“The impact of inventory management on Vietnam’s industrial firm performance: A double-threshold regression approach”

AUTHORS	Hai Anh Vu Thi Thi Thanh Hoang

ARTICLE INFO	Hai Anh Vu Thi and Thi Thanh Hoang (2025). The impact of inventory management on Vietnam’s industrial firm performance: A double-threshold regression approach. *Investment Management and Financial Innovations*, *22*(4), 57-69. doi:10.21511/imfi.22(4).2025.05
DOI	http://dx.doi.org/10.21511/imfi.22(4).2025.05
RELEASED ON	Monday, 13 October 2025
RECEIVED ON	Tuesday, 24 June 2025
ACCEPTED ON	Friday, 03 October 2025

JOURNAL	"Investment Management and Financial Innovations"
ISSN PRINT	1810-4967
ISSN ONLINE	1812-9358
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
57	1	9

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

Hai Anh Vu Thi (Vietnam), **Thi Thanh Hoang** (Vietnam)

THE IMPACT OF INVENTORY MANAGEMENT ON VIETNAM'S INDUSTRIAL FIRM PERFORMANCE: A DOUBLE-THRESHOLD REGRESSION APPROACH

Abstract

This paper examines the influence of inventory management on firm performance, applying Hansen's threshold estimation method across firm size. It uses panel data, including 149 industrial manufacturing firms listed on HOSE, HNX, and UPCOM markets in Vietnam from 2014 to 2024. In small firms (SIZE ≤ 24.4679), WIP (work in progress) and ITO (inventory turnover) positively affect ROA, while FIN (finished goods) has a negative effect. As SIZE increases (24.4679 < SIZE ≤ 25.0912), WIP reverses to a strong negative effect, FIN turns positive, and ITO loses statistical significance. In large firms (SIZE > 25.0912), RAW (raw materials) appears as a significant negative factor on ROA, WIP continues to have a negative effect but at a decreasing level, and FIN reverses to a negative effect. These findings suggest that SIZE is important in moderating the relationship between inventory and firm performance. The control variables also show significant effects: TANG (tangible assets) negatively affects firm performance, while CASH has a positive impact, confirming the role of working capital balance. Regarding managerial implications, SIZE is an important moderator in the relationship between inventory and firm performance. For small firms, exploiting the benefits of WIP and increasing inventory turnover can improve profitability. Meanwhile, maintaining a reasonable WIP level becomes urgent for medium and large firms to avoid wasting resources and delaying production. For the largest firms, more attention should be paid to RAW to limit the risk of capital congestion, while maintaining a suitable level of FIN to ensure a smooth supply chain.

Keywords double-threshold, industrial firms, performance, inventory management, RAW, WIP, FIN, Vietnam

JEL Classification M11, G31, D22, D24

Type of the article: Research Article

Received on: 24th of June, 2025
Accepted on: 3rd of October, 2025
Published on: 13th of October, 2025

Hai Anh Vu Thi, Doctor, Lecturer, Faculty of Transport Economics, University of Transport Technology, Vietnam. (Corresponding author)

Thi Thanh Hoang, Doctor, Lecturer, Faculty of Transport Economics, University of Transport Technology, Vietnam.

INTRODUCTION

Due to the significance of improving firm performance for stakeholders in a rapidly changing business environment, researchers have focused on increasing and identifying influencing factors. Previous studies on corporate performance have been conducted on industrial enterprises (Koumanakos, 2008; Heredia et al., 2019; Khan et al., 2020).

The performance of a company is influenced by external and internal factors (Wen, 2022; Elsayed, 2015; Orobia et al., 2020). Resource management, including inventory management, significantly affects the performance of small and medium-sized enterprises with limited working capital. Inventory plays a crucial role in a business's working capital, enabling continuous production and operations to meet market demand (Sekeroglu & Altan, 2014). Inventory management directly affects the control of accurate inventory levels and their movement in the supply chain (Oluwaseyi et al., 2017). Effective inventory management is a strategic tool to improve performance (Capkun et al., 2009; Muchaendepi et al., 2019; Hashed & Shaik, 2022).

Conflict of interest statement:
Author(s) reported no conflict of interest

In reality, many businesses have difficulty maintaining reasonable inventory levels, leading to high capital costs and reduced ability to meet customer needs. Improper inventory management reduces returns on assets (Shaik, 2021). Excess inventory increases storage costs, taxes, insurance, and spoilage costs, but conversely, inventory shortages directly reduce sales. In addition, purchasing and financial decisions in inventory management affect other functional goals in the company. Inventory decisions aim to reduce inventory to reduce capital and holding costs, but they conflict with the marketing goal of being ready to meet customer needs and retain customers. Inventory reduction decisions can cause disruptions in production when the supply chain is uncertain. Inventory management has become a key factor in balancing financial efficiency and competitiveness for enterprises in the industrial manufacturing industry with long production cycles, large investment capital, and high dependence on raw material supply.

Vietnam industrial firms are currently facing many difficulties in inventory management. The supply chain is unstable, and the demand forecasting capacity of Vietnam's industrial manufacturing firms is limited, so inventory turnover is slow. With limited capital scale, many enterprises have difficulty applying technology in inventory management, mainly relying on experience instead of quantitative data analysis, leading to frequent inventory surpluses or shortages. Therefore, this study was conducted to provide empirical evidence on the impact of inventory management on operational efficiency and propose some management implications to help enterprises optimize inventory policies to achieve operational efficiency goals.

1. LITERATURE REVIEW AND HYPOTHESES

Determining the impact of inventory management on firm performance is an issue that authors are interested in both theoretically and practically. Empirical studies on the effect of inventory in developed countries show the impact of inventory management on enterprises' performance (Eroglu & Hofer, 2010; Barker et al., 2022). Effective inventory management is difficult (Wetzel & Hofmann, 2019; Mahajan et al., 2024). Inventory management aims to reduce inventory costs and maximize profits. The right amount of inventory and the ability to meet market demand promptly are important for ensuring a company's sales. However, when the inventory is large, the reserve will increase, and losses may occur when selling at a lower price. Vastag and Whybark (2005) explained the spillover effect of effective inventory management on other management techniques, thereby increasing firm performance. Muchaendepi et al. (2019) showed that small and medium-sized manufacturing firms tend to minimize inventory investment. There is a positive correlation between inventory management strategy and performance decisions. Reducing the inventory ratio can create value for the business (Para-González et al., 2016; Zhu et al., 2020), affecting performance (Li et al., 2020). However, empirical studies by Abushaikha et al. (2018), Ali et al. (2022), and Bawa et al. (2018) showed that inventory management through the inventory reduction ratio does not affect firm performance.

