Managerial and Decision Economics

WILEY

RESEARCH ARTICLE OPEN ACCESS

Resilience in Cyclicality: Impact of Inventory Management Efficiency on Operational Profitability

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Received: 27 July 2024 | **Revised:** 10 September 2024 | **Accepted:** 24 September 2024

Funding: This work was supported by Nord Business School.

Keywords: cyclical | inventory days | non-linear | operating margin | profitability | working capital management

ABSTRACT

The cyclical and non-cyclical nature of the consumer goods industry presents unique dynamics that require discernment in analyzing working capital (WC). These firms often deal with considerable inventory levels that create costs and liquidity challenges, particularly during economic downturns. This paper investigates the impact of inventory days (InvD) on operating margin (OM) in both demand-stable and demand-sensitive businesses. The empirical analysis employs system GMM regression with a sample of publicly traded US consumer goods firms from 2010 to 2022. The findings reveal an inverted U-shaped relationship between InvD and OM among cyclical companies, indicating that these firms require a comparatively lower optimal inventory level (108 days) to maximize profitability at 3%. The results highlight the importance of strategic inventory management (IM) under varying economic and demand conditions and balancing the risks of stock-outs against the costs of overstocking to optimize profitability. This paper contributes to the literature on the impact of inventory dynamics on operating profit in stable and volatile markets. It estimates the optimal inventory level that enhances profitability and predicts the optimal inventory dynamics for maximum profit.

1 | Introduction

Inventory management has garnered significant managerial attention since the early 21st century. In 2015, the top 2000 companies in the United States and Europe invested approximately $187.5 billion and $820 billion in excess inventory, respectively. This situation highlights inefficiencies in inventory management (Afrifa et al. 2021). To enhance operational efficiency, US firms reduced their inventory investments by $70 billion by the end of March 2010; for instance, Wal-Mart reduced its inventory by 8% in 2009 alone.

Inventory optimization is widely recognized as an effective mechanism for cost reduction and profit enhancement (Isaksson and Seifert 2014). Inventory imbalance poses a significant risk of adverse financial consequences for companies, given its essential role in operational activities. Current assets, including inventory, constitute 61.7% of the total assets of many companies (Rey-Ares, Fernández-López, and Rodeiro-Pazos 2021). Investments in inventory and accounts receivable represent a substantial portion of total investments in many firms (Nwude, Allison, and Nwude 2021; Özkaya and Yaşar 2023). This is particularly pronounced in the consumer goods industry, which deals with significant inventory volumes and working capital management (WCM). Figure 1 illustrates that inventory comprises a substantial portion of current assets among US consumer goods firms, averaging 42% of their liquid capital mix from 2010 to 2022.

This study explores how inventory days affect the OM of consumer goods companies, particularly in cyclical firms. Louw,

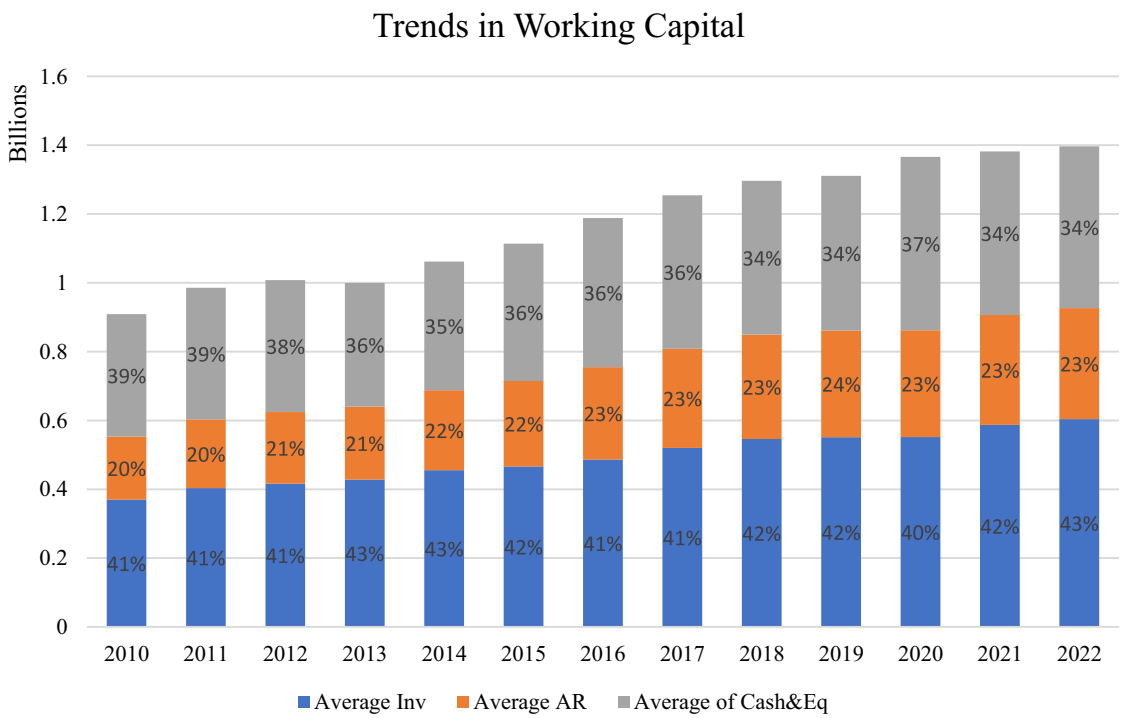

FIGURE 1 | Trends in working capital among consumer goods firms in the United States. AR, account receivables; Cash&Eq, cash and cash equivalents; Inv, inventory.

