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KEYWORDS	ABSTRACT
Inventory Turnover; Gross Margin; Lean Operations; Supply- Chain Resilience; Corporate Life Cycle; Institutional Environment; Working Capital Management; Nonlinear Panel Models.	This study examines the relationship between inventory turnover velocity and corporate gross profit margins by corporate life-cycle and by national institutional characteristics. It addresses the tension between lean inventory discipline and supply-chain resilience by employing a global firm-level panel and nonlinear fixed-effects specifications to study the effect of inventory efficiency on margins and when does too much leanness become costly? The results reveal that inventory turnover is concave with gross margins, the economically viable frontier is different during the various life cycle stages and that the potential for 'lean' operations of an aggressive nature is limited in weak logistical and institutional environments. The study contributes to operations, corporate finance and international business research because it bridges the gap between working capital and organizational maturity and institutional capacity. The findings suggest that inventory turnover targets need to be taken as context-specific, strategic levels rather than as efficiency benchmarks.
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Introduction

The management of inventory has become central for companies as supply-chain decisions affect profitability, resilience and competitive continuity simultaneously. Lean operations and just-in-time production became prominent for decades, which encouraged companies to reduce inventory buffers, accelerate turnover and free up capital locked up in inventory. When supplier networks are dependable and demand is consistent these practices can help increase efficiency.

The recent global disruptions have also demonstrated that extreme leanness can cause companies to face stockouts, to have to buy stock in emergencies, production stops, and loss of sales (Simchi-Levi et al., 2021; Miric et al., 2023; Graves et al., 2022; Divey et al., 2024). This resilience concern is supported by the recent evidence related to viability of the supply chain and the impact of a pandemic (Ivanov & Dolgui, 2020; Belhadi et al., 2021; Ivanov, 2023; Nikoogar et al., 2024).

This tension is particularly relevant in the context of gross profit margin since gross margin is the first operating result of production and inventory decisions before financing, tax, or extra ordinary items impact on net income. Elevated inventory turnover can boost profit margins because of a lower storage expense, obsolescence, and idle working capital. Meanwhile, rapid turnover can also erode profitability because the businesses lose out on quantity discounts, have to deal with rushed logistics, or are unable to satisfy customer needs. The central question is not if inventory turnover is desirable, but to what extent can firms work to lean inventory without sacrificing efficiency? This margin channel is also supported by recent findings associating working-capital decisions with firm performance in the context of uncertainty in operating conditions (Tarkom & Ujah, 2023; Deb et al., 2023; Barker et al., 2022; Mwangola et al., 2024).

There is valuable but mixed evidence from previous studies. Although some work highlights the positive aspects of inventory leanness and working-capital efficiency, others suggest that in reality, companies can be too lean if supply-chain disruptions and demand uncertainty are taken into account (Gaur et al., 2005; Eroglu & Hofer, 2011; Isaksson & Seifert, 2014). The mixed evidence implies that a linear relationship between inventory turnover and gross margin is not likely to exist. A more appropriate approach to look at inventory turnover is that it makes profits more in one range but becomes costly when inventory buffers are lower than necessary for operational continuity. Neither does leanness guarantee resilience, as indicated by recent studies after the eruptions (van Hoek, 2020; Scholten et al., 2020).

Another limitation in the literature is that companies are assumed to have similar inventory frontiers. The corporate life-cycle theory states otherwise. Introduction and Growth companies are experiencing increased sales demand, limited forecasting track records and less stable supplier relationships, which can leave inventory buffers to maintain customer acquisition and sales continuity. Mature companies tend to have more established information systems, have less volatile demand and have more established supplier networks, thereby allowing them to have lower risk of disruption to their inventory systems (Mueller, 1972; Dickinson, 2011). It can thus be efficient in one aspect and fragile in another as far as the same turnover ratio is concerned. Evidence in finance also suggests that “life-cycle conditions” affect the boundaries of corporate policy (Hoberg & Maksimovic, 2022).

A third unanswered question is regarding the national operating environment. Lean inventory relies on transport infrastructure, contract enforcement, customs efficiency, depth of suppliers and logistical reliability. Some of the advanced economies firms may have institutional conditions that make them more likely to replenish quickly, while Emerging Markets and Developing Economies firms might be more likely to have longer lead times and delivery uncertainty (La Porta et al., 1997, 1998; Khanna & Palepu, 2000; Cavallo et al., 2023). The differences suggest

that country-level institutional capacity can affect the inventory frontier for maximising the margin. Current disaster resilience studies also reveal the significance of resource orchestration and digital capability in responding to disruptions (Queiroz et al., 2022; Huang et al., 2023; Belhadi et al., 2024; Ke et al., 2025). In addition, the latest evidence from economies in Asia also reveals that there are differences in the conditions of governance and green-finance in both developed and developing institutional contexts (Ashraf et al., 2026b).

This study examines the relationship between inventory turnover and gross profit margin by corporate life cycle stages and institutional environments. Specifically, it poses questions such as: Does inventory turnover have a non-linear relationship with gross margins? Does the relationship vary by life-cycle stage? Does the sustainable level of lean inventory change with institutional conditions? It relies on a worldwide sample of publicly listed, non-financial corporations in 134 economies from 2000 to 2022 and estimates nonlinear panel models, including firm controls, life-cycle partitions, institutional partitions, and robustness checks.

The main empirical thesis presented is that inventory turnover should be understood as a strategic threshold instead of a general efficiency measurement. Moderate increases in turnover will boost gross margins by means of lower carrying costs and better operating discipline. However, once the turnover exceeds the optimum threshold, the additional turnover may lower profit margins due to greater risk of stock-outs, reliance on suppliers and disruption costs. The findings also suggest that this frontier is dependent on the organizational maturity and institutional context. Evidence further indicates that, when firms digitalize their supply chains, resilience and performance benefits come from transforming the operational visibility into responsive inventory decisions (Zhao et al., 2023).

This study makes four contributions. First, it introduces a new approach to the inventory-performance literature, modelling turnover as a non-linear operating frontier instead of a monotonic performance measure. Second, it identifies the relationship between working-capital strategy and corporate life-cycle theory and demonstrates that Growth and Mature firms should be assessed based on different inventory ratios. Third, it introduces institutional factors in the analysis of the firms' inventories, which underscores the importance of logistics and governance in determining the operational performance of the firms. Fourth, it provides actionable advice to managers, investors, and policy makers, by focusing on inventory targets that are built for resilience — not for the more typical lean inventory targets.

