & Taylor, 2011, p.439). Furthermore, as found by many previous studies in the United States, inventory turnover is correlated with other performance measures in a firm. Specifically, Balakrishnan et al. (1996) investigate the impact of just-in-time (JIT) processes on return on assets and find no correlation between return on assets and just-in-time adoption. However, Callen et al. (2000) and Fullerton and McWatters (2001) find that JIT implementation improves firm performance through lower inventory levels, reduced quality costs, and greater customer responsiveness with higher profit.

Other studies attempt to investigate the relationship between inventory levels and firm performance throughout stock market reactions (Hendricks and Singhal, 2009). They find that firm size, growth prospects, and debt-equity ratio influence the market's reaction to excess inventory announcements. Specifically, excess inventory

announcements by larger firms are associated with less negative stock market reactions than those associated with smaller firms. Firms with either higher growth prospects or higher debt-equity ratios have more negative market reactions.

Recent researches on the relationship between a managerial focus on improving operations and performance have focused on inventory turnovers. For example, by using financial data from 311 publicly-listed retail firms in retail sector for years 1987-2000 in the U.S, Gaur et al. (2005) find that inventory turns are negatively correlated with gross margin. Meanwhile, they are positively associated with capital intensity and sales surprise. Furthermore, Gaur and Kesavan (2008) find inventory is positively associated with sales ratio.

While the literature has mainly focused on investigating the relationship between inventory management and firm performance throughout exploring financial data from publicly-listed firms in the United States, only a few of researches examine the relationship between inventory performance and capital intensity and sales growth in Vietnam. We attempt to fill this gap.

We collate a quarterly panel data that contains 187 publicly-listed firms at HOSE for the period 2006-2011. Panel data allow us to implement fixed effect model that controls the effects of unobserved firm-specific or time-specific factors. After deleting missing data and taking natural logarithm, the remaining firms in our data are 179. We also split our dataset into two sub-datasets including firms in the real estate industry and firms in others. Our paper examines effects of firm performances and characteristics measured by gross margin, sales ratio, capital intensity and firm size on inventory turnovers. Based on the existing literature, we replicate baseline regression models and modify them to investigate the determinants influencing on inventory turnover. We distinguish from prior studies by using two different datasets including the real estate industry and others. We find some interesting results.

First, quarterly inventory turnover is found to be positively correlated with capital intensity in both datasets. These results are consistent with the previous studies. It means that the more capital intensity the firm invests in, the higher inventory turnover it can achieve. On average, a 1% increase in capital intensity is associated with 1% increase in inventory turnover in our full dataset.

Second, we also find a positive correlation between sales ratio and inventory turns. It is worth mentioning that we do not directly measure sales growth rate since the

results may get many negative numbers, and taking natural logarithm of sales growth rate would delete many value observations. Instead, we follow Gaur and Kesavan (2008) to measure sales growth by calculating sales ratio that is defined as the ratio of sales in the current quarter to sales in the previous quarter. Specifically, a 1% increase in sales ratios is associated with a 0.55% increase in inventory turnover in our full dataset.

The third purpose of the paper is to test the correlation between inventory turnovers and two determinants including gross margin and firm size. We find less evidence to support these relationships by using the sub-dataset of firms in the real estate industry. However, by using dataset of the other industries, we find inventory turnover is negatively correlated with both gross margin and firm size. The results are consistent with previous studies.

The rest of this paper is organized as follows. Section 2 reviews previous studies. Section 3 provides a description of the dataset and outlines the estimation strategies. Section 4 presents the empirical results. Finally, conclusion is presented in section 5.

2. LITERATURE REVIEW

In recent years, there have been many empirical studies to investigate a relationship between inventory turnovers and firm performance in the fields of strategic management, financial management and operations management. Indeed, each of these areas focuses on different predictor variables, and thus we only review empirical studies on operational performance relevant to our paper.