Hall, and Pradhan (2022) assert that WCM, especially inventory management, is crucial for the profitability measures attributable to the operating cycle, such as the gross profit margin.

A growing body of academic research focuses on determining the relationship between a company's InvD and financial performance. Recent literature (Nwude, Allison, and Nwude 2021; Sawarni, Narayanasamy, and Ayyalusamy 2021; Yousaf, Bris, and Haider 2021) supports a negative linear relationship. However, we align with Isaksson and Seifert (2014) that certain IM strategies can adversely affect a company's financial performance. Strategies that underestimate the costs of shortages, resulting in customer dissatisfaction, can be particularly costly. This consideration reflects a fundamental trade-off in corporate financial decision-making. Transaction cost theory encourages companies to minimize inventory holdings to enhance WC. The Just-in-Time (JIT) strategy advocates for minimal inventory levels. Simultaneously, firms aim to maintain certain inventory levels to prevent lost sales and operational disruptions. Due to its dynamic nature, this trade-off requires careful consideration in the consumer goods market. Cyclical consumer goods businesses are sensitive to economic cycles and face fluctuating and unpredictable demands. During economic downturns, companies in this sector face significant challenges due to reduced consumer spending. In such situations, maintaining larger inventories serves as a safeguard against stock-outs, especially in uncertain times. Contrarily, this approach risks overstocking, leading to increased storage and obsolescence costs. The precautionary theory advocates for higher inventory levels to mitigate potential stock-outs. Non-cyclical companies, generally more stable and less sensitive to economic changes, experience steady demand and may even observe increased demand during economic downturns (Enqvist, Graham, and Nikkinen 2014). Understanding these economic dynamics is essential for developing targeted WCM, particularly IM strategies that optimize operational efficiency.

Moreover, traditional literature on WCM often finds that InvD impacts profitability linearly and negatively (Aldubhani et al. 2022; Lyngstadås and Berg 2016; Nwude, Allison, and Nwude 2021; Özkaya and Yaşar 2023; Sawarni, Narayanasamy, and Ayyalusamy 2021; Yazdanfar and Öhman 2014; Yousaf, Bris, and Haider 2021). Other studies assert a linear positive association (Abuzayed 2012; Amponsah-Kwatiah and Asiamah 2020; Gonçalves, Gaio, and Robles 2018; Naz et al. 2022; Sharma and Kumar 2011). Despite the contributions of these studies, the optimal inventory level necessary to maximize profitability and the nature of the association between InvD and profitability are still undefined. This study employs a quadratic estimation approach to test the non-linear association between InvD and OM using financial data from US public consumer goods companies from 2010 to 2022. The results indicate an inverted U-shaped relationship between InvD and OM, suggesting that cyclical firms maintain an optimal InvD level that mitigates stock-out risks while avoiding overstocking. An optimal InvD of 108 days increases OM by 3% among cyclical businesses. Maintaining relatively higher optimal inventory levels benefits non-cyclical businesses with predictable demand patterns. The distinct impacts in cyclical and non-cyclical sectors highlight the importance of considering industry characteristics in IM research. This study enhances our understanding of the impact of IM strategies on profitability across industries. In line with the study's findings, prior literature identifies the connection between WCM and its components as concave or inverted U-shaped rather

than linear (Anton and Nucu 2021; Boțoc and Anton 2017; EL-Ansary and Al-Gazzar 2021; Jaworski and Czerwonka 2022; Shakil et al. 2019).

This study is the first to comprehensively explore and understand inventory management dynamics under varying market conditions, particularly the effect of InvD on operating profit (OP) in predictable and fluctuating market conditions in a sector heavily reliant on inventory. By exploring the quadratic estimation model, the study provides a non-linear analytical pathway to understand the InvD-profitability nexus. It also predicts the optimal InvD required to enhance OP at a specific rate.

The choice of the United States as the setting for this study on the impact of InvD on OM in the consumer goods sector is strategic for several reasons: The United States boasts one of the world's most diverse and mature consumer goods markets. This diversity offers rich data for analysis and meaningful insights that might be less apparent in less varied markets. Many large multinational consumer goods companies are headquartered or have significant operations in the United States. The practices and performance of these companies can influence global trends in IM, making the United States a crucial location for understanding contemporary practices and challenges in this area. The US economy's response to various economic cycles provides a unique opportunity to study IM under differing economic conditions. Understanding how US consumer goods companies adapt their inventory strategies in response to these conditions can offer valuable insights for businesses worldwide.