Performance measured by financial indicators shows the results of implementing strategic goals and the ability to allocate resources to create profits and value for the company most clearly and convincingly (Richard et al., 2009). Return on assets (ROA) and return on equity (ROE) are two indicators used mainly to reflect the ability to implement strategic goals and allocate resources to maximize profits and corporate value. ROA reflects better performance, while ROE reflects decisions on capital structure and is greatly influenced by financial leverage (Padachi, 2006; Sharma & Kumar, 2011). ROA shows the ability of a business to exploit and effectively use total assets to generate profits, so this index shows the management efficiency from the investment, production, and product consumption stages. The higher the ROA, the better the company manages its assets to get high profits, so ROA shows the efficiency from production to sales (Tutcu et al., 2024). The empirical study of Tutcu et al. (2024) confirmed that high ROA is a testament to the company's ability to connect resources in fierce competition and constantly fluctuating markets.

http://dx.doi.org/10.21511/imfi.22(4).2025.05

Inventory includes all products in the production process, finished goods, raw materials, and finished goods that are maintained and meet current and future needs (Hedrick et al., 2008; Viloria & Robayo, 2016). Research on inventory management can be conducted on the total inventory or considered according to the types of inventories that need to be managed (Isaksson & Seifert, 2014; Manikas, 2017; Khan & Siddiqui, 2019). Empirical research by Lieberman et al. (1999) on inventory management of large-scale manufacturing firms shows that not only the short-term decision on inventory holding volume, but also the results of organizational capacity and inventory management technology have a direct impact on an enterprise's overall performance. Inventory levels reflect enterprises' choice of production and supply strategies and are greatly affected by productivity, technology level, and coordination mechanisms in the supply chain. When enterprises control the production process, increase the application of advanced technology, and have effective cooperative relationships with suppliers in the supply chain, they maintain lower inventory levels while still ensuring they meet market demand. Panigrahi et al. (2024) prove that applying modern inventory management methods using new technology reduces storage costs, shortens delivery times, improves demand forecasting accuracy, and improves market responsiveness for small and medium-sized enterprises.

Considering the individual impacts and relationships between inventory components (raw materials, work-in-process, finished goods) is an important basis for companies to focus their management efforts on different inventory areas. Gołaś (2020) pointed out that inventory components have different relationships to operational efficiency. Therefore, businesses need to have optimal inventory strategies according to the characteristics of each type of inventory. A detailed analysis of inventory structure in the study by Dave et al. (2021) shows that managing each type of inventory helps reduce inventory costs while improving the ability to respond to market demand, significantly improving operational flexibility. Empirical studies on manufacturing companies also show a significant impact of each inventory component on revenue and profit (Alrjoub & Ahmad, 2017; Eroglu & Hofer, 2011; Khan & Ghazi, 2013; Risal & Acharya, 2021).

In inventory management, inventory turnover shows the ability to sell quickly, reflecting the efficiency of working capital use (Nasution, 2020). Inventory turnover affects the cost of inventory, thus directly affecting a firm's financial performance (Sekeroglu & Altan, 2014). Huynh and Pan (2015) assert that enterprises need a clear strategy to increase inventory turnover to meet the company's value needs. Wan et al.'s (2020) study on the relationship between product diversification and inventory turnover shows that a product diversification strategy tends to increase inventory, reduce inventory turnover, and negatively affect the enterprise's profitability.

Firm Size, Asset Tangibility, and Cash Ratio are used to avoid model misspecification. Firm size indicates the volatility of inventories in the firm with different economic scales (Carpenter et al., 1998; Elsayed, 2015; Breivik, 2019; Hung & Su, 2022). In addition, firm size significantly influences inventory efficiency (Breivik et al., 2023). Asset tangibility includes being used for a long time in production, representing the tangibility of a firm (Oganda et al., 2023). Tangible assets significantly improve a firm's valuation, support effective inventory decisions, and should be considered a predictor of firm performance (Puspitawati et al., 2024). A study by Lemma-Lalisho (2022) shows that the variables tangibility, inventory turnover, and firm growth rate have a statistically significant impact on ROA. Cash Ratio indicates a company's financial flexibility in the face of market uncertainties and its ability to seize business opportunities (Yun et al., 2021). Keynes's liquidity preference theory (1936) explains the role of cash holdings on business performance.

In summary, the relationship between inventory management and firm performance has been empirically evaluated, considering the overall and individual effects of inventory factors on firm performance. However, the studies mainly focused on the context of developed countries, and some studies are in developing countries. The research results are still inconsistent in the effects of total inventory and individual inventory components on firm performance in different sectors and when considering different control variables. This is a gap for research on the relationship between inventory management and business performance, especially in the context of Vietnamese industrial manufacturing firms.

Therefore, the hypotheses are given as follows:

H1: Raw material ratio affects firm performance.

H2: Work in Progress ratio affects firm performance.

H3: Finished goods inventory ratio affects firm performance.

H4: Inventory turnover affects firm performance.

2. METHODOLOGY

The study uses secondary panel data of 149 industrial manufacturing firms listed on the Ho Chi Minh City Stock Exchange (HOSE), Hanoi Stock Exchange (HNX), and UPCOM (Unlisted Public Company Market) from 2014 to 2024 with 1639 observations. The data are from the FinPro database, including enterprises whose financial statements have been audited with an unqualified opinion, ensuring honesty and reasonableness according to the materiality principle. The data analysis process is shown in Figure 1.

Before conducting the analysis, the raw data were processed to address the issues of missing values and outliers. Processing missing data is necessary to ensure the completeness of the information and the reliability of the analysis results. After processing missing values, the research team checked and processed the balanced panel data. According to Hansen (1999), panel data must be strongly balanced to use the xthreg command. Therefore, in 2014–2024, firms with incomplete annual observations were removed to ensure the consistency and reliability of the model. Outliers, too high or too low values, compared to most of the data set, were also identified and processed to remove extreme values without losing data.