In examining inventory decisions and firm performance, many authors have developed theoretical frameworks in operation management. They explore impacts of inventory management on firms' financial performance. For instance, Balakrishnan et al. (1996) investigate the impact of JIT processes on return on assets. They compare a sample of 46 firms that adopted JIT processes against a matched sample of 46 control firms that did not. The results show that there is no correlation between return on assets and JIT adoption. However, Callen et al. (2000) and Fullerton and McWatters (2001) find that JIT implementation improves firm performance through lower inventory levels, reduced quality costs, and greater customer responsiveness with higher profit.

While the above papers examine the effect of various JIT management ways on firm performance, other researchers have conducted time-series data to investigate operational events. For instance, Hendricks and Singhal (2005), exploring a sample of

885 supply chain glitches, which commonly cause inventory problem, show that supply chain disruptions can be quite costly for a company. Particularly, the announcement glitches on average are associated with a 107% drop in operating income, 114% drop in return on sales, and 93% drop in return on assets. Additionally, firms do not quickly recover from the negative economic consequences of glitches.

Hendricks and Singhal (2009) extend their previous study to investigate a correlation between inventory announcements and stock market reaction. They find that firm size, growth prospects, and debt-equity ratio influence the market's reaction to excess inventory announcements. Specifically, excess inventory announcements by larger firms are associated with less negative stock market reactions than those associated with smaller firms. Firms with either higher growth prospects or higher debt-equity ratio have more negative market reactions.

Recent researches on the relationship between a managerial focus on improving operations and performance have concentrated on inventory turnovers. Many authors have explored public financial data in their empirical works to consider the relation between inventory turnovers and sales performance. For example, by using financial data for 311 publicly-listed retail firms in the years 1987-2000 in the United States, Gaur et al. (2005) analyze the effects of gross margin, capital intensity, and sales surprise on inventory turns. They state that changes in inventory turnover cannot be directly interpreted as performance improvement or deterioration because they may be caused by changes in product portfolio, pricing, demand uncertainty, and many other firm-specific and environmental characteristics. As a result, they find that inventory turns are negatively correlated with gross margin. Meanwhile, they are positively associated with capital intensity and sales surprise.

Furthermore, Gaur and Kesavan (2008), exploring a larger sample size of 353 listed US retailers for the period 1985-2003, investigate the impacts of firm size and sales growth on inventory turnovers. With respect to firm size, they find strong evidence of diminishing returns to scale. Otherwise, with respect to sales growth rate, they find that inventory is positively associated with sales ratio. Additionally, they discuss various factors that could cause positive or negative correlations of size and sales growth rate with inventory turnover, and provide evidence regarding the existence of economies of scale and scope in retailing as well as the effect of growth rate of firms on their inventory turnover performance.

Although there is an extensive body of operations management literature that investigates inventory management issues by exploring financial data from publicly-listed firms in the United States, there are very few studies that consider the linkage between inventory performance and capital intensity and sales growth in Vietnam. We attempt to extend this research stream in Vietnam.

Our paper is closest to Gaur et al. (2005) and Gaur and Kesavan (2008) who are among pioneers investigating inventory turnover performances in retailing sector by using publicly available data in the United States. We collate a quarterly panel data that contains 187 publicly-listed firms at HOSE for the period 2006-2011. After deleting missing data and taking natural logarithm, the full data contains 179 publicly-listed firms. Our paper is the first to look at the effects of firm performances and characteristics measured by gross margin, sales growth, capital intensity and firm size on inventory turnovers in Vietnam. The two mentioned papers investigating the effects have been limited to publicly-listed retail firms in the United States. By contrast, our paper uses a sample of many firms across industries in Vietnam.