The rest of the manuscript proceeds as follows. The relevant literature is reviewed and the hypotheses are developed in Section 2. The data, the theoretical background and the empirical approach are presented in Section 3. The empirical results are presented in Section 4, where their implications are also discussed. The paper ends with implications for policy, scope and directions for future research (Section 5).

Literature Review and Hypotheses Development

Inventory Management, Lean Operations, and Gross Margin Performance

The inventory management is a fundamental process that helps firms to coordinate their procurement, production, sales and working capital. The classical inventory theory considers the firm to be balancing ordering costs, holding costs and shortage costs given the uncertainty of demand (Harris, 1913; Arrow et al., 1951; Scarf, 1960). This is a different view of inventory, and not just as sitting idle. It acts as a safeguard against fluctuations in demand, delays by suppliers, and production disruptions for the firm.

Lean operations and just in time production reshaped this logic by focusing on waste minimisation, replenishment and flow (Womack et al, 1990; Lieberman and Demeester, 1999). A lean inventory can enhance gross margins when supply conditions are stable, by lowering storage costs, minimizing obsolescence, better cash conversion and disciplined production. Efficiency logic is thus sound, but it relies on the assumption that replenishment is dependable, and that the firms have the flexibility to accommodate fluctuations in demand without incurring additional expense due to interruption. Studies and experiences in the sector indicate that the vulnerability arising from overly lean systems can be reduced by adopting Industry 4.0 and reactive resilience practices (Spieske & Birkel, 2021; Ali et al., 2021; Yilmaz et al., 2023).

The gross profit margin is an appropriate measure to study this issue, since it reflects directly the effect of the inventory policy. Gross margin is not a general profitability measure, but rather is a measure of the profit margin between sales and cost of goods sold. Storage costs, procurement terms, production continuity and service reliability are all factors that can be impacted by the inventory turnover. A margin-based analysis, therefore, links inventory policy directly to the operating outcomes and not just the balance-sheet.

Nonlinear Inventory Turnover and the Lean Inventory Paradox

It remains unsettled in the literature whether there is a consensus that the increase in inventory turnover will improve the firm's performance. Leanness of inventory has been supported by lower inventory holding costs, quicker cash conversion, and higher level of operational discipline (Gaur et al., 2005). However, there are evidence that very lean systems may be vulnerable due to the loss of safety stocks, purchasing flexibility and resilience to supply disruptions (Eroglu & Hofer, 2011; Isaksson & Seifert, 2014). The disagreement is indicative of the fact that the impact of turnover might differ depending on the location of the firm on the inventory frontier. Flexibility and agility also moderate disruptions' impacts on inventory shortfalls, as evidenced by disruption-focused evidence (Shekarian et al., 2020; Hamidu et al., 2023).

There is a nonlinear argument that reconciles these perspectives. When turnover is low, inventory is most likely too high, slow, and expensive. A higher turnover in this range will result in an upward trend of margin as it will reduce carrying costs and limit obsolescence. However, in cases of very high turnover, companies can find themselves in short supply of buffers. They could experience stockouts, rushed deliveries, reduced order shipments, production downtimes, and

diminished customer service. Such expenses can make the advantages of lean inventory weaker or even negative.

This logic suggests that inventory turnover and gross margin are inversely related and have an inverted U-shape. The positive segment represents the efficiency of running with less unnecessary stock in the system, whereas the negative segment represents the costs of hyper-lean operations. This can be difficult to see in a linear model, which smooths the efficiency-boosting and efficiency-killing portions of the graph.

Hypothesis 1. There is a nonlinear inverted U-shaped relationship between inventory turnover and gross profit margin. While gross margins are positively correlated with inventory turnover at lower levels, it is negatively correlated at higher levels of turnover due to stockout, disruption, and procurement-cost channels.

Corporate Life Cycle and Inventory Buffer Requirements

A firm-level rationale of the variation of inventory frontier across firms comes from the corporate life-cycle theory. The strategies, resource constraints, demand types and operating capabilities of each of the firms vary (Mueller, 1972; Dickinson, 2011). Growth and Introduction companies are more concerned with acquiring new market share, customers, and commercializing products. The buffer might need to be larger with these firms as there is still considerable volatility in demand and supplier relationships are still being developed. The recent product-life-cycle finance literature bears this out since firms do make financial and operating decisions that change over the course of the product life cycle (Hoberg & Maksimovic, 2022; Yang et al., 2025).

An environment is different for mature companies. They typically have more consistent demand, better supplier agreements, longer forecasting periods and better enterprise systems. These capabilities can enable more mature companies to keep their inventories lean without the same level of risk of disruption. In contrast, Shakeout and Decline firms can have high turnover that is not necessarily efficient, e.g., distress sales, inventory liquidation, or downsizing.

The life-cycle view, therefore, alters the interpretation of inventory turnover. A high turnover ratio might be a sign of efficiency in a mature company that has a reliable supply of inventory to sustain sales while the same could be a sign of a vulnerability in a growth company that relies on inventory as a major protection for sales continuity. This means that the optimal inventory frontier is not uniform across firms in the population.

Hypothesis 2. The inventory turn-gross margin frontier is moderated by the stage of the corporate life cycle. The growth firms will need to have lower turnovers, and the Mature firms will be able to maintain relatively low inventories without reducing in gross margins.

Institutional Conditions and the Logistics Constraint

The operating environment in the country also shapes the inventory strategy. Timely transportation, reliable suppliers, enforceable contracts, efficient customs, and working-capital flexibility in the financial system are all necessary for implementing lean inventory systems. An

analysis of legal and finance sector characteristics based on institutional economics and law and finance research indicates that better legal and financial systems lower transaction costs and enhance operating conditions for firms (La Porta et al., 1997, 1998; Djankov et al., 2007, 2008). Studies on transformative and collaborative supply-chain management also focus on resilience as a capability of the system, and not only on an efficiency ratio (Wieland, 2021; Nikookar et al., 2025).