Hao et al. (2022) used a double-threshold panel model to explore the nonlinear relationship between financial flexibility (FF) and sustainable innovation (SI) and the moderating role of economic policy uncertainty (EPU). Attia et al. (2023) found a nonlinear relationship between debt and firm performance using a dynamic panel threshold regression model (DPTR). SIZE was selected as the threshold variable for the results of two thresholds and three data regions.

Based on the empirical findings of previous studies, combined with the synthesized theoretical basis, a research model on the relationship between

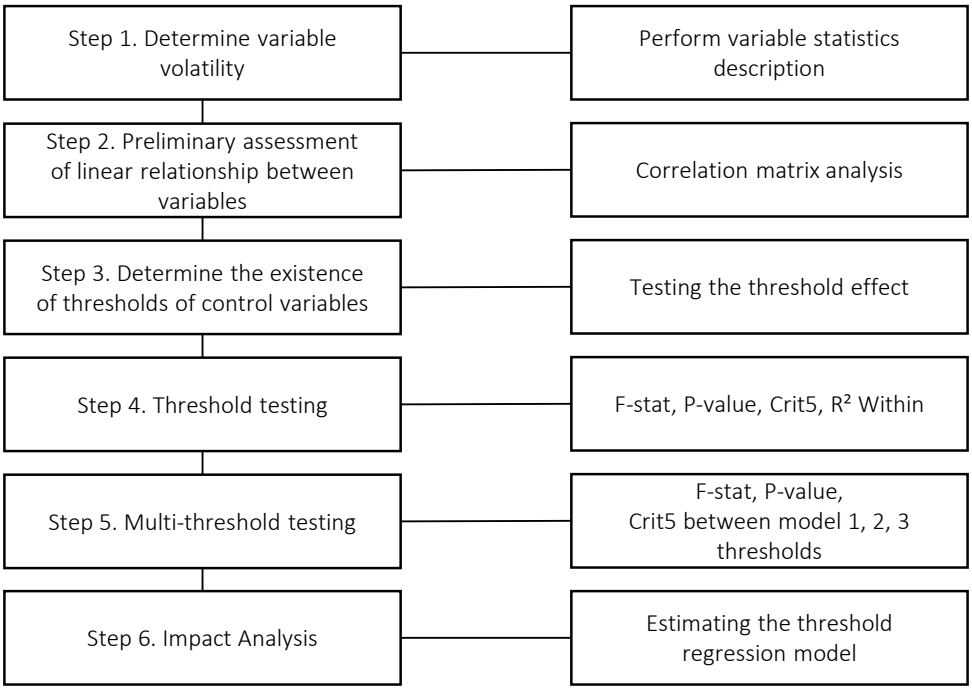

Figure 1. Research framework

http://dx.doi.org/10.21511/imfi.22(4).2025.05

inventory components and financial performance is proposed using the general threshold regression method as follows:

$$ROA = \beta 0 + \sum_{(J=1)}^{(n+1)} \beta_1 \cdot INV\_Group_{i,t} \times I(\gamma_{(j-1)} < SIZE_{i,t} < \gamma_j) + \sum(\beta k \cdot Control_{(k,i,t)}) + \varepsilon_{i,t}, \quad (1)$$

where *ROA* (Return on Assets) is the dependent variable. $INV\_Group_{i,t}$ is the group of independent variables representing inventory management (such as RAW, WIP, FIN, and ITO), with the assumed impact that can change depending on the value of the threshold variable. *SIZE* is the size of an enterprise used as the threshold variable. $Control_k$ is the control variable, including SIZE (firm size), TANG (tangible assets), and CASH (Cash and Cash Equivalents). γ is the unknown threshold value of the SIZE variable, which needs to be estimated from the data. I(·) is the indicator function, which takes the value one if the condition in parentheses is true and zero otherwise. ε is the random error of the model.

Detailed definitions and measurements of the variables are in Table 1.

3. RESEARCH RESULTS

The variable descriptive statistics are presented in Table 2, in which the number of research samples includes 149 industrial manufacturing firms listed on the Ho Chi Minh City Stock Exchange (HOSE), Hanoi Stock Exchange (HNX), and UPCOM market from 2014 to 2024, with 1,639 observations. The statistics describe the variables' mean values, standard deviation, minimum values, and maximum values.

Table 2. Descriptive statistics

Variables	Obs.	Mean	Std. dev.	Min	Max
ROA	1639	0.0403	0.0847	–0.2816	0.2878
RAW	1639	0.0721	0.0590	0.0013	0.2175
WIP	1639	0.0685	0.1126	0.0000	0.4188
FIN	1639	0.0626	0.0795	0.0000	0.2871
ITO	1639	6.7409	6.6600	0.9782	27.8481
SIZE	1639	26.6459	1.4334	23.1189	31.7450
TANG	1639	0.2333	0.1975	0.0000	0.8888
CASH	1639	0.0744	0.0874	0.0005	0.4378

The statistical results in Table 2 show that Return on Assets (ROA) has an average value of 0.0403. This means that the average industrial manufacturing firm earns a profit of 4.03% of total assets; the standard deviation is 0.0847, the smallest value is –0.2816, and the largest value is 0.2878. There is a high standard deviation and large amplitude of fluctuations, reflecting significant differences in management efficiency between industrial manufacturing firms. Some enterprises operate inefficiently, as negative ROA shows, while others utilize resources effectively to achieve high profitability.

The indicators related to inventory management, RAW, WIP, FIN, and ITO, have average values of 0.0721, 0.0685, 0.0626, and 6.7409, respectively. The minimum value of inventory variables WIP and FIN is 0, which shows that during the research period, there were years when firms had no unfinished products at the time of reporting.