3. DATA, HYPOTHESIS DEVELOPMENT AND EMPIRICAL STRATEGIES

a. Data:

The dataset for this paper is collected from financial data of 187 firms listed at HOSE in the years 2006-2011. We select all listed firms that issued financial statements in at least six continuous quarters. We use quarterly financial reports including income statements and balance sheets of the listed firms to create a panel data. The dataset is unbalanced since some firms do not have all of quarterly financial reports during this period. We omit all firm-quarter observations without data available on inventory. We also omit all firm-quarter observations with data unavailable on sales, cost of goods sold, total assets and fixed assets.

From these data, we compute the following performance variables:

Inventory turnover (or turns) (IT):

$$IT_{iq} = \frac{CGS_{iq}}{Inv_{iq}}$$

Capital intensity (CI):

$$CI_{iq} = \frac{GFA_{iq}}{Inv_{iq} + GFA_{iq}}$$

Sales ratio (SR)

$$SR_{iq} = \frac{Sales_{iq}}{Sales_{iq-1}}$$

Gross margin (GM)

$$GM_{iq} = \frac{Sales_{iq} - CGS_{iq}}{Sales_{iq-1}}$$

here, *iq* is firm *i* in quarter *q*; *Sales* denotes net sales in billion VND; *CGS* denotes the corresponding cost of goods sold; *Inv* denotes total average aggregate value of inventory of firm *i* in quarter *q;* and *GFA* denote the gross fixed assets including land, property, and equipment. It is worth noting that there are several measures of capital intensity in addition to the one defined above. For instance, either Total Assets or Net Fixed Assets could substitute for GFA. However, we follow Gaur et al. (2005) to measure CI.

The sales growth rate is measured by taking the difference between the current quarter sales and the previous quarter sales and then divided by the previous quarter sales. Doing so might result in many negative numbers because a firm's sales are often unstable over quarters of a year. To eliminate loss data when taking natural logarithm, we follow Gaur and Kesavan (2008) to measure SR (sales ratio) and GM (gross margin) as defined above. Finally, IT is considered as a dependent variable and other indicators are considered as explanatory variables.

We compute the log transformed variables and delete missing data. Our final data set contains 2,857 observations across 179 companies, an average of 15.2 quarters of data per firm. Table 1 shows the descriptive statistics for our panel data. The average firm has an inventory value of VND291 billion. However, there is substantial cross-sectional variation on the inventory level, with a quarterly standard deviation of VND607 billion. Similarly, the average gross fixed asset of a firm is VND546 billion. However, its quarterly standard deviation is VND1,262 billion. We also report the summary statistics of main variables used in our study that are generally consistent with the previous studies. Nevertheless, these variables are reported in a natural log transformed version.

Table 1: Descriptive Statistics

Variables	Description	Mean	Standard Deviation
Inv (VND billion)	Inventory	291.34	607.02
GFA (VND billion)	Gross Fixed Assets	546.71	1,261.95
log IT	Natural logarithm of Inventory Turnover	0.37	1.54
log CI	Natural logarithm of Capital Intensity	-0.74	0.79
log SR	Natural logarithm of Sales Ratio	-0.04	0.53
log GM	Natural logarithm of Gross Margin	-1.77	0.82
FS	Natural log of Total Asset adjusted inflation rate is a proxy for Firm Size (FS)	13.61	1.18

Note: Sample size after taking natural logarithm is 2,857.

We also separate the dataset into two sub-datasets. The first one includes 148 observations of 12 companies in real estate industries and the second has 2,709 observations of 167 companies in other industries. In so doing, we aim to examine the possibly different effect on inventory turns between real estate industry and others.

Table 2 reports correlation coefficients of variables used in our model. Here, we use log-values of variables since they are used to implement multiplication regression models in the rest of the paper. The correlation coefficients of independent variables (logarithm of CI, GM, SR, and FS) are all smaller than 0.5. Therefore, it is more likely that the multicollinearity among explanatory variables do not exist. It is worth noting that logIT is negatively correlated with logGM and logFS and positively correlated with CI.