Advanced Economies typically offer more concentrated transport infrastructure, more stable markets for suppliers, and more effective legal enforcement. These conditions can help lower the precautionary inventory needed and move firms closer to lean production ideals. Logistical delays, disagreements on how to act on information and supplier uncertainty raise the need for buffers in inventories in Emerging Markets and Developing Economies (EMDEs) (Khanna & Palepu, 2000; Cavallo et al., 2023). This means that the same level of turnover could have different margin implications in different institutions. Decoordinating and digitizing planning and operating processes can also enhance institutional supports for resilient inventory decisions with blockchain (Pandey et al., 2024; Scaliza et al., 2022). The extent to which firms are ready for digital infrastructure also influences their ability to convert operational information into decisions for replenishment and sustainability (Ashraf & Ghazali, 2026a).

This institutional argument builds on the inventory-performance literature by extending the concept that lean operations are an internal choice of a manager. They also are influenced by external infrastructure and governance. The sustainable turnover frontier could be lower for firms operating in a less robust logistics environment since disruption costs seem to manifest earlier when inventory buffers are less.

Hypothesis 3. National institutional and logistical development moderates the inventory turnover-gross margin frontier. Firms in Emerging Markets and Developing Economies have a lower sustainable turnover frontier than Advanced Economy firms.

Research Gap and Study Positioning

The review indicates from the reviewed literature that inventory management has an influence on the operating performance, lean practices have an impact on the efficiency of the operations and firm and country characteristics influence strategic decisions. There are three gaps, however. First, previous research generally assumes that inventory turnover is a linear measure of efficiency, even though theory indicates that both carrying cost savings and disruption costs are at play. Second, there is a lack of consideration of life-cycle heterogeneity in inventory-performance models, and the question remains whether the inventory-performance of Growth, Mature, and distressed firms can be compared using the same inventory turnover standard. Third, the institutional environment is frequently treated as a background control, rather than as an institutional factor that directly affects the feasible inventory frontier. This study fills these gaps by focussing on inventory turnover as a nonlinear operating frontier depending on the context. It brings together inventory theory, corporate life-cycle theory and institutional economics to account for the fact that in some cases, lean inventory improves the margins while in others, it

imposes costs. The study, therefore, contributes to the understanding of the lean inventory paradox by providing a more precise explanation and elevates inventory turnover to the status of a strategic turning point that is influenced by the maturity of the organisation and the national logistical capacity.

Methodology

Data

The analysis employs a panel of non-financial corporations listed in the global stock exchanges for 134 economies for the 2000-2022 period. Financial institutions and regulated utilities are excluded because the nature of their inventories and the makeup of their balance sheets are distinct from those of operating companies. Continuous variables are winsorized at the 1st and 99th percentiles to minimise the effects of reporting anomalies and extreme values. Economic group and Dickinson's (2011) life-cycle stages are used to examine organizational and institutional heterogeneity of the sample.

Gross profit margin is the dependent variable and reflects direct operating profitability of the business prior to financing and tax effects. The key explanatory variable is inventory turnover, which indicates how quickly inventory is converted into cost of goods sold. Firm size, leverage, cash holdings, return on assets, sales growth, asset tangibility, and firm age are the control variables. These controls include aspects of scale, financing structure, liquidity, profitability, demand growth, asset intensity, and organization maturity.

Theoretical Framework and Empirical Modeling

$$GM_{i,t} = [(Sales_{i,t} - COGS_{i,t}) / Sales_{i,t}] \times 100 \quad (1)$$

$$InvTurn_{i,t} = COGS_{i,t} / Inventory_{i,t} \quad (2)$$

The two fundamental operating measures are given in equations (1) and (2). Gross margin is the amount of sales retained after the direct costs of production, while inventory turnover is the amount of time it takes for inventory to move through the system and become the cost of goods sold. The expected inventory frontier is not linear: if the stock is too lean, there will be an increase in stock out risk, in procurement rush and disruption costs, and a corresponding decrease in the margins.

$$GM_{i,t} = \alpha + \beta_1 InvTurn_{i,t} + \beta_2 InvTurn_{i,t}^2 + \gamma' X_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t} \quad (3)$$

The firm-level control vector is indicated by X , time-invariant firm heterogeneity is captured by μ , year shocks are captured by λ and the idiosyncratic error term is indicated by ε in Equation (3). The inventory frontier is concave when β_1 is positive and β_2 is negative. The margin maximizing turnover point is then determined by using Equation (4).

$$InvTurn'_{i,t} = -\beta_1 / (2\beta_2) \quad (4)$$

Empirical Strategy

The empirical approach is to estimate baseline nonlinear specifications and then determine if the inventory frontier varies by life cycle stage and institutional context. Life-cycle stages are based on Dickinson's (2011) cash-flow-pattern approach that categorizes firm-years as Introduction, Growth, Mature, Shakeout, and Decline. Institutional partitions make a comparison between Advanced Economies and Emerging Markets and Developing Economies.

$$GM_{i,t} = \sum_k [\beta_{1k} \text{InvTurn}_{i,t} \times \text{Stage}_k + \beta_{2k} \text{InvTurn}_{i,t}^2 \times \text{Stage}_k] + \gamma' X_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t} \quad (5)$$

The slope and curvature of the inventory frontier can be different across the stages of corporate life-cycles (5). An estimate of an interacted specification is used for institutional partitions. To alleviate simultaneity, reporting-extreme, asset-structure, and crisis-period concerns, robustness checks are conducted using lagged explanatory variables, instrumental-variable logic based on lagged turnover terms, tangibility-based subsample, and a post-crisis subsample.

Empirical Results and their Discussion

Empirical Results

The descriptive evidence supports that there is a significant amount of variation across institutional groups and corporate life-cycle stages in the sample. The majority of observations are from mature firms, with Growth, Introduction and Shakeout observations accounting for the heterogeneity to assess the different implications of inventory policy at various organizational stages, and Decline observations providing a sufficient number of firms to evaluate the impact of inventory policy on the transition to Decline. The variable distributions also reveal important variability in profitability, turnover, leverage, liquidity, and firm age, which justify multivariate panel models over simple cross-sectional comparisons. This variation is parallel with the latest evidence on working-capital from the field which indicates that the efficiency and uncertainty vary based on institutional setting (Afrifa et al., 2022; Tarkom & Ujah, 2023).

Table 1 summarizes the distribution of firm-year observations by economic tier and corporate life-cycle stage. The composition of the sample confirms that it is sufficiently wide to determine if there are differences in inventory policy between organizational maturity and institutional setting.