The structure of this paper is as follows: Section 2 delves into the theoretical framework and formulates the hypotheses. Section 3 covers the data, variables, and methodology used for estimation. Section 4 presents the results. In Section 5, the implications of these findings are discussed, and Section 6 provides the conclusion.

2 | Previous Literature and Hypothesis Development

2.1 | Inventory Management Efficiency and Profitability

Inventory management efficiency and programs aimed at reducing inventory are widely embraced as fundamental cost-reduction mechanisms. Transaction cost theory posits that companies can enhance performance by maintaining only the minimum inventory needed for anticipated demand and production (Ferris 1981). This approach aims to boost efficiency by minimizing the expenses linked to holding surplus inventory. However, a potential drawback is the heightened risk of delivery delays, inventory shortages, and unforeseen adverse exogenous shocks. An even more extreme version is the JIT strategy, which advocates for maintaining a zero-inventory level. This approach acknowledges the costs associated with storing inventory and contends that inventory does not add value to the product (Morgan 1991). These theories suggest a negative association between holding inventory and firm performance. Conversely, precautionary theory advocates for maintaining higher inventory levels to safeguard against stock-outs, which can lead to customer dissatisfaction. Avoiding stock-out situations can help prevent losses due to customer attrition. Additionally, this theory recommends maintaining higher inventory levels due to uncertainties in delivery lead times. While this approach is sound in a business context, it only adds value if the advantages of holding additional inventory outweigh the associated costs, which include various expenses related to inventory storage, such as warehousing, heating, and lighting. Precautionary theory suggests a positive impact of extended InvD on firm performance.

This figure shows the components of current assets and reveals the importance of inventory in managing WC. Inv represents inventory, AR represents accounts receivables, and Cash&Eq represents cash and cash equivalents.

Moreover, several studies support a negative linear association between WCM and its components, particularly InvD, and profitability. Sawarni, Narayanasamy, and Ayyalusamy (2021) posit that shorter InvD enhances the return on the use of shareholders equity and Tobin's Q. With a sample of listed Indian cement companies from 2012 to 2018, they suggest that companies can enhance performance by concentrating on inventory management efficiency that reduces capital tied up in inventory. Yousaf, Bris, and Haider (2021) reach a similar conclusion by analyzing a sample of 332 Czech firms from 2015 to 2019, emphasizing the detrimental effect of extended InvD on return on assets (ROA). Conversely, other studies support a positive link between InvD and profitability. Amponsah-Kwatiah and Asiamah (2020) observe a positive association between all components of WCM, including InvD, accounts receivable days, accounts payable days, and cash conversion cycle on the returns. Using a sample of 20 manufacturing firms listed from 2015 to 2019, they suggest that a well-managed inventory results in increased profitability. Abuzayed (2012) finds a positive association between InvD and gross operating profit and Tobin's Q. The study analyses a sample of public Jordanian firms from 2000 to 2008 and reveals a positive association between WCM and ROA using a sample of large non-financial firms (Naz et al. 2022). Isaksson and Seifert (2014) express reservations and recognize the unfavorable financial outcomes that certain IM strategies can yield, particularly those that underestimate the costs of shortages and customer loss. Alternative strands of literature support a non-linear association between WCM and firm performance and define the connection between these variables as concave or inverted U-shaped rather than linear. Boțoc and Anton (2017), utilizing a panel dataset of high-growth firms from southeastern, eastern, and central Europe spanning 2005 to 2016, identify a non-linear association between WCM and firm profitability. Similarly, Jaworski and Czerwonka (2022), in their analysis of 326 publicly listed companies on the Warsaw Stock Exchange from 1998 to 2016, observe that as WCM values increase, the rate of profitability growth declines at a slower rate. The preceding discussions suggest a possible non-linearity in the InvD-profitability nexus, leading to the hypothesis that

Hypothesis 1. *There is a non-linear (concave) relationship between InvD and OM.*

2.2 | Inventory Management Efficiency and Cyclicality

IM remains a critical aspect of operations management across various industries. Firms in sectors like food and

pharmaceuticals deal with perishable goods and prioritize quick inventory turnover and efficient distribution to minimize waste and ensure product freshness. This necessitates a JIT approach, which aims to receive goods only as they are needed in the production process to reduce inventory costs (Liker 2004). In contrast, firms in industries like electronics and automobiles deal with less perishable goods and can afford to maintain higher inventory levels. This flexibility allows for bulk purchasing, often resulting in cost savings (Krajewski and Malhotra 2022). Additionally, industries like fashion and technology, where consumer preferences change rapidly, face high demand variability and often adopt a responsive inventory strategy that maintains higher inventory levels to meet diverse customer demands. Industries with more predictable demand, such as utilities or basic consumer goods, can implement a more efficient inventory system with lower stock levels due to predictable consumption patterns. Global supply chain-reliant industries like consumer electronics must navigate longer lead times, necessitating larger safety stock levels to buffer against supply chain disruptions (Christopher 2023). In contrast, industries with localized supply chains can adopt lean inventory strategies due to shorter lead times and more predictable supply patterns.