Table 2: Correlation Coefficients

	log IT	log CI	log GM	log SR	log FS
log IT	1.00000				
log CI	0.5350*	1.00000			
log GM	-0.2111*	0.1261*	1.00000		
log SR	0.1863*	0.0018	-0.0059	1.00000	
log FS	-0.0515*	0.0910*	0.2096*	0.02000	1.00000

* correlation coefficients significant at the 5% level or better.

b. Hypothesis Development:

In this section, we present hypotheses to relate inventory turnover (IT) to capital intensity (CI), gross margin (GM) and sales ratio (SR). It is worth mentioning that we only concentrate on quarter-to-quarter variations within a firm, instead of differences across firms. We do so because differences in IT across firms may not only have close relationship with their CI, GM, and SR, but also be associated with other factors such as accounting policies, location strategies, management, seasonal products, and so on. These factors are considered as exogenous variables to any available data collected from the stock exchanges and our data is not exceptional. Therefore, concentrating on variations within a firm by using firm-specific fixed effects allow us to eliminate the influences of these factors in the empirical analysis.

From the above mentioned literature review, we state our hypotheses as:

H1: Inventory turnover is positively correlated with capital intensity.

We expect that new capital investment in, for example, information technology systems, warehouses, stores, distribution centers, and etc. improves inventory management. As Cachon and Fisher (2000) pointed out, improvement of information systems enables managers to control inventory efficiently such as better allocation of the inventory to the stores, shorter ordering lead times, smaller batch sizes, and lower cost of processing orders. Specially, in the real estate industry where companies have invested a huge capital in constructing apartments, buildings, resorts and so forth, this would have a strong impact on inventory turns.

We move on Hypothesis 2 to test the linkage between inventory turnover and gross margin:

H2: Higher gross margin decreases inventory turnover.

Previous studies find that managers trade off inventory turnovers and gross margin as making decisions in retailing firms (Gaur et al, 2005; and Gaur and Kesavan, 2008). However, there is little or no evidence to prove this trade-off in Vietnamese companies. Gross margin can be related to inventory turnover because it affects the optimal service level, price, product variety, and length of product life cycle. Meanwhile these factors have a negative impact on inventory turns. The following examples enable us to explain such a negative relationship: (1) an increase in inventory level implies a decrease in expected inventory regardless of the form the demand distribution and helps the firm achieve the optimal service level; (2) from the laws of demand, an increase in price declines the demand for the goods, hence decreasing inventory turns; (3) greater variety leads to an increase in the consumer utility, but from consumer utility theory, higher consumer utility implies higher prices for a given cost (Kotler, 1986), and then it can be explained as in example 2; (4) a shorter product life cycle implies rapid changes to new product version to better meet consumer needs, as a result of increasing consumer utility, and then it is explained as in example 2.

These factors play an essential role in inventory management but we could not measure them in our data. Therefore, to test the linkages between these factors and inventory turnover and gross margin is beyond the scope of our study. Instead, H2 is limited to estimating the relationship between inventory turnover and gross margin.

In our Hypothesis 3, we concern the relationship between inventory turnover and sales growth.

H3: Inventory turnover is positively correlated with sales ratio.

We identify reasons to support the arguments for the positive correlation. First, based on recorded sales in period t-1, a firm makes better decisions for the next period t. When the sales recorded as a good prospective growth imply the increase in demand, the firm's average inventory decreases over the period. Therefore, sales ratio has a positive effect on inventory turnover. Second, a firm's growth rate is constrained by its internal resources such as capital, labor, stores, distribution channels and so on. We expect that in such a firm, sales could exceed inventory and it is more likely that there is a positive effect of sales ratio on inventory turnover.

In our last hypothesis, we also investigate the correlation between inventory turnover and firm size.

H4: Inventory turnover is negatively correlated with firm size.