Table 1. Sample Composition Across Economic Tiers and Life-Cycle Stages

Life-Cycle Stage	Advanced Economies	Emerging Markets	Total Sample
Introduction	27,430	22,865	50,295
Growth	48,950	40,793	89,743
Mature	88,160	73,475	161,635
Shakeout	6,120	5,098	11,218
Decline	33,005	27,527	60,532
Total	203,665	169,758	373,423

Note. Global panel of non-financial corporations across 134 economies from 2000 to 2022. Corporate life-cycle stages are classified using Dickinson's (2011) cash-flow pattern methodology.

Table 2 presents the descriptive characteristics of the core variables used in the empirical analysis. The spread of profitability, inventory turnover, liquidity, leverage, and firm age suggest the presence of the necessary variation to examine nonlinear relationships between inventory margin and firm attributes.

Table 2. Descriptive Statistics for Core Variables

Variable	Mean	Std. Dev.	P25	Median	P75	Min	Max
Gross Profit Margin (%)	30.63	20.55	16.28	27.17	42.38	-22.62	89.35
Inventory Turnover (x)	13.17	26.44	2.65	4.88	10.09	0.13	173.73
Firm Size: Log(Assets)	12.09	2.13	10.70	12.04	13.44	6.98	17.45
Financial Leverage (%)	23.48	20.62	5.95	20.21	35.62	0.00	101.97
Cash Holdings Ratio	0.13	0.13	0.03	0.09	0.18	0.00	0.65
CapEx Ratio	0.05	0.05	0.01	0.03	0.06	0.00	0.28
Return on Assets (%)	2.72	8.78	0.70	3.29	6.45	-46.47	23.01
Sales Growth Rate (%)	11.55	33.90	-4.04	6.62	21.30	-68.35	167.53
Asset Tangibility (%)	29.66	21.55	11.97	26.08	43.45	0.24	87.63
Firm Age (Years)	33.44	26.83	15.00	25.00	45.00	1.00	136.00

Note. Continuous variables are winsorized at the 1st and 99th percentiles to mitigate outlier influence.

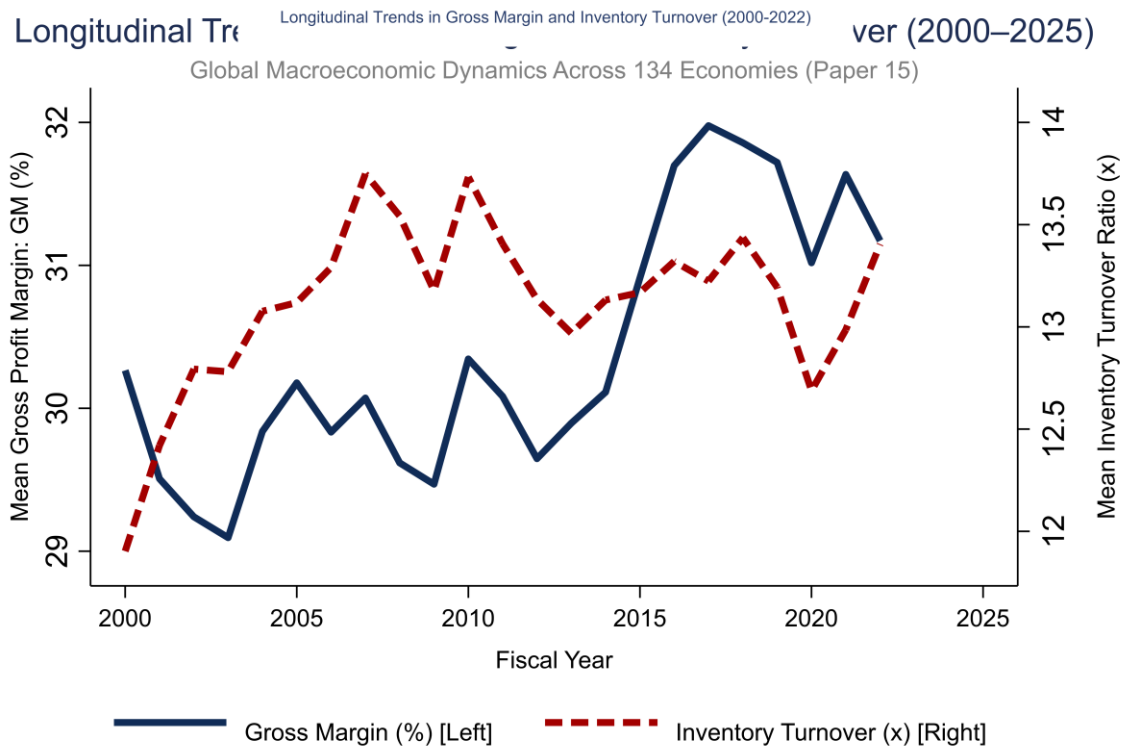
Table 3 reports the pairwise correlations among the study variables. The correlation pattern provides a preliminary indication of association and the primary explanatory variables are not strongly correlated with each other to compromise the design of the regression.

Table 3. Pearson Correlation Matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Gross Profit Margin (%)	1.000									
(2) Inventory Turnover (x)	~	1.000								
(3) Firm Size: Log(Assets)	0.003	0.013	1.000							
(4) Financial Leverage (%)	~	-0.011	0.082	1.000						
(5) Cash Holdings Ratio	0.154	0.073	~	~	1.000					
(6) CapEx Ratio	0.052	0.031	0.006	0.063	~	1.000				
(7) Return on Assets (%)	0.203	0.022	0.205	-0.171	~	0.091	1.000			
(8) Sales Growth Rate (%)	0.075	0.024	~	~	0.035	0.118	0.156	1.000		
(9) Asset Tangibility (%)	~	0.060	0.051	0.257	~	0.411	0.039	~	1.000	
(10) Firm Age (Years)	~	~	0.261	~	-0.118	~	0.067	-0.113	0.067	1.000

Note. Correlations are computed across the global panel. Statistical significance follows conventional reporting thresholds.

Descriptive background is illustrated in Fig. 1, which depicts the changes of inventory turnover and gross margin over the sample period. The figure is used to determine if inventory velocity changes are related to overall profitability trends prior to the onset of the regression evidence.



Note: Annual cross-sectional means calculated across global non-financial panel.