Similarly, IM strategies often vary between cyclical and non-cyclical sectors, reflecting their distinct operational and market dynamics. Cyclical businesses are heavily influenced by economic cycles. These firms, including automotive, luxury goods, and construction, face fluctuating demands tied to consumer confidence and spending. In response, these companies often employ flexible IM systems that allow them to adjust inventory levels in line with economic indicators (Irzhavtseva 2017). During peak demand periods, companies might lower InvD to rapidly meet demand and enhance margins due to higher sales volume. Conversely, lower InvD may not affect margins similarly during low-demand periods. Excessively high InvD suggests overstocking, which can negatively impact OM due to increased holding costs and potential obsolescence. Conversely, an InvD that is too low might indicate understocking, which can hurt margins due to lost sales opportunities.

The non-cyclical sector, yielding only essential goods, tends to have a stable demand regardless of economic conditions. These companies, including utilities, healthcare, and basic consumer goods, experience less dramatic fluctuations in inventory requirements. Non-cyclical firms typically focus on efficiency and cost minimization in IM. JIT and lean inventory strategies are prevalent, taking advantage of predictable demand to reduce inventory holding costs (Gurtu and Johny 2021). However, inventory needs can still vary due to seasonality, consumer trends, and supply chain disruptions. If InvD is too high, it might result in higher holding costs that minimize OM. Conversely, too low InvD might lead to stockouts and lost sales (Deloof 2003). The optimal level of inventory that maximizes profit may not follow a direct linear relationship, as different inventory levels can have varying impacts on costs and sales. Sawarni, Narayanasamy, and Ayyalusamy (2021) argue that the significance of the WCM and profitability relationship depends on the nature of the business. The preceding discussions imply a possible non-linearity in the relationship between InvD and profitability. The study further hypothesizes that

Hypothesis 2. *Cyclicality non-linearly impacts the relationship between InvD and OM.*

3 | Methodology

3.1 | Data

The data for public US consumer goods companies come from the Refinitiv Eikon's database, which categorizes consumer goods firms into cyclical and non-cyclical. The data extraction process begins with all firms. The study includes data from all listed consumer goods firms from 2001 with complete inventory values and excludes more service-oriented companies in the industry. The final sample includes 522 firms with 6786 firm-year observations, which have been winsorized at both tails to address outlier issues.

3.2 | Variables

It is common to use profitability proxies such as ROA, return on equity, return on invested capital, and Tobin's Q to assess firm performance (Boțoc and Anton 2017; Sawarni, Narayanasamy, and Ayyalusamy 2021). This research concentrates on profit generated through the operating process rather than on broad measures of firm profitability (Yeboah and Kjærland 2024). To evaluate the effect of IM on profitability, this study employs OM as a proxy for measuring the efficiency in generating profits attributable to the operating process. The independent variable of interest, InvD, serves as a proxy for the time needed to convert inventory to cash in the operating cycle. The square term of the independent variable, $InvD^2$, is included to account for non-linearities in the data. Furthermore, the study assesses the influence of cyclicality on the InvD and OM. relationship by introducing the interaction term InvD*CY, with non-cyclical firms as the reference group. To control for other potential influences on OM, ROA, leverage (Lev), revenue growth (Grw), and quick ratio (QR) are factored into the analysis. The study also controls for the impact of the health pandemic on OM by including Cov19 dummy variables.

Table 1 summarizes the study variables, stating how they are consistently referred to in the context of this study and how they are measured. The table categorizes the variables into dependent and independent variables for clarity. The independent variables are further grouped into the primary independent variable of interest, interaction terms, and the control variables. The notation column shows how the variables are referred to throughout this study, and the formula column illustrates how the variables are measured.

3.3 | Estimation

This research employs the two-step System-GMM technique introduced by Arellano–Bond and utilized in previous studies (Al-Ajmi et al. 2023; Da et al. 2024; Dkhili 2023; Yeboah and Kjærland 2024). The panel GMM technique addresses endogeneity issues and manages heterogeneity specific to each individual, mitigating

TABLE 1 | Summary of variables.

Variables	Notation	Formula
A. Dependent variable		
Operating margin	*OM*	Operating Income/Total Revenue
BI. Independent variables		
Inventory days	*InvD*	Inventory*365/COGS
Inventory days squared	$InvD^2$	(Inventory*365/COGS)^2
BII. Interaction terms		
Inventory Days*Cyclical	*InvD*CY*	Inventory Days*Cyclical Dummy
Inventory Days*Cyclical Squared	$InvD*CY^2$	(Inventory Days*Cyclical Dummy)^2
BIII. Control variables		
Return on assets	*ROA*	Net Income/Total Assets
Leverage	*Lev*	Debt/Equity
Growth	*Grw*	(Revenue_t - Revenue_t-1) /Revenue_t-1
Quick ratio	*QR*	(Current Assets - Inventory) / Current Liabilities
Covid-19	*Cov19*	Dummy Variables for the Covid-19 Period
Cyclical	*CY*	Refinitiv Eikon Industry/Sector Categorization