Table 1. Variable description

Category	Variable name	Symbol	Formula	Source
Firm Performance	Return On Assets	ROA	Net Income / Net revenue	Capkun et al. (2009), Sekeroglu and Altan (2014)
Inventory Management	Raw Material Inventory Ratio	RAW	Raw Material Inventory / Net revenue	Alrjoub and Ahmad (2017), Capkun et al. (2009)
	Work in Progress Ratio	WIP	Work in progress / Net revenue	Alrjoub and Ahmad (2017), Capkun et al. (2009)
	Finished Goods Inventory Ratio	FIN	Finished Goods Inventory / Net Revenue	Alrjoub and Ahmad (2017), Capkun et al. (2009)
	Inventory Turnover	ITO	Cost of Goods Sold / Inventory	Lemma-Lalisho (2022)
Control variables	Firm Size	SIZE	Logarit (Total assets)	Breivik (2019), Hung and Su (2022)
	Asset Tangibility	TANG	Tangible Fixed Assets / Total Assets	Puspitawati et al. (2024), Oganda et al. (2023)
	Cash Ratio	CASH	Cash And Cash Equivalents / Total Assets	Yun et al. (2021)

They had sold all finished products. WIP and FIN have extremely high dispersion, indicating significant differences in the industrial manufacturing firms' production processes, production scale, or inventory strategies. RAW also has a high level of dispersion, but lower than WIP and FIN; some enterprises almost do not record the ending inventory of raw materials, but there are also enterprises with high ending inventory. The ITO variable has an average value of 6.7409; the standard deviation is 6.66, the minimum value is 0.9782, and the maximum value is 27.8481, showing that the inventory value of industrial manufacturing firms has a high level of dispersion. The firms keep inventories at very different levels. The range between the maximum and the minimum value is 26.8699, so there is a large difference in inventory policy between industrial manufacturing firms. This indicator also reflects the clear diversity in inventory management policies.

For the control variable group, the SIZE variable has an average value of 26.6465, a low standard deviation of 1.4334, and a range between the largest and smallest values of 8.6261, showing that the research sample is relatively uniform in size, mostly belonging to the group of medium and large firms. The TANG variable has an average value of 0.2333 and a standard deviation of 0.1975, showing that enterprises have a relatively low proportion of tangible fixed assets and a wide dispersion. Excluding the difference in size, this proves that each industrial manufacturing firm has differences in investment strategies and production characteristics. The smallest value of TANG is zero because two observation samples record the remaining value of tangible fixed assets as 0. After all, tangible fixed assets have been fully depreciated. The cash holding ratio (CASH) is quite modest, averaging only 0.0744 and ranging from 0.0005 to 0.4378, reflecting the characteristics of the industrial manufacturing sector that often prioritizes investment in inventories.

Table 3 presents the Pearson correlation coefficient matrix between the variables in the model to determine the linear relationship between profitability (measured by ROA), the independent and control variables. The results show that ROA has a significant negative correlation with all inventory variables, such as RAW, WIP, and FIN, with values of –0.1242, –0.2845, and –0.1519, respectively. These negative coefficients reflect the increase in inventory, specifically the accumulation of raw materials, unfinished products, and finished products, showing that the production process is not optimal, increasing production costs, and causing disadvantages to the business results; this is consistent with the Modern Inventory Theory, specifically the JIT (Just-In-Time) model of G. Singh and A. I. Singh (2012). The ITO variable positively correlates with ROA, suggesting that increased inventory efficiency can improve firm profitability.

For the remaining group, ROA is positively correlated with SIZE and CASH and negatively correlated with TANG, indicating that large-scale enterprises, stable asset structure, and effective inventory management capabilities imply higher profits. Meanwhile, holding a large amount of cash is a factor that helps firms proactively respond to flexible inventory strategies to increase the financial efficiency of industrial manufacturing firms.

In addition to the dependent variable (ROA) and independent variables related to inventory management, the model includes a group of control variables. The group of control variables includes three variables: SIZE, TANG, and CASH. Tables 4 and 5 present the threshold results testing the

Table 3. Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) ROA	1.000	–	–	–	–	–	–	–
(2) RAW	–0.1242	1.000	–	–	–	–	–	–
(3) WIP	–0.2845	–0.0130	1.000	–	–	–	–	–
(4) FIN	–0.1519	0.4371	–0.0295	1.000	–	–	–	–
(5) ITO	0.1202	–0.4505	–0.3152	–0.3981	1.000	–	–	–
(6) SIZE	0.1261	–0.1085	0.0674	–0.0904	–0.0895	1.000	–	–
(7) TANG	–0.1456	0.1446	–0.1913	0.0799	0.0323	0.1151	1.000	–
(8) CASH	0.3043	–0.0866	–0.1550	–0.0797	0.1082	–0.0698	–0.2325	1.000

http://dx.doi.org/10.21511/imfi.22(4).2025.05

Table 4. Threshold estimates

Model	Dependent Variable	Estimated Threshold	95% Confidence Interval		R^2 Within
			Lower	Upper	
SIZE	ROA	24.4679	24.4210	24.5397	0.1786

Table 5. The threshold effect test

Model	Dependent Variable	RSS	MSE	F-stat	p-value	Crit10	Crit5	Crit1
SIZE	ROA	3.8560	0.0024	145.09	0.0000	39.3931	44.3507	56.1324

Note: Critical values at 10%, 5%, and 1% significance levels.

SIZE control variables and whether the relationship between the elements constituting inventory and the profitability of industrial manufacturing firms changes according to this threshold variable. The threshold regression model allows dividing the research sample into groups based on the values of the moderating variables used as threshold variables, thereby assessing the different effects of the elements constituting the inventory in each threshold value range. The test is performed through the fixed-threshold regression method with 150 bootstraps to calculate the statistical critical value.

Based on the values of Fstat, Prob, and Crit5, the results show that the variable SIZE has Fstat > Crit5 (145.09 > 44.3507) and P-value = 0.0000 < 0.05, rejecting the hypothesis H0 about the nonexistence of the threshold and confirming that the threshold is statistically significant at the 1% level (Hansen, 1999). Thus, a threshold effect was determined after testing the threshold effect at the variable SIZE. That shows that SIZE divides the relationship between the factors that make up inventory and the performance of industrial manufacturing enterprises according to different threshold zones.

After determining a threshold at the SIZE variable to examine the deeper nonlinearity in the relationship between inventory management and firm performance, the study continued to test whether there was more than one threshold between the independent and dependent variables.