Figure 1 Longitudinal Trends in Inventory Turnover and Gross Profit Margin

The baseline regressions provide evidence for the central nonlinear argument. The turnover rate is also linked to high gross margins within the efficiency-enhancing range, but the quadratic shows that too much turnover will eventually have an adverse effect on margin performance. This represents a lean inventory frontier where companies gain from bringing lower levels of slow moving inventory, but suffer from the costs of being out of stock, the pressures of fast procurement, and the risk of disruption and inefficiency from an over-thin supply chain. The evidence thus backs up Hypothesis 1 and thereby eliminates the apparent paradox between Lean-efficiency and disruption-risk concerns. The finding is also consistent with the findings of Deb et al. (2023) and Afrifa et al. (2022) who reported that working-capital policy influences the operating performance through coordination and discipline in the use of capital using technology.

Table 4 reports the baseline test of the nonlinear inventory-turnover argument. The specification tests the stability of the relationship between inventory and the earnings margin across different models of unobserved heterogeneity: pooled, industry-year, firm-fixed-effects and year-adjusted.

Table 4. Baseline Regressions: Inventory Turnover Velocity and Gross Profit Margin

Independent Variables	(1) Pooled OLS	(2) Year FE	(3) Quad Year FE	(4) Ind & Year FE	(5) Firm FE
Inventory Turnover (x)	-0.0477*** (0.0037)	-0.0477*** (0.0037)	-0.2432** (0.0112)	-0.2671*** (0.0111)	-0.2602*** (0.0096)
Inventory Turnover Squared	—	—	0.0014*** (0.0001)	0.0015*** (0.0001)	0.0012*** (0.0000)
Firm Size: Log(Assets)	-0.2330*** (0.0596)	-0.2682*** (0.0604)	-0.2209*** (0.0602)	-0.3068*** (0.0563)	-0.2460** (0.0880)
Financial Leverage (%)	-0.0394*** (0.0054)	-0.0395*** (0.0054)	-0.0406*** (0.0054)	-0.0432** (0.0051)	-0.0118*** (0.0033)
Cash Holdings Ratio	23.5527*** (0.7911)	23.1038*** (0.7953)	24.0658*** (0.7900)	21.9927*** (0.7548)	5.6270*** (0.4222)
CapEx Ratio	16.5471*** (1.4989)	18.2823*** (1.5146)	18.6789*** (1.5177)	16.7895*** (1.4157)	7.2126*** (0.6848)
Return on Assets (%)	0.4896*** (0.0148)	0.4983*** (0.0149)	0.4998*** (0.0148)	0.5672*** (0.0140)	0.8138*** (0.0106)
Sales Growth Rate (%)	0.0207*** (0.0015)	0.0210*** (0.0015)	0.0224*** (0.0015)	0.0185*** (0.0014)	0.0032** (0.0010)
Asset Tangibility (%)	-0.0034 (0.0062)	-0.0034 (0.0062)	0.0074 (0.0062)	0.0481*** (0.0062)	0.0111* (0.0052)
Firm Age (Years)	0.0026 (0.0046)	0.0021 (0.0046)	0.0004 (0.0045)	0.0212*** (0.0043)	0.1488** (0.0566)
Constant	29.2879*** (0.7236)	29.7553*** (0.7289)	30.0982*** (0.7270)	42.9360*** (0.9483)	28.1416*** (1.5594)
Optimal Turnover Turning Point (x)	—	—	85.7 _x	89.7 _x	108.1 _x
Observations	349,229	349,229	349,229	349,210	349,229

R-squared		0.0769	0.0797	0.0883	0.1735	0.1875
F-statistic	/	445.57	154.11	161.99	218.90	300.30
Wald Chi2						
Firm Effects	Fixed	No	No	No	No	No

Note. The dependent variable is gross profit margin. Standard errors are clustered by firm. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The non-linear relationship between inventory turnover and gross margin is shown in Figure 2. The graph illustrates when further velocity of stock has a negative impact on bottom-line profit. What this means is that the point at which additional inventory velocity takes a turn for the worse in bottom-line profit is illustrated in the figure.

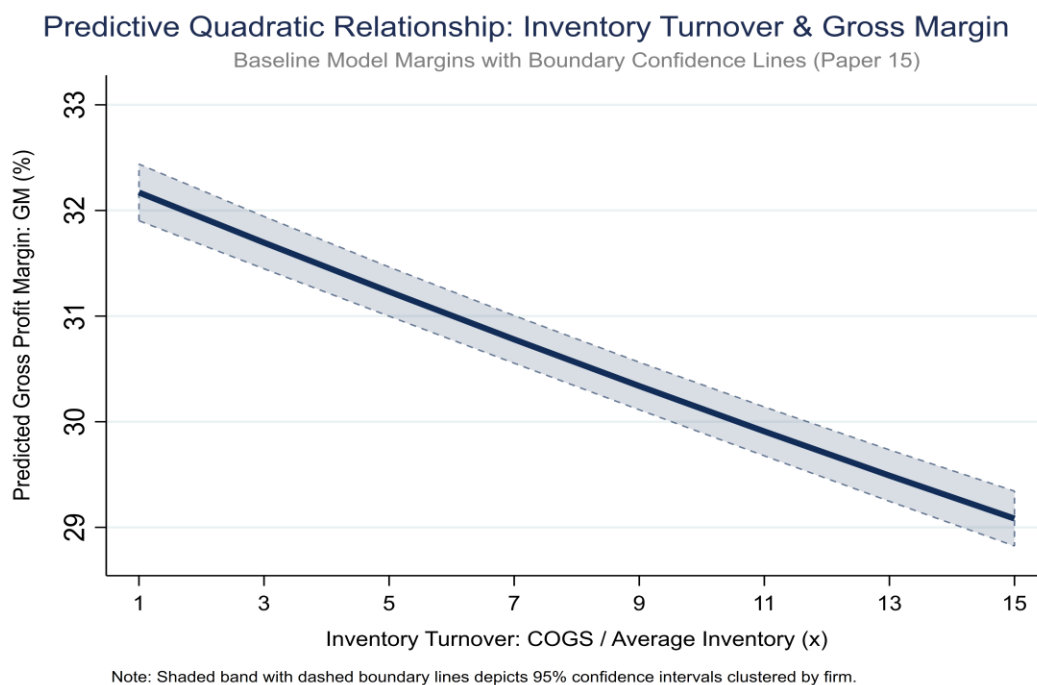


Figure 2 Quadratic Predictive Margins of Inventory Turnover on Gross Margin

The operational heterogeneity tests indicate that the inventory frontier is not the same for all conditions in the firm. There is a variation in the capacity to absorb the supply interruption and financing strain across firms with varying leverage, liquidity and size profiles. The findings suggest that inventory turnover goals should be related to financial flexibility and operating size, not be set as standards. The results are particularly important for companies that assess their working-capital policies based on short-term efficiency measures. More recent resilience research also

highlights how flexible and responsive performance and exposure to disruption are linked (Shekarian et al., 2020; Hamidu et al., 2023).