Note: The table details the study variables. The independent variables include components of inventory days, their square terms, interaction terms, a set of firm controls, and the global pandemic dummy variable. The dependent variable is the operating margin.
Source: Authors' own creation.

potential biases in dynamic panel concerns. The method involves using lagged-dependent and instrumental variables to ensure that estimates for panel data models with endogenous variables are consistent and efficient (Arellano and Bover 1995; Blundell and Bond 1998). Given the data characteristics suggesting a possible non-linear relationship between the variables, the study introduces a quadratic technique to capture a potential turning point. In line with previous literature (Baños-Caballero, García-Teruel, and Martínez-Solano 2014; Laghari and Chengang 2019; Mahmood et al. 2022), InvD, its square term InvD^2, firm controls (FC), global pandemic (Cov19), and cyclicality (CY) dummy variables are regressed against OM for individual firm (i) at time (t). The Cov19 dummy equals 1 for 2020 and 0 for all other years. CY equals 0 for non-cyclical firms and 1 for cyclical firms, as categorized using the Refinitiv industry/sector identifiers. An inverted U-shaped relationship is expected between the variables. The study checks the turning point in the data to assess the optimal level of InvD that maximizes OM using the formula.

$$X = -\beta_1 / 2\beta_2 \tag{1}$$

The baseline regression equation is given as follows:

$$\begin{aligned} \mathrm{OM}_{it} = {} & \beta_0 + \lambda \mathrm{OM}_{it-1} + \beta_1 InvD_{it} + \beta_2 InvD^2{}_{it} \\ & + \beta_3 FC_{it} + \beta_4 Cov19_{it} + \beta_5 CY_{it} + \mu_i + \varepsilon_{it} \end{aligned} \tag{2}$$

The model is extended to accommodate the specific variables employed in the study. The proxy for IM, InvD, and its square term InvD^2, along with control variables ROA, Lev, Grw, QR, Cov19, and CY, are introduced. The GMM incorporates $\lambda \mathrm{OM}_{it-1}$, the lag of the dependent variable, and γD_{it} as year dummy variables, with μ_i and ε_{it} capturing unobserved firm-specific time-invariant effects and error terms across firms.

$$\begin{aligned} \mathrm{OM}_{it} = {} & \beta_0 + \lambda \mathrm{OM}_{it-1} + \beta_1 InvD_{it} + \beta_2 InvD^2{}_{it} + \beta_3 ROA_{it} \\ & + \beta_4 Lev_{it} + \beta_5 Grw_{it} + \beta_6 QR_{it} + \beta_7 Cov19_{it} \\ & + \beta_8 CY_{it} + \gamma D_{it} + \mu_i + \varepsilon_{it} \end{aligned} \tag{3}$$

Additionally, the study assesses the influence of cyclicality on the InvD–OM relationship by introducing interactions for cyclicality ($InvD*CY_{it}$) and the square term $(InvD*CY_{it})^2$.

$$\begin{aligned} \mathrm{OM}_{it} = {} & \beta_0 + \lambda \mathrm{OM}_{it-1} + \beta_1 InvD * CY_{it} + \beta_2 InvD * CY^2{}_{it} \\ & + \beta_3 ROA_{it} + \beta_4 Lev_{it} + \beta_5 Grw_{it} + \beta_6 QR_{it} \\ & + \beta_7 Cov19_{it} + \beta_8 CY_{it} + \gamma D_{it} + \mu_i + \varepsilon_{it} \end{aligned} \tag{4}$$

4 | Results

The results chapter presents the outcomes of the empirical analysis assessing the impact of InvD on OM. It encompasses a descriptive summary, a correlation matrix of the variables, and a two-step system GMM panel regression analysis.

4.1 | Descriptive Statistics

This subsection presents the summary statistics and the correlation matrix of the variables.

Table 2 summarizes the statistics of key variables used in the study for the combined sectors on panel A. It further shows these statistics for the cyclical and non-cyclical consumer goods sectors from 2010 to 2022 on panel B. The table presents statistics on the total number of observations, mean, median, standard deviation, minimum, and maximum values of all the variables employed in the study. Panels B and C further isolate these statistics on the cyclical and non-cyclical consumer goods industries.

The OM indicates that consumer goods firms generate a 6.40% margin in panel A. Yeboah and Kjærland (2024) report comparatively better operational efficiency in the Scandinavian market. Cyclical firms achieve a 6.50% margin, four percentage points higher than the 6.10% for non-cyclical companies.

On average, the combined sector holds inventory for 75 days before it is sold. The results show extended InvD relative to the Scandinavian region (Denmark 60 days, Norway 66 days, and Sweden 72 days) (Hassan et al. 2023). However, it is slightly more efficient than the 77 days reported for Indian firms (Sawarni, Narayanasamy, and Ayyalusamy 2021). From the panel B, firms in the non-cyclical space demonstrate greater

TABLE 2 | Descriptive statistics.