Tables 6 and 7 show the results of the multi-threshold test. For the firm size variable, at the first and second threshold values, Fstat > Crit5, P-value < 0.05, but at the third threshold value, Fstat < Crit5 (62.69 < 125.6456) and P-value = 0.6800 > 0.05, so the model only has two threshold values, and both threshold values are statistically significant at the 1% level.

Table 8 shows that all independent variables impact the dependent variable ROA. In region 1 (SIZE ≤ 24.4679), WIP, FIN, and ITO all have significant

Table 6. Multiple threshold estimates

Model		Threshold Lower	95% Confidence Interval		R^2 Within
			Upper		
SIZE	Th-1	24.4679	24.4210	24.5397	0.2413
	Th-21	24.4679	24.4210	24.5397	
	Th-22	25.0912	25.0426	25.1276	
	Th-3	25.8367	25.7876	25.8498	

Table 7. Multiple threshold test statistics

Model		RSS	MSE	F-stat	p-value	Crit10	Crit5	Crit1
SIZE	Single	3.8560	0.0024	145.09	0.0000	36.9366	42.7355	67.2727
	Double	3.6985	0.0023	69.33	0.0000	35.7140	42.2740	53.6749
	Triple	3.6985	0.0022	62.69	0.6800	106.8280	125.6456	137.4809

Note: The table reports bootstrap F-statistics based on 150 replications.

Table 8. Threshold effects of inventory components on ROA

Variable	ROA (SIZE ≤ 24.4679)	ROA (24.4679< SIZE ≤ 25.0912)	ROA (SIZE > 25.0912)
TANG	−0.0304* (0.0161)		
CASH	0.119*** (0.0219)		
RAW	0.115 (0.131)	0.0299 (0.0907)	−0.251*** (0.0442)
WIP	0.388*** (0.0902)	−0.270*** (0.0626)	−0.0998*** (0.0264)
FIN	−0.558*** (0.0928)	0.193** (0.0830)	−0.184*** (0.0339)
ITO	0.0116*** (0.0012)	0.0005 (0.0007)	−0.0005 (0.0004)
Constant	0.0690*** (0.00687)		
Gamma, γ	–	24.4679	25.0912
Observations	1639		

Note: *** p < 0.01; **p < 0.05; * p < 0.1. Standard errors are in parentheses.

effects (P-value < 0.01) with the regression coefficients of 0.388, −0.558, and 0.0116, respectively.

Beyond this threshold point to zone 2 (24.4679 < SIZE ≤ 25.0912), for larger firms, RAW still has no impact on ROA while WIP reverses from positive to negative impact, but the impact level is strong (coefficient = −0.27, p < 0.01). Like WIP, FIN also reverses negative to positive impact, but the impact level decreases (coefficient = 0.193, p < 0.05).

Crossing the second threshold to zone 3 (SIZE > 25.0912), RAW strongly affects ROA with a coefficient of 0.251. WIP still has a negative impact, but the regression coefficient decreases from −0.27 to −0.0998, both of which are statistically significant at the 1% level.

Regarding the control variables, the TANG has a negative coefficient that is weakly significant (β = −0.0304, p < 0.10), indicating a limited adverse effect on ROA. In contrast, LEV exhibits a positive and highly significant impact (β = 0.119, p < 0.01), suggesting that higher leverage is associated with improved firm performance in Vietnam industrial manufacturing firms. This implies that the use of debt financing plays a stronger role in explaining firm performance compared with asset tangibility.

Results of hypothesis testing are presented in Table 9.

4. DISCUSSION

The results of the multiple threshold test with the SIZE control variable indicate that there are two thresholds (3 regions). In the first region, WIP has a positive impact on ROA, consistent with the study of Alrjoub and Ahmad (2017), and ITO has a positive impact on ROA; this result is similar to the studies by Sekeroglu and Altan (2014),

Table 9. Hypothesis testing

Hypothesis	SIZE ≤ 24.4679	24.4679 < SIZE ≤ 25.0912	SIZE > 25.0912
H1: Raw material inventory ratio affects firm performance	Not supported	Not supported	Supported (–)
H2: Work in Progress Ratio affects firm performance	Supported (–)	Supported (–)	Supported (–)
H3: Finished goods inventory ratio affects firm performance	Supported (–)	Supported (+)	Supported (–)
H4: Inventory turnover affects firm performance	Supported (+)	Not supported	Not supported

http://dx.doi.org/10.21511/imfi.22(4).2025.05

Huynh and Pan (2015), Wan et al. (2020), and Lemma-Lalisho (2022). FIN negatively impacts the financial performance of industrial manufacturing firms, contrary to the study by Manikas (2017). Within the second regime, like WIP, FIN also reverses the negative to positive impact, differing from the findings of Alrjoub and Ahmad (2017), but the impact level decreases. ITO has a clear impact in the pre-threshold zone but is no longer significant in the post-threshold zone. This shows that larger industrial firms need to strictly control the inventory of unfinished products to avoid production delays, resource waste, and negatively affect the financial performance, while maintaining a reasonable level of finished product inventory to ensure a smooth supply chain, increase sales speed, and improve a firm's performance. RAW now has a strong negative impact on ROA in regime 3; this result is contrary to the studies by Alrjoub and Ahmad (2017) and Dave et al. (2021). This proves that large-scale industrial manufacturing firms, keeping inventories at a reasonable level, help firms manage the production process well, effectively control costs arising from WIP. Finished product inventories have a negative impact on ROA. ITO no longer affects ROA after the first threshold.

For small-scale industrial manufacturing firms (SIZE ≤ 24.4679), managers need to optimize the process of handling unfinished products and ensure continuous production flow as a top priority, reducing excess finished product inventory to reduce storage costs and loss risks. Strengthen production process control to minimize unfinished products, avoid waste accumulation, and effectively manage finished product inventory to support the ability to respond to the market in medium-sized enterprises (24.4679 < SIZE ≤ 25.0912). For large-scale firms (SIZE > 25.0912), managers need solutions to improve the ability to forecast raw material demand, avoid excessive storage of raw materials, standardize production processes to reduce intermediate inventory, implement lean inventory or Just-in-Time (JIT) for finished products, and reduce storage costs.