Table 5 shows how the baseline relationship differs across operational partitions and alternative margin definitions. These estimates provide insight into the robustness of the inventory frontier in terms of variations in leverage, firm size, and performance measurement.

Table 5. Heterogeneity Across Operational Partitions and Alternative Margins

Independent Variables	(1) ROA Control	(2) High Leverage	(3) Low Leverage	(4) Large Firms	(5) Small Firms
Inventory Turnover (x)	0.0105** (0.0030)	-0.1543*** (0.0148)	-0.3390*** (0.0140)	-0.2305*** (0.0151)	-0.2769*** (0.0146)
Inventory Turnover Squared	-0.0000 (0.0000)	0.0010*** (0.0001)	0.0019*** (0.0001)	0.0014*** (0.0001)	0.0016*** (0.0001)
Firm Size: Log(Assets)	0.8594*** (0.0216)	0.1182 (0.0708)	-0.4272*** (0.0826)	0.9263*** (0.1180)	-2.1151*** (0.1195)
Financial Leverage (%)	-0.0933*** (0.0023)	0.0543*** (0.0079)	-0.2539*** (0.0164)	-0.0277*** (0.0079)	-0.0573*** (0.0065)
Cash Holdings Ratio	-6.0485*** (0.3995)	20.0231*** (1.3595)	21.2434*** (0.8845)	14.2603*** (1.2030)	29.5753*** (0.9428)
CapEx Ratio	15.6584*** (0.5006)	18.3550*** (1.8241)	22.5741*** (2.1469)	3.3517 (2.5037)	22.2141*** (1.7142)
Return on Assets (%)	—	0.4905*** (0.0198)	0.5187*** (0.0170)	1.2688*** (0.0273)	0.3825*** (0.0149)
Sales Growth Rate (%)	0.0371*** (0.0008)	0.0196*** (0.0020)	0.0265*** (0.0021)	-0.0025 (0.0023)	0.0258*** (0.0019)
Asset Tangibility (%)	0.0037* (0.0015)	0.0042 (0.0074)	0.0017 (0.0087)	0.0343*** (0.0084)	-0.0027 (0.0082)
Firm Age (Years)	0.0073*** (0.0011)	0.0081 (0.0055)	-0.0041 (0.0058)	-0.0150** (0.0053)	0.0183* (0.0071)
Constant	-5.5967***	20.8813***	36.5079***	12.7233***	49.1703***

	(0.2738)	(0.9531)	(0.9756)	(1.5678)	(1.2879)
Optimal Turnover Turning Point (x)	145.8x	80.9x	88.2x	84.8x	86.8x
Observations	349,229	174,395	174,834	177,629	171,600
R-squared	0.1326	0.0521	0.1120	0.1401	0.1057
F-statistic /	320.22	61.00	123.45	126.65	119.73
Wald Chi2					
Firm Fixed Effects	No	No	No	No	No

Note. Subsample partitions are based on leverage and asset-size medians. Standard errors are clustered by firm. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 6 decomposes the inventory-margin relationship by turnover velocity and cash-buffer groups. The comparison helps to elucidate whether benefits and risks of lean inventory are a function of liquidity protection and the movement of inventory.

Table 6. Decomposition Across Turnover Velocity Tiers and Cash Buffers

Independent Variables	(1) Low Turnover	(2) Moderate Turnover	(3) High Turnover	(4) High Cash Buffer
Inventory Turnover (x)	-10.5672*** (0.7798)	-6.8566*** (0.4084)	0.1498*** (0.0127)	-0.2841*** (0.0136)
Inventory Turnover Squared	1.4803*** (0.2169)	0.4665*** (0.0371)	-0.0008*** (0.0001)	0.0016*** (0.0001)
Firm Size: Log(Assets)	-0.6701*** (0.1052)	0.0450 (0.0692)	-0.0463 (0.0938)	-0.7233*** (0.0789)
Financial Leverage (%)	-0.0976*** (0.0090)	-0.0607*** (0.0064)	-0.0024 (0.0086)	-0.0346*** (0.0073)
Cash Holdings Ratio	36.9607*** (1.2633)	25.0238*** (0.9607)	22.7418*** (1.2510)	30.5599*** (0.9445)
CapEx Ratio	44.5156*** (2.6465)	22.5199*** (1.7516)	12.5367*** (2.3684)	19.5241*** (1.9668)
Return on Assets (%)	0.5568*** (0.0219)	0.5843*** (0.0192)	0.5992*** (0.0224)	0.4810*** (0.0168)
Sales Growth	0.0426***	0.0365***	0.0059*	0.0277***

Rate (%)	(0.0025)	(0.0023)	(0.0026)	(0.0021)
Asset Tangibility (%)	0.0421***	-0.0106	0.1105***	-0.0018
Firm Age (Years)	(0.0111)	(0.0083)	(0.0088)	(0.0088)
	0.0746***	0.0256***	-0.0463***	-0.0030
Constant	(0.0075)	(0.0049)	(0.0077)	(0.0056)
	50.4129***	44.0061***	16.4191***	34.5672***
	(1.4302)	(1.3419)	(1.1721)	(1.0083)
Optimal Turnover Turning Point (x)	—	—	—	—
Observations	100,243	139,861	109,125	176,607
R-squared	0.1493	0.1628	0.1065	0.1108
F-statistic	/ 114.95	157.85	63.23	127.10
Wald Chi ²				
Firm Fixed Effects	No	No	No	No

Note. Partitions compare inventory-velocity cohorts and liquidity-buffer subsamples. Standard errors are clustered by firm. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figure 4 shows gross margins as a function of discrete inventory turns. The figure illustrates why improving turnover by a moderate amount can be beneficial, but increasing it by a significant amount could indicate a operational fragility.