We expect that firm size is negatively associated with inventory turns. On the operational side, excess inventory can poorly reflect ability and consequence of the firm's management team as well as effectiveness of the firm's supply chain processes (Hendricks and Singhal, 2009). In Vietnam, most basic supply chain processes are not working smoothly, thus the larger firms tend to hold more inventory levels. Furthermore, because of poor forecasting ability, unstable supply chain sources and a lack of flexibility and agility to adjust to demand shifts, the larger firm size often needs to hold a greater inventory volume. This implies that many firms deal with a huge inventory because they could not predict precisely market demand for their products. Furthermore, during the economic recession in the recent years, there have been many unsold products in most of Vietnamese firms. Consequently, it is more likely that the firm size has a negative correlation with inventory turns.

We test these hypotheses by using three separated datasets including firms in the real estate industry, firms in other industries and all firms.

c. Empirical Strategies:

We investigate the determinants impacting on inventory turnover. We rely on recent empirical research in operations management where authors explore public financial data on inventories to examine the correlation between inventory turnover and many aspects of firms' performances. Specifically, they investigate the effects of capital intensity, gross margin and sales surprise on inventory turnover (Gaur et al., 2005). Furthermore, Gaur and Kesavan (2008) extend to examine other impacts of sales growth rate and firm size on inventory turns. We follow Gaur et al. (2005) and Gaur and Kesavan (2008) to develop the regression model:

$$logIT_{iq} = \beta_0 + \beta_1 logCI_{iq} + \beta_2 logGM_{iq} + \beta_3 logSR_{iq} + \beta_4 logFS_{iq} + F_i + time_q + \varepsilon_{iq}$$

where *i* and *q* denote firms and quarters, F_i is the time-invariant firm-specific fixed effect for firm *i*, $time_q$ is the quarter-specific fixed effect for quarter *q*, and ε_{iq} denotes the error term for the observation for quarter *q* for firm *i*, called the idiosyncratic error.

We include firm-effects to control for a static firm-level unobservable. For instance, controlling firm-fixed effects enables us to avoid the possible reverse causality that

some provinces or cities with large public finances could develop a better transportation system, storages and seaports and a firm could utilize the advantages to manage inventory turns efficiently. Furthermore, as Gaur et al. (2005) pointed out, using the firm-specific fixed effects can eliminates correlations between inventory turnovers and other factors that are omitted in our data set, such as managerial efficiency, marketing, location strategy, accounting policy, and so on.

Following Gaur et al. (2005), we also include time-specific fixed effects ($time_q$) to control changes in secular characteristics over time. For instance, these changes may include economic conditions, interest rates, price level and so on. Thus, adding $time_q$ enables us to measure and compare trends in average inventory turnovers over quarters after controlling the impacts of the other factors.

We follow previous studies (Gaur et al., 2005; and Gaur & Kesavan, 2008) to test the impacts of CI, GM, SR and FS on inventory turnovers by using listed firms at HOSE. We test the hypotheses by implementing regression model above with full dataset and two separated sub-datasets. Our analysis is extended to combine different sectors instead of retailing segments as previous studies. This paper sheds a new light on the study of operation management in field of inventory, specifically in Vietnam.

4. RESULTS

We perform the replication from the empirical models of previous studies by considering the influential level of explanatory variables on inventory turnovers. First, Gaur et al. (2005) pointed out that (1) higher capital intensity increases inventory turnover, but (2) higher gross margin decreases inventory turnover. We re-examine these findings by using our dataset.

Second, following Gaur and Kesavan (2008), we investigate the impacts of sales growth and firm size on inventory turnovers. As in their argument, each factor could have either positive or negative correlation with inventory turnover. However, our arguments are different from previous studies. On the sales growth side, our expectation is in favor of positive correlation between sales growth and inventory turns. Consider a given firm with known sales in quarter q-1 making inventory decision for the next quarter q. An increase in sales will lead to an increase in sales growth. Moreover, as realized sales increase, the firm's average inventory over the period decreases. Therefore, its inventory turnover increases. Meanwhile, on the scale

side, we expect that firm size is negatively associated with inventory turns. The arguments to support our expectation is discussed further in H4 above.