The empirical results show that all inventory constituents have significant effects and are statistically within the threshold range of industrial manufacturing firm size. This emphasizes the role of inventory management in production and business activities, especially in industrial manufacturing firms. The role of inventory management is reflected in inventory turnover and the structure of inventory components. Effective inventory control helps industrial manufacturing firms maintain reasonable inventory levels while ensuring a smooth supply chain. Thus, industrial manufacturing firms at different scales have different mechanisms of impact of factors related to inventory management on financial performance.

For the remaining control variables, TANG has a negative effect on the firm performance; this result is consistent with Lemma-Lalisho (2022) on the impact of tangible assets. Industrial manufacturing firms with more tangible fixed assets tend to have lower profitability. In working capital management, the level of cash holding and inventory has a trade-off relationship. CASH has a positive and highly statistically significant relationship with ROA in the model, which agrees with the results of Yun et al. (2021), Hung and Su (2022). It confirms the role of cash in the relationship between inventory and firm performance. Manufacturing firms often hold cash at an average level to maintain stable inventories.

CONCLUSION

The purpose of this study is to investigate the impact of inventories on the financial performance of Vietnam's industrial manufacturing enterprises by applying the threshold model. The study provides relevant evidence and proposes a research model on the nonlinear relationship between inventories and the profitability of these firms. The research results show strong evidence of the nonlinear relationship between inventory management and firm performance. The threshold variable of firm size reveals a clear change in both the magnitude and the direction of impact of the elements inventory on firm performance across different thresholds. Enterprises with small and medium-scale inventory can reduce their financial performance if they do not manage inventory effectively; enterprises with large-scale

inventory are better controlled. Inventory management is closely related to the supply chain from raw materials of suppliers to unfinished products in the production process and finished product inventory serving consumers. Effective inventory management helps to connect the links in the product supply chain in a synchronous manner. This study evaluated the relationship between inventory components and the firm performance of industrial manufacturing firms using the double-threshold model. There have been studies on the relationship between inventory components and financial performance. However, this study used the SIZE variable partitioning to evaluate the relationship between inventory components and financial performance in the context of industrial manufacturing firms in Vietnam.

Besides the importance of this study, it also has certain limitations. First, the empirical results only apply to industrial manufacturing firms on the stock exchange and the Upcom market. Second, this study only considers internal factors without including how macro factors affect and regulate the relationship between inventories and a firm's performance. Future research should test the inclusion of macro factors, expand the research sample to other industries, and compare industries with each other.

AUTHOR CONTRIBUTIONS

Conceptualization: Hai Anh Vu Thi, Thi Thanh Hoang.
Data curation: Hai Anh Vu Thi.
Formal analysis: Hai Anh Vu Thi.
Investigation: Hai Anh Vu Thi, Thi Thanh Hoang.
Methodology: Hai Anh Vu Thi.
Project administration: Hai Anh Vu Thi.
Resources: Hai Anh Vu Thi.
Software: Hai Anh Vu Thi.
Supervision: Hai Anh Vu Thi.
Validation: Hai Anh Vu Thi, Thi Thanh Hoang.
Visualization: Hai Anh Vu Thi.
Writing – original draft: Hai Anh Vu Thi, Thi Thanh Hoang.
Writing – review & editing: Hai Anh Vu Thi, Thi Thanh Hoang.

REFERENCES

1. Abushaikha, I., Salhieh, L., & Towers, N. (2018). Improving distribution and business performance through lean warehousing. *International Journal of Retail & Distribution Management, 46*(8), 780-800. https://doi.org/10.1108/IJRDM-03-2018-0059
2. Ali, K., Showkat, N., & Chisti, K. A. (2022). Impact of inventory management on operating profits: Evidence from India. *Journal of Economics, Management and Trade, 28*(9), 22-26. https://doi.org/10.9734/JEMT/2022/v28i930435
3. Alrjoub, A. M. S., & Ahmad, M. A. (2017). Inventory management, cost of capital and firm performance: evidence from manufacturing firms in Jordan. *Investment Management and Financial Innovations, 14*(3), 4-14. https://doi.org/10.21511/imfi.14(3).2017.01
4. Attia, E. F., Ezz Eldeen, H. H., & Daher, S. S. (2023). Size-threshold effect in the capital structure–firm performance nexus in the MENA region: a dynamic panel threshold regression model. *Risks, 11*(2), 23. https://doi.org/10.3390/risks11020023
5. Barker, J. M., Hofer, C., Hoberg, K., & Eroglu, C. (2022). Supplier inventory leanness and financial performance. *Journal of Operations Management, 68*(4), 385-407. https://doi.org/10.1002/joom.1185
6. Bawa, S., Asamoah, G. E., & Kissi, E. (2018). Impact of inventory management on firm performance: A case study of listed manufacturing firms in Ghana. *International Journal of Finance and Accounting, 7*(4), 83-96. Retrieved from http://article.sapub.org/10.5923.j.ijfa.20180704.01.html
7. Breivik, J. (2019). Retail chain affiliation and time trend effects on inventory turnover in Norwegian SMEs. *Cogent Business & Management, 6*(1). https://doi.org/10.1080/23311975.2019.1604932
8. Breivik, J., Larsen, N. M., Thyholdt, S. B., & Myrland, Ø. (2023). Measuring inventory turnover

http://dx.doi.org/10.21511/imfi.22(4).2025.05

efficiency using stochastic frontier analysis: building materials and hardware retail chains in Norway. *International Journal of Systems Science: Operations & Logistics, 10*(1), 1964635. https://doi.org/10.1080/23302674.2021.1964635