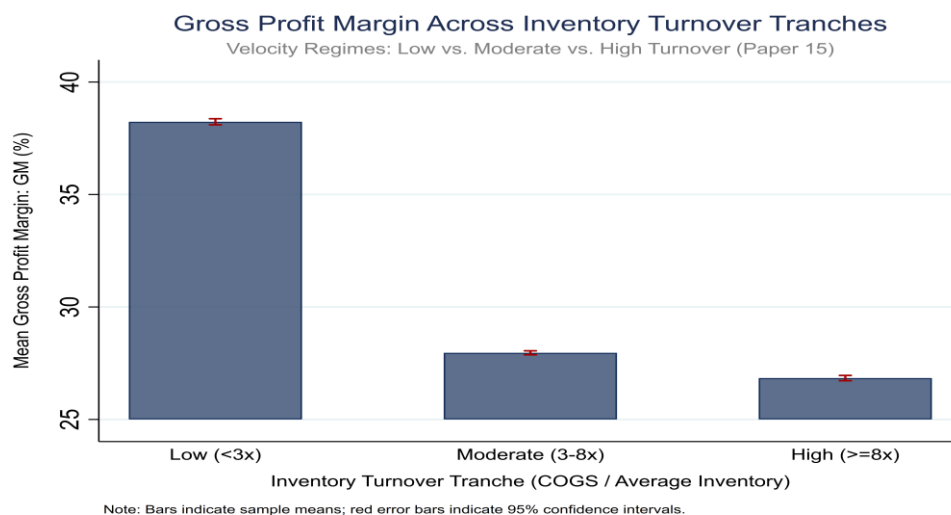


Figure 4 *Gross Profit Margin Across Discrete Inventory Velocity Tranches*

The life-cycle estimations provide evidence in favor of Hypothesis 2. Growth companies will need to be more careful with their inventory policies, as greater sales growth, customer acquisition and distribution reliability place a higher value on buffer inventory. Leaner can be supported in mature companies as they often have the advantage of more stable demand, long-term supplier relationships, and better forecasting capabilities. The high turnover in Shakeout and Decline companies must be interpreted with caution since it can be a symptom of liquidation pressure, not of high performance.

Table 7 tests the life-cycle moderation hypothesis by estimating the frontier separately for Introduction, Growth, Mature, Shakeout, and Decline firms. For each of the organizational conditions, the table shows whether a firm's optimal inventory policy changes as it transitions through those different conditions.

Table 7. Corporate Life-Cycle Stage Regressions

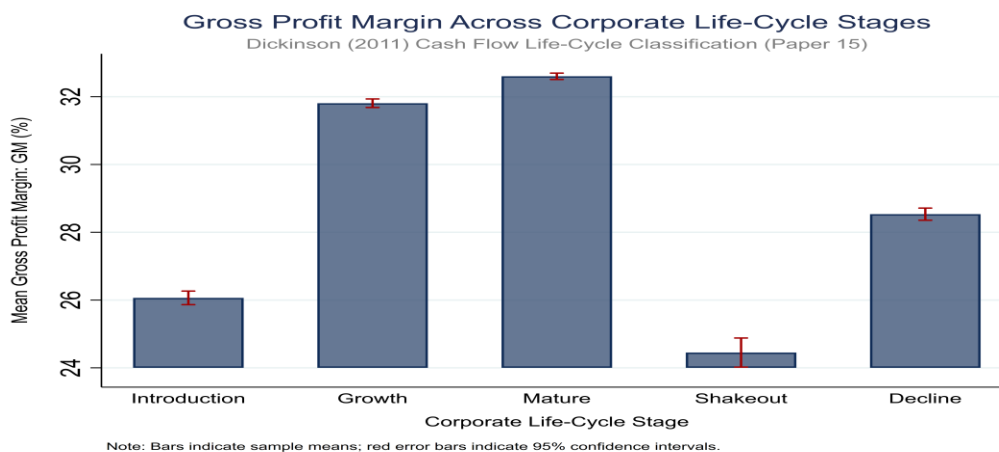
Independent Variables	(1) Introduction	(2) Growth	(3) Mature	(4) Shakeout	(5) Decline
Inventory Turnover (x)	-0.4784*** (0.0203)	-0.1612*** (0.0138)	-0.2038*** (0.0138)	-0.3356*** (0.0310)	-0.3439*** (0.0161)
Inventory Turnover Squared	0.0027*** (0.0001)	0.0010*** (0.0001)	0.0012*** (0.0001)	0.0018*** (0.0002)	0.0020*** (0.0001)
Firm Size: Log(Assets)	-1.4884*** (0.0907)	-0.2483** (0.0735)	0.2047** (0.0713)	-1.1204*** (0.1696)	-0.3544*** (0.0903)
Financial Leverage (%)	-0.0307*** (0.0083)	-0.0432*** (0.0076)	-0.0162* (0.0068)	-0.0314* (0.0141)	-0.0314*** (0.0084)
Cash Holdings Ratio	22.9346*** (1.4776)	17.4348*** (0.9970)	16.6683*** (1.0330)	19.5190*** (2.4251)	23.5813*** (1.1539)
CapEx Ratio	9.7620*** (2.7939)	3.7699* (1.8534)	9.2937*** (2.5835)	18.9426* (9.1124)	32.7863*** (4.3681)
Return on Assets (%)	0.1155*** (0.0184)	0.8394*** (0.0234)	1.1380*** (0.0210)	0.5067*** (0.0473)	0.4680*** (0.0246)
Sales Growth Rate (%)	0.0209*** (0.0028)	0.0103*** (0.0026)	-0.0095*** (0.0025)	0.0271*** (0.0069)	0.0208*** (0.0031)
Asset Tangibility	-0.1425***	0.0206*	0.0353***	-0.0721***	0.0176

(%)					
Firm Age (Years)	(0.0105)	(0.0083)	(0.0074)	(0.0167)	(0.0098)
	-0.0100	-0.0106	0.0028	0.0168	0.0019
Constant	(0.0076)	(0.0054)	(0.0050)	(0.0130)	(0.0067)
	47.7335***	30.8913***	21.1904***	36.4959***	30.5466***
Optimal Turnover Turning Point (x)	(1.2764)	(0.9982)	(0.8883)	(2.4316)	(1.2570)
	88.0x	82.3x	84.7x	91.1x	86.7x
Observations	46,337	85,189	154,724	9,934	53,045
R-squared	0.1076	0.0961	0.1419	0.0814	0.0851
F-statistic / Wald Chi2	52.81	99.51	160.22	16.64	58.91
Firm Fixed Effects	No	No	No	No	No