Table 3 shows the results for the five different baseline specifications of the regression model by using log-transformed variables and running regressions with a full set of firm fixed effects. In column (1), we present the estimated results from the baseline replication of two hypotheses from Gaur et al. (2005) with the full dataset. Column (2) shows estimated results from the basic test of sales growth and firm size following Gaur and Kesavan (2008) with the full dataset. Column (3) presents the estimated coefficients by using the sub-dataset of firms in the real estate industry. Column (4) presents estimated coefficients by using the sub-dataset of firms in the other industries. Column (5) shows the estimated results by using the full dataset.

In Table 3, we find all estimated coefficients of main explanatory variables to be statistically significant at the 1% level, except the estimated coefficients of logGM and logFS presented in Column (3) that are significant at the 10% level and insignificant, respectively. Now we focus on some main results as follows.

First, in Column (1), the two hypotheses in Gaur et al. (2005) are consistent with our results. On the one hand, the coefficient of capital intensity is 1.0237. This implies when a firm invests more in warehouses, information technology, and inventory and logistics management, capital intensity will increases. Such an increase in capital intensity will improve inventory management efficiently. Therefore, our results are consistent with the finding of Gaur et al. (2005) that is "higher capital intensity increases inventory turnover."

On the other hand, the coefficient of gross margin is -0.1805. This result is also consistent with the finding of Gaur et al. (2005). As they point out, gross margin can not only be related to inventory turns directly through determining the optimal inventory level, but also be related to inventory turns through price, product variety, and length of product life cycle. Such an increase in indirect factors leads to decreases in inventory turns. For instance, keeping other factors constant, an increase in price of an item decreases the demand for the item but increases the gross margin of the firm and increases the coefficient of variation of demand, hence decreasing inventory turns.

Second, Column (2) presents the estimated results following Gaur and Kesavan (2008). The coefficient of sales ratio (logSR) is 0.5404. It means that a 1% increase in the sales ratio leads to a 0.5404 increase in inventory turnover, significant at the 1%

level. Our result is consistent with the finding of Gaur and Kesavan (2008). On the contrary, the coefficient of logFS is -0.5499 and significant at 1% level. This result provides a strong support for our expectation as pointed out above.

Third, Column (3), (4) and (5) show the estimated results of our regression model by using two sub-datasets and full dataset. We recognize that the effect of capital intensity on inventory turnover is much stronger among firms in the real estate industry than among firms in other industries. This result is more likely to reflect the current situation of firms in the real estate industry in recent years when the average gross fixed assets and inventory of a real estate firm is much higher than that of a firm in other industries. For instance, the mean of inventory and GFA of a real estate firm in our data is VND1,141.75 and 583.66 billion respectively, while the mean of inventory and GFA of a firm in other industries is VND244.88 and 544.69 billion respectively. As Gaur et al. (2005) pointed out, the higher the capital intensity, the greater the inventory turnover.

When we perform the regression model by using the sub dataset of firms in the real estate industry, the estimated coefficient of logGM in Column (3) is only significant at 10% level, while that of logFS is not statistically significant. Therefore, using the sub dataset of firms in the real estate industry, there is not strong evidence to support the hypothesis two (H2) and there is not enough evidence to support the hypothesis four (H4). However, the main results in the last columns are consistent with previous studies. It means that by using sub dataset of firms in other industries or full dataset, we find strong evidence to support the four hypotheses.