9. Capkun, V., Hameri, A. P., & Weiss, L. A. (2009). On the relationship between inventory and financial performance in manufacturing companies. *International Journal of Operations & Production Management, 29*(8), 789-806. https://doi.org/10.1108/01443570910977698
10. Carpenter, R. E., Fazzari, S. M., & Petersen, B. C. (1998). Financing constraints and inventory investment: A comparative study with high-frequency panel data. *Review of Economics and Statistics, 80*(4), 513-519. https://doi.org/10.1162/003465398557799
11. Dave, T., Joshi, A. B., & Dave, A. (2021). An Impact of Inventory Management on the Profitability of Pharmaceutical Companies: Evidences from India. *Turkish Online Journal of Qualitative Inquiry, 12*(3), 1827-1835. Retrieved from https://tojqi.net/index.php/journal/article/view/1581
12. Elsayed, K. (2015). Exploring the relationship between efficiency of inventory management and firm performance: an empirical research. *International Journal of Services and Operations Management, 21*(1), 73-86. https://doi.org/10.1504/IJSOM.2015.068704
13. Eroglu, C., & Hofer, C. (2010). Lean, leaner, too lean? The inventory-performance link revisited. *Journal of Operations Management, 29*(4), 356-369. https://doi.org/10.1016/j.jom.2010.05.002
14. Eroglu, C., & Hofer, C. (2011). Inventory types and firm performance: Vector autoregressive and vector error correction models. *Journal of Business Logistics, 32*(3), 227-239. https://doi.org/10.1111/j.2158-1592.2011.01019.x
15. Gołaś, Z. (2020). Does Inventory Management Improve Profitability? Empirical Evidence from Polish Manufacturing Industries. *European Research Studies, 23*(2), 939-961. https://doi.org/10.35808/ersj/1908
16. Hansen, B. E. (1999). Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of Econometrics, 93*(2), 345-368. https://doi.org/10.1016/S0304-4076(99)00025-1
17. Hao, Z., Zhang, X., & Wei, J. (2022). Research on the effect of enterprise financial flexibility on sustainable innovation. *Journal of Innovation & Knowledge, 7*(2), 100184. https://doi.org/10.1016/j.jik.2022.100184
18. Hashed, A. W. A., & Shaik, A. R. (2022). The nexus between inventory management and firm performance: A Saudi Arabian perspective. *The Journal of Asian Finance, Economics and Business, 9*(6), 297-302. Retrieved from https://scholar.kyobobook.co.kr/article/detail/4010036893266
19. Hedrick, F. D., Barnes, F. C., Davis, E. W., Whybark, C. D. C., & Krieger, M. (2008). *Inventory management.* US Small Business Administration. Retrieved from https://www.academia.edu/30820913/INVENTORY_MANAGEMENT
20. Heredia Pérez J. A., Geldes, C., Kunc, M. H., & Flores, A. (2019). New approach to the innovation process in emerging economies: the manufacturing sector case in Chile and PERU. *Technovation, 79,* 35-55. https://doi.org/10.1016/j.technovation.2018.02.012
21. Hung, N. T., & Su Dinh, T. (2022). Threshold effect of working capital management on firm profitability: evidence from Vietnam. *Cogent Business & Management, 9*(1), 2141090. https://doi.org/10.1080/23311975.2022.2141090
22. Huynh, C. H., & Pan, W. (2015). Operational strategies for supplier and retailer with risk preference under VMI contract. *International Journal of Production Economics, 169,* 413-421. https://doi.org/10.1016/j.ijpe.2015.07.026
23. Isaksson, O. H., & Seifert, R. W. (2014). Inventory leanness and the financial performance of firms. *Production Planning & Control, 25*(12), 999-1014. https://doi.org/10.1080/09537287.2013.797123
24. Keynes, J. M. (1937). The general theory of employment. *The Quarterly Journal of Economics, 51*(2), 209-223. https://doi.org/10.2307/1882087
25. Khan, F., & Siddiqui, D. A. (2019). Impact of Inventory Management on Firm's Efficiency – A Quantitative Research Study on Departmental Stores Operating in Karachi. *Social Science and Humanities Journal,* 3(4), 964-980. Retrieved from https://ssrn.com/abstract=3397105
26. Khan, G. A., & Ghazi, I. U. (2013). Working capital management and firm performance in Karachi Stock Exchange (KSE). *Management and Administrative Sciences Review, 1*(1), 1-13. Retrieved from https://www.academia.edu/3671909/Working_Capital_Management_and_Firm_Performance_in_Karachi_Stock_Exchange_KSE
27. Khan, U., Zhang, Y., & Salik, M. (2020). The financial performance of Korean manufacturing SMEs: influence of human resources management. *The Journal of Asian Finance, Economics and Business, 7*(8), 599-611. Retrieved from https://www.kci.go.kr/kciportal/ci/sereArticleSearch/ciSereArtiView.kci?sereArticleSearchBean.artiId=ART002616472
28. Koumanakos, D. P. (2008). The effect of inventory management on firm performance. *International Journal of Productivity and Performance Management, 57*(5), 355-369. https://doi.org/10.1108/17410400810881827
29. Lemma-Lalisho, D. (2022). Determinants of firm's profitability: in the case of selected Ethiopian tannery companies. *Revista de Investigaciones Universidad del Quindío, 34*(1), 80-96. Retrieved from https://portal.amelica.org/ameli/journal/517/5173110007/
30. Li, G., Li, L., Choi, T. M., & Sethi, S. P. (2020). Green supply chain management in Chinese firms: Innovative measures and the moderating role of quick response technology. *Journal of Operations Management, 66*(7-8), 958-988. https://doi.org/10.1002/joom.1061

31. Lieberman, M. B., Helper, S., & Demeester, L. (1999). The empirical determinants of inventory levels in high-volume manufacturing. *Production and Operations Management, 8*(1), 44-55. https://doi.org/10.1111/j.1937-5956.1999.tb00060.x

32. Mahajan, P. S., Raut, R. D., Kumar, P. R., & Singh, V. (2024). Inventory management and TQM practices for better firm performance: a systematic and bibliometric review. *The TQM Journal, 36*(2), 405-430. https://doi.org/10.1108/TQM-04-2022-0113

33. Manikas, A. (2017). Interdependence among inventory types and firm performance. *Operations and Supply Chain Management: An International Journal, 10*(2), 63-80. http://doi.org/10.31387/oscm0270181

34. Muchaendepi, W., Mbohwa, C., Hamandishe, T., & Kanyepe, J. (2019). Inventory management and performance of SMEs in the manufacturing sector of Harare. *Procedia Manufacturing, 33,* 454-461. https://doi.org/10.1016/j.promfg.2019.04.056

35. Nasution, A. A. (2020). Effect of inventory turnover on the level of profitability. In *IOP Conference Series: Materials Science and Engineering, 725*(1), 012137. https://doi.org/10.1088/1757-899X/725/1/012137