	Obs	Mean	Median	SD	Min	Max
Panel A. All						
OM	6786	0.064	0.066	0.054	−0.004	0.175
InvD	6786	75.390	60.215	46.435	28.603	212.732
ROA	6786	0.040	0.040	0.037	−0.003	0.109
Lev	6786	1.664	1.331	0.943	0.330	3.326
Grw	6786	0.001	0.000	0.039	−0.183	0.224
QR	6786	1.297	1.265	0.544	0.542	2.526
Cov19	6786	0.077	0.000	0.266	0.000	1.000
CY	6786	0.724	1.000	0.447	0.000	1.000
Panel B. Cyclicality						
Cyclical						
OM	4914	0.065	0.067	0.053	−0.004	0.175
InvD	4914	77.362	60.860	48.840	28.603	212.732
ROA	4914	0.041	0.040	0.038	−0.003	0.109
Lev	4914	1.716	1.399	0.978	0.330	3.326
Grw	4914	0.001	0.000	0.043	−0.183	0.224
QR	4914	1.294	1.265	0.550	0.542	2.526
Cov19	4914	0.077	0.000	0.266	0.000	1.000
CY	4914	1.000	1.000	0.000	1.000	1.000
Non-cyclical						
OM	1872	0.061	0.062	0.056	−0.004	0.175
InvD	1872	70.212	57.284	38.967	28.603	212.732
ROA	1872	0.038	0.041	0.036	−0.003	0.109
Lev	1872	1.527	1.156	0.831	0.330	3.326
Grw	1872	0.000	0.000	0.029	−0.167	0.224
QR	1872	1.306	1.266	0.527	0.542	2.526
Cov19	1872	0.077	0.000	0.267	0.000	1.000
CY	1872	0.000	0.000	0.000	0.000	0.000

Note: The table reports the descriptive summary of all the variables based on the number of observations, mean, median, standard deviation, and minimum and maximum values. It presents variables including the operating margin, inventory days, return on assets, leverage, quick ratio, revenue growth, Covid-19, and cyclicality dummies for the combined sample and further for cyclical and non-cyclical firms. The sample period is 2010–2022.
Source: Authors' own creation.

efficiency in converting their inventory into cash, utilizing 70 days compared to 77 days in the cyclical sector.

The positive ROA indicates efficiency in asset utilization, with the studied firms generating an average return of 4% on their investments. This outcome implies positive asset utilization, indicating that the firms are generating returns.

The average leverage ratio of 1.66 suggests that the firms' total liabilities are 1.66 times their total equity, indicating moderate reliance on debt financing. Cyclical firms are even more reliant on debt financing relative to equity than non-cyclical firms, given their respective leverage ratios of 1.72 and 1.53.

The average growth rate implies a stable but stagnant revenue situation over the sample period.

The mean quick ratio of 1.30 indicates that firms in the consumer goods sector possess sufficient liquid assets. This sign of good, short-term financial health is more pronounced in non-cyclical firms (1.31) than in cyclical firms (1.29). The Cov19 dummy variable indicates the presence of the global pandemic during the study period.

Table 3 presents the correlation analysis of the variables employed in the study. The analysis confirms the absence of any multicollinearity concerns in the data. Additionally, the Variance Inflation Factor (VIF) further investigates potential multicollinearity issues. Each variable's VIF results are below the commonly accepted threshold of 5. Furthermore, the average VIF score of 1.100 also remains below this threshold, reinforcing the conclusion that multicollinearity is not a concern. This observation is consistent with outcomes reported in prior studies (Amponsah-Kwatiah and Asiamah 2020; Bhattacheryay 2020; Hassan et al. 2023; Mahmood et al. 2022).

4.2 | Regression Analyses

This subsection presents the results of the regression analyses (SYS-GMM) conducted to examine the association between IME and OP.

Table 4 shows the effect of InvD on OM. The variable OM is regressed against InvD and $InvD^2$, including other control variables. The table also presents the moderating effect of cyclicality on the InvD-OM nexus.

The positive and significant InvD coefficient for all firms suggests that an increase in InvD is associated with a 0.064% increase in OM. The results indicate that holding inventory for an extended period benefits the company. The negative and significant $InvD^2$ coefficient suggests a diminishing return effect, demonstrating that as InvD increases, the beneficial impact on OM decreases and eventually turns negative. The combined effect of ($\beta 1 > 0$) and ($\beta 2 < 0$) and the turning point of 122.40 days lying within the data range confirm a non-linear association between InvD and OM and these findings agree with Hypothesis 1.

For cyclical consumer goods businesses, the InvD*CY coefficient is positive and significant, indicating that an increase in InvD is associated with a 0.055% increase in OM. The negative and significant $InvD*CY^2$ coefficient suggests a reducing return effect, indicating that as InvD increases, the favorable impact on OM decreases and eventually turns negative among cyclical firms. The combined effect of ($\beta 1 > 0$) and ($\beta 2 < 0$) and the turning point of 108.40 days lying within the data range confirms a non-linear association between InvD and OM among these companies, which is consistent with Hypothesis 2 corresponding to the concave InvD and OM interaction in the cyclical sector.

TABLE 3 | Correlation matrix.