Table 3: Estimated Coefficients

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	(Gaur et al.,2005-Full Dataset)	**(G&K, 2008-Full Dataset)**	**Firms in the Real Estate Industry**	**Firms in Other Industries**	**Full Dataset**
logCI	1.0237***		2.4517***	0.6899***	1.0046***
	(0.0462)		(0.1720)	(0.0407)	(0.0418)
logGM	-0.1805***		-0.3250*	-0.1639***	-0.1634***
	(0.0316)		(0.1870)	(0.0261)	(0.0284)
logSG		0.5404***	0.6058***	0.5306***	0.5473***

		(0.0252)	(0.0961)	(0.0220)	(0.0228)
logFS		-0.5499***	-0.5571	-0.4304***	-0.4148***
		(0.0549)	(0.6326)	(0.0448)	(0.0499)
time	-0.0251***	0.0030	-0.0702	-0.0007	-0.0048
	(0.0024)	(0.0036)	(0.0485)	(0.0029)	(0.0033)
N	2857	2857	148	2709	2857
R^2	0.7955	0.7976	0.7606	0.8465	0.8350

Note: The dependent variable in all columns is the natural log of inventory turnover (IT). All regressions include a full set of firm fixed effects. Constants are included in all regressions but not presented in Table3. Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01

Moreover, possibly one of the interesting results is that the coefficient of time trend is negative and statistically significant at the 1% level in Column (1). It implies that inventory turnover becomes worse as the time goes on. This also reflects the recent issues of inventory management of many Vietnamese companies. Specifically, unsold products become one of main challenges that most of Vietnamese companies have to overcome.

Overall, after testing different regression models with different datasets, we find some interesting results. First, we find the positive impact of capital intensity on inventory turnover is not different from four columns. This result is consistent with previous studies. It implies that by investing in information technology as well as implements total quality management efficiently, a firm receives benefits from the management of inventory including better allocation of inventory to distribution agents, smaller batch sizes, shorter ordering lead time, and a lower of processing orders. Furthermore, we also find that the capital intensity has a stronger effect on inventory turns in the real estate industry than in the others. Since a real estate firm may attempt to increase inventory turns through using inventory as collateral to either deal with cash flows or accept an additional expenditure. By doing so, the capital intensity would increase due to a decrease in inventory level.

Second, we find sales ratio is positively associated with inventory turns. This result is also consistent with previous studies. Third, within the real estate industry, there is not enough evidence to confirm the correlation between inventory turnover and gross margin or inventory turnovers and firm size. However, with the second dataset of firms

in other industries, the results provide strong empirical evidence in support of our hypotheses.

5. CONCLUSIONS

A rich variety of inventory models has been introduced in operations management throughout exploring financial data from publicly listed firms in the United States. In this exploratory study, we have identified the need to implement empirical research to replicate and modify previous inventory models by exploring listed companies in Vietnam. We have highlighted the importance of understanding whether predictions from these models enable us to explain the current issues of inventory management in Vietnam. Like previous studies, we find that capital intensity has a strongly positive relationship with inventory turnovers by using different datasets. We also find sales ratio is positively correlated with inventory turnovers. Additionally, by using the sub-dataset of real estate firms, there is not enough strong evidence to prove the negative correlations between inventory turns and gross margin or inventory turnover and firm size. However, by using the dataset of firms in other industries, we find that gross margin has a statistically significant effect on inventory turnover and so does firm size.

We have separated two datasets but the dataset of real estate industry only covers 12 firms. This dataset could not represent the whole industry. Therefore, the results from this sub-dataset should be used with caution. Our paper suggests two durable directions for future studies on inventory management in Vietnam.

(i) Using the models to investigate the effects on inventory turnover in different sectors for all listed companies in both stock exchanges in Vietnam: The results may enable managers in each sector to have a better picture of inventory turnover management.

(ii) Investigating other drivers of inventory productivity using augmented datasets: Since public financial data do not include operational factors that play important role in efficiently inventory management. Particularly, these factors may include store locations, suppliers, number of warehouses, economic order quantity, and other operational methods being used for total quality management and so on. Conducting a richer dataset might enable us to investigate the aforementioned relationships more clearly.

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