Note. Life-cycle stages follow Dickinson's (2011) cash-flow pattern classification. Standard errors are clustered by firm. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

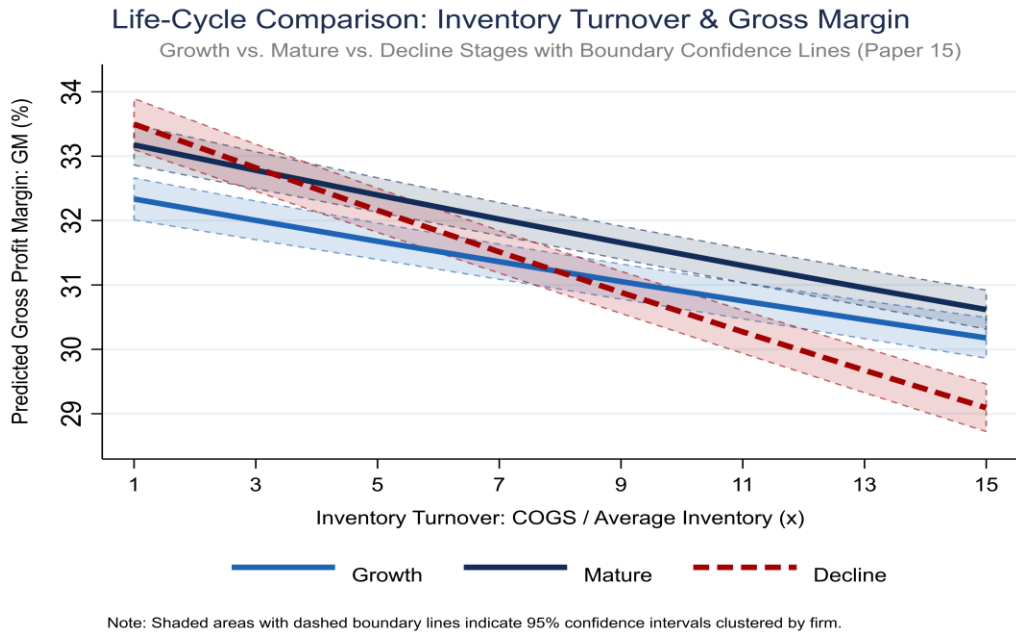
Figure 3 shows gross-margin results by corporate life-cycle stage. The figure correlates organizational maturity and performance dispersion with the support of the argument to use a life cycle context to evaluate inventory strategy.

Figure 3 Gross Profit Margin Across Corporate Life-Cycle Stages



The predicted nonlinear margins are shown separately by life-cycle stage in Figure 5. The figure shows that the shape of the inventory frontier varies between Introduction, Growth, Mature, Shakeout and Decline firms.

Figure 5 Predictive Margins of Inventory Turnover by Life-Cycle Stage



The institutional results lend support to Hypothesis 3, indicating a national context that influences the sustainable inventory frontier. Advanced Economies offer infrastructure and contract structure that enable companies to run with relatively high inventory turnover. Weaker logistics and more delivery uncertainty means that more precautionary inventory is valuable and makes it difficult to implement aggressive lean inventory in Emerging Markets and Developing Economies. This core interpretation is confirmed by the formal robustness tests, which are alternative empirical tests. This perspective is consistent with evidence suggesting that resource orchestration and digital coordination influence resilience during challenging operating conditions (Queiroz et al., 2022; Pandey et al., 2024).

Table 8 reports estimated inventory–turnover turning points by life-cycle stage and institutional group. The turning points allow the economic interpretation of the nonlinear coefficients as inventory targets.

Table 8. Optimal Inventory Turnover Turning Points Across Life Cycle and Institution

Life-Cycle Stage	Institutional Group	Optimal Turnover (x)	Std. Err.	z-statistic	p-value	95% Conf. Interval	Observations
Growth	Advanced	91.2x	3.35	27.22	<0.001	[84.7x, 97.8x]	43,768
Mature	Advanced	93.3x	2.72	34.33	<0.001	[88.0x, 98.6x]	86,995

Decline	Advanced	91.0 _x	2.28	39.94	<0.001	98.6 _x [86.6 _x , 95.5 _x]	28,172
Growth	EMDE	74.0 _x	2.78	26.64	<0.001	[68.6 _x , 79.5 _x]	41,421
Mature	EMDE	71.1 _x	2.54	28.04	<0.001	[66.2 _x , 76.1 _x]	67,729
Decline	EMDE	81.0 _x	2.23	36.27	<0.001	[76.6 _x , 85.3 _x]	24,873

Note. Optimal turning points maximize gross margin and are derived using Delta-method standard errors clustered by firm.

Table 9 formally tests the differences in the estimated turning points across life-cycle and institutional groups. The Delta-method comparisons are carried out to tell if the difference between observed optimal turnover is statistically significant.

Table 9. Delta-Method Formal Hypothesis Tests of Inventory Turning Point Differences

Pairwise Comparison	Difference (Delta)	Std. Err.	z-statistic	p-value	95% Conf. Interval	Decision
EMDE Growth vs AE Growth	-15.7 _x	4.26	-3.70	<0.001	[-24.1 _x , -7.4 _x]	Significant (p<0.05)
EMDE Mature vs AE Mature	-22.5 _x	3.86	-5.83	<0.001	[-30.1 _x , -15.0 _x]	Significant (p<0.05)
EMDE Decline vs AE Decline	-10.1 _x	3.05	-3.29	<0.001	[-16.0 _x , -4.1 _x]	Significant (p<0.05)
AE Mature vs AE Growth	2.8 _x	3.37	0.84	0.402	[-3.8 _x , 9.4 _x]	Not Significant
EMDE Mature vs EMDE Growth	-4.0 _x	2.86	-1.39	0.166	[-9.6 _x , 1.6 _x]	Not Significant

Note. Statistical significance is evaluated using Delta-method comparisons from fully interacted models with firm-clustered standard errors.

Table 10 compares Advanced Economies with Emerging Markets and Developing Economies to assess institutional moderation. Results indicate whether the sustainable inventory turn-over frontier moves as a result of changing national logistics, governance and market conditions.