Variables	OM	InvD	ROA	Lev	Grw	QR	Cov19	CY
OM	1.000							
InvD	0.187	1.000						
ROA	0.594	0.217	1.000					
Lev	0.146	−0.066	−0.091	1.000				
Grw	−0.147	−0.035	−0.242	−0.007	1.000			
QR	−0.048	−0.205	−0.101	−0.333	0.012	1.000		
Cov19	−0.071	0.008	−0.039	0.048	0.026	0.014	1.000	
CY	0.039	0.068	0.045	0.094	0.001	−0.014	−0.000	1.000
Multicollinearity diagnostics								
(VIF)		1.210	1.180	1.140	1.110	1.060	1.020	1.010
(Mean VIF)				1.100				

Note: The table reports the results of the correlation test and VIF for the variables used in the study. OM represents operating margin, InvD represents inventory days, ROA represents return on assets, Lev represents leverage, Grw represents revenue growth, QR stands for quick ratio, Cov19 represents the Covid-19 pandemic period, and CY represents the cyclicality dummy.
Source: Authors' own creation.

TABLE 4. | Impact of inventory days on operating margin.

	All	Cyclical
InvD	4.53×10^{-4}*	
	(2.51×10^{-4})	
$InvD^2$	-1.85×10^{-6}*	
	(9.61×10^{-7})	
InvD*CY		5.53×10^{-4}*
		(3.0×10^{-4})
$InvD*CY^2$		-2.55×10^{-6}**
		(1.14×10^{-6})
ROA	1.102***	0.966***
	(0.096)	(0.074)
Lev	0.044***	0.031***
	(0.005)	(0.004)
Grw	0.023*	0.027**
	(0.013)	(0.012)
QR	0.012***	0.012***
	(0.004)	(0.004)
Cov19	−0.011***	−0.007***
	(0.002)	(0.002)
CY	−0.028**	−0.033*
	(0.012)	(0.019)
Cons	−0.080***	−0.048***
	(0.017)	(0.011)
Observations	6263	6263
Prob. > F	0.000	0.000
Prob. > χ^2	0.000	0.000
Group (Inst)	522(99)	522(99)
AR (2)	0.440	0.801
Hansen J test	0.483	0.176
Year dummy	Yes	Yes

Note: The table reports the results of the two-step system-generalized method of moments regression. OM represents operating margin, InvD represents inventory days, $InvD^2$ represents the square terms, ROA is return on assets, Lev represents leverage, Grw represents revenue growth, QR stands for quick ratio, Cov19 represents the Covid-19 pandemic period, and CY represents the cyclicality dummy. Standard errors are in parentheses.
Source: Authors' own creation.
*$p<0.10$, **$p<0.05$, and ***$p<0.01$.

Regarding control variables, the significantly positive impact of ROA on OM indicates that an increase in asset utilization is associated with a 97% average increase in OM among cyclical firms. This relationship highlights the importance of efficient asset management in enhancing profitability. Furthermore, the significantly positive influence of Lev on OM suggests that the use of debt positively influences OM, with an increase in debt financing, and boosting OM by 3.10% on average in cyclical businesses. This could be due to the tax advantages of debt and its ability to finance growth and investment. Moreover, revenue growth has a 2.70% average positive influence on OM among cyclical companies. Liquidity, measured by QR, shows a significantly positive impact on OM, indicating that a rise in liquid assets is linked to a 1.20% average increase in OM. The health pandemic has a significantly negative effect on OM, accounting for a 0.70% reduction in OM in the cyclical sector. Cyclicality negatively impacts OP in the consumer goods industries.

The optimal InvD of 112.40 days suggests that holding inventory for approximately 122 days is generally more profitable for the consumer goods industries. The InvD*CY of 108.40 days implies that comparatively lower inventory levels are optimal in sectors with cyclical demand patterns. InvD*Cov19 of 94.61 indicates that the pandemic disrupted supply chains and altered consumer behavior, creating uncertainty in predicting optimal inventory levels that maximize OM. For cyclical firms, the pandemic necessitated significant adjustments in InvD; extended InvD proved more beneficial during the pandemic.

5 | Discussion

5.1 | Impact of Inventory Days on Operating Margin

The significantly positive impact of InvD and the subsequent negative effects of its squared value on OM suggest that as InvD increases, OM initially rises. However, as InvD continues to rise, the positive impact on OM diminishes and eventually turns negative. The findings indicate a non-linear relationship between InvD and OM. Ideally, InvD should be maintained at an optimal InvD level of 122 days in the combined consumer goods industries. Substituting 122 into regression Equation (3) results in a 2.77% increase in OP at this optimal InvD level. With the average firm holding inventory for 75 days, most firms operate at a suboptimal InvD level, missing out on the 2.77% margin boost. Mahmood et al. (2022) document an inverted U-shaped relationship between working capital finance and firm performance using the two-step system GMM analysis.