36. Oganda, A. J., Mogwambo, V. A., & Museve, E. (2023). Asset tangibility and financial performance: The moderating role of economic growth and earnings volatility. *Journal of Finance & Accounting, 7*(1), 139-164. https://doi.org/10.53819/81018102t2125

37. Oluwaseyi, J. A., Onifade, M. K., & Odeyinka, O. F. (2017). Evaluation of the role of inventory management in logistics chain of an organisation. *LOGI: Scientific Journal on Transport and Logistics, 8*(2), 1-11. https://doi.org/10.1515/logi-2017-0011

38. Orobia, L. A., Nakibuuka, J., Bananuka, J., & Akisimire, R. (2020). Inventory management, managerial competence and financial performance of small businesses. *Journal of Accounting in Emerging Economies, 10*(3), 379-398. https://doi.org/10.1108/JAEE-07-2019-0147

39. Padachi, K. (2006). Trends in working capital management and its impact on firms' performance: an analysis of Mauritian small manufacturing firms. *International Review of Business Research Papers, 2*(2), 45-58. Retrieved from https://www.semanticscholar.org/paper/TRENDS-IN-WORKING-CAPITAL-MANAGEMENT-AND-ITS-IMPACT-Padachi/242f9290635ce167d15f1b5ca20f3e3b44f6d7b8

40. Panigrahi, R. R., Shrivastava, A. K., & Kapur, P. K. (2024). Impact of inventory management practices on the operational performances of SMEs: review and future research directions. *International Journal of System Assurance Engineering and Management, 15*(5), 1934-1955. https://doi.org/10.1007/s13198-023-02216-4

41. Para-González, L., Jiménez-Jiménez, D., & Martínez-Lorente, Á. N. R. (2016). Do total quality management and the European Foundation for Quality Management model encourage a quality-oriented human resource management system? *International Journal of Productivity and Quality Management, 17*(3), 308-327. https://doi.org/10.1504/IJPQM.2016.074863

42. Puspitawati, L., Lhutfi, I., & Qudratov, I. (2024). Enhancing inventory efficiency: the role of Strategic Management Accounting and Integrated Management Accounting Information systems. *Cogent Business & Management, 11*(1), 2429801. https://doi.org/10.1080/23311975.2024.2429801

43. Richard, P. J., Devinney, T. M., Yip, G. S., & Johnson, G. (2009). Measuring Organizational Performance: Towards Methodological Best Practice. *Journal of Management, 35*(3), 718-804. https://doi.org/10.1177/0149206308330560

44. Risal, N., & Acharya, S. (2021). Inventory management and financial performance of Nepalese public enterprises. *Journal of Business and Social Sciences, 3*(1), 45-63. https://doi.org/10.3126/jbss.v3i1.40855

45. Sekeroglu, G., & Altan, M. (2014). The relationship between inventory management and profitability: A comparative research on Turkish firms operated in weaving industry, eatables industry, wholesale and retail industry. *International Journal of Social, Management, Economics and Business Engineering, 8*(6), 1665-1670. http://dx.doi.org/10.5281/zenodo.1093140

46. Shaik, A. R. (2021). Components of working capital and profitability in Saudi Arabian companies. *Investment Management & Financial Innovations, 18*(3), 52. https://doi.org/10.21511/imfi.18(3).2021.05

47. Sharma, A. K., & Kumar, S. (2011). Effect of working capital management on firm profitability: Empirical evidence from India. *Global Business Review, 12*(1), 159-173. https://doi.org/10.1177/097215091001200110

48. Singh, G., & Singh, A. I. (2012). Just-in-time manufacturing: literature review and directions. *International Journal of Business Continuity and Risk Management, 3*(1), 57. https://doi.org/10.1504/IJBCRM.2012.045519

49. Tutcu, B., Kayakuş, M., Terzioğlu, M., Ünal Uyar, G. F., Talaş, H., & Yetiz, F. (2024). Predicting Financial Performance in the IT Industry with Machine Learning: ROA and ROE Analysis. *Applied Sciences, 14*(17), 7459. https://doi.org/10.3390/app14177459

50. Vastag, G., & Whybark, D. C. (2005). Inventory management: is there a knock-on effect? *International Journal of Production Economics, 93,* 129-138. https://doi.org/10.1016/j.ijpe.2004.06.011

51. Vătavu, S. (2015). The impact of capital structure on financial performance in Romanian listed companies. *Procedia Economics and Finance, 32,* 1314-1322. https://doi.org/10.1016/S2212-5671(15)01508-7

52. Viloria, A., & Robayo, P. V. (2016). Inventory reduction in the supply chain of finished products for multinational companies.

http://dx.doi.org/10.21511/imfi.22(4).2025.05

Indian Journal of Science and Technology, 9(47), 1-5. https://dx.doi.org/10.17485/ijst/2016/v9i47/107366

53. Wan, X., Britto, R., & Zhou, Z. (2020). In search of the negative relationship between product variety and inventory turnover. *International Journal of Production Economics, 222,* 107503. https://doi.org/10.1016/j.ijpe.2019.09.024

54. Wen, Y. (2022). [Retracted] The Macroreform of the Electronics Manufacturing Industry under the Industry 4.0 Wave Based on Financial Performance Indicators. *Mobile Information Systems, 2022*(1), 6436112. https://doi.org/10.1155/2022/6436112

55. Wetzel, P., & Hofmann, E. (2019). Supply chain finance, financial constraints and corporate performance: An explorative network analysis and future research agenda. *International Journal of Production Economics, 216,* 364-383. https://doi.org/10.1016/j.ijpe.2019.07.001

56. Yun, J., Ahmad, H., Jebran, K., & Muhammad, S. (2021). Cash holdings and firm performance relationship: Do firm-specific factors matter? *Economic Research-Ekonomska Istraživanja, 34*(1), 1283-1305. https://doi.org/10.1080/1331677X.2020.1823241

57. Zhu, S., van Jaarsveld, W., & Dekker, R. (2020). Spare parts inventory control based on maintenance planning. *Reliability Engineering & System Safety, 193,* 106600. https://doi.org/10.1016/j.ress.2019.106600