Similarly, in the cyclical sector, additional InvD initially has a positive effect on OM, but after 108 days, it becomes detrimental to OM. This lowered InvD level implies a more conservative IM that sufficiently cushions against stock-outs. It also helps to minimize the costs associated with excess inventory in industries with unstable and varied demand patterns, such as luxury goods, automobiles, and electronics. Avoiding stock-outs can lead to higher sales, customer satisfaction, and ultimately a higher OM. However, overstocking triggers increased holding costs, obsolescence, and liquidity risks and OM eventually decreases if the cost of maintaining additional inventory outweighs the benefits. According to regression Equation (4), this optimal level of InvD initiates a 3.00% increase in operational profitability. Cyclical firms often maintain suboptimal InvD levels, resulting in the loss of the 3.00% margin increase. The outcome indicates that effective IM

can help these firms align their production and stock levels better with fluctuating demand, thereby maximizing profit margins during peak demand periods and minimizing losses during low-demand periods. Baker et al. (2017) observe that inventory management is crucial for meeting high seasonal demands among large firms. Mehar (2005) and Xin, Zeng, and Luo (2022) recognize the significant role inventory plays in enhancing business operations management.

Non-cyclical businesses include essential goods such as food and beverages, household goods, and other basic commodities. Demand for these products remains relatively stable regardless of economic conditions. The optimal inventory level of approximately 122 days for both types of firms suggests that non-cyclical businesses operate effectively with relatively higher inventory levels. This is attributed to the predictable nature of demand, which reduces the risks associated with higher inventory levels. The observed 2.77% increase in OM, at this inventory level and for all firms, emphasizes the benefits of achieving an optimal balance between inventory holding and sales. For non-cyclical firms, maintaining adequate inventory levels ensures that they can consistently meet consumer demand without frequent stock-outs or excess overstock. The results show variations in IM dynamics between the cyclical and non-cyclical sectors. Jaworski and Czerwonka (2022) recognize the importance of industry variations in managing WC.

Generally, it is imperative that companies maintain sufficient inventory to reduce stock-outs, leading to more consistent sales and improved customer satisfaction. However, extended InvD can result in overstocking, where the costs of holding inventory, such as storage, insurance, and potential obsolescence, begin to outweigh the benefits (Anton and Nucu 2021). Aktas, Croci, and Petmezas (2015) document the existence of optimal net WC and state that the firms converging at that optimal level enhance their stock performance. The cyclical variations in this observation imply that IM strategies should be tailored according to the sector's nature, and target different optimal levels of InvD (Boisjoly, Conine, and McDonald 2020). A slightly lower inventory level is optimal in the cyclical sector, where demand varies. In contrast, the non-cyclical sector benefits from marginally higher inventory levels due to a more stable market. This invites the need to balance the trade-off between transaction costs and precautionary motives in IM across different sectors. A study by Eroglu and Hofer (2011) observes substantial cross-industry variations in the shape and significance of the relationship between inventory and performance. The findings suggest an optimum level of inventory leanness beyond which it becomes detrimental to performance. Aldubhani et al. (2022) indicate the necessity for inventory to be maintained at reasonable and optimal levels to mitigate storage and obsolescence costs while ensuring customer satisfaction.

5.2 | Implications

The results highlight the need for strategic IM. Financial managers should adapt their inventory strategies to balance the risk of stock-outs against the cost of overstocking. Increasing inventory can help reduce stock-outs, which is crucial for maintaining customer satisfaction and ensuring steady revenue streams, ultimately resulting in a better market reputation, repeat customers, and improved margins. However, this strategy is effective only up to a certain point. Beyond that, the costs associated with additional inventory may not justify the stock-out prevention perspective but instead invite the risks of overstocking.

These insights can be integrated into decision-making processes and IM systems. This can help businesses balance inventory during normal periods and periods of uncertainty. Companies can leverage these findings in strategic planning, especially in consumer goods and other sectors where IM is critical to operations.

6 | Conclusion

This paper assesses the profitability implication of IM encompassing cyclical and non-cyclical public consumer goods firms. The empirical analysis employs a non-linear regression approach and applies a dynamic panel data technique, drawing from a dataset of 6786 firm-year observations.

The study documents a non-linear relationship between InvD and OM in cyclical and non-cyclical businesses. This observation suggests an optimal InvD level of InvD that maximizes OM, with the cyclical sector requiring comparatively lower levels. This relationship is economically significant in employing sector-specific IM strategies that balance the risk of stock-outs against the cost of overstocking.

The study opens avenues for further research to understand the underlying causes of this non-linear relationship and to explore similar relationships in different contexts or industries. Differences in market competition, customer expectations, and supply chain dynamics across sectors can influence the impact of InvD on OM. The study highlights how economic sensitivity influences inventory strategy. Further research could focus on the effective management of other components of WC, such as accounts receivable and accounts payable, during economic cycles and downturns.

Author Contributions

Samuel Yeboah: conceptualization, methodology, data curation, data analysis and interpretation, writing – original draft, paper finalization, visualization. **Frode Kjærland**: supervision, data curation, writing – review and editing, paper finalization. **Irena Kustec:** supervision, writing – review and editing.

Acknowledgements

The authors highly acknowledge Nord Business School, Bodo, Norway, for their financial and technical support for completing this research work.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data are sourced from the Refinitiv database and publicly available to its subscribers.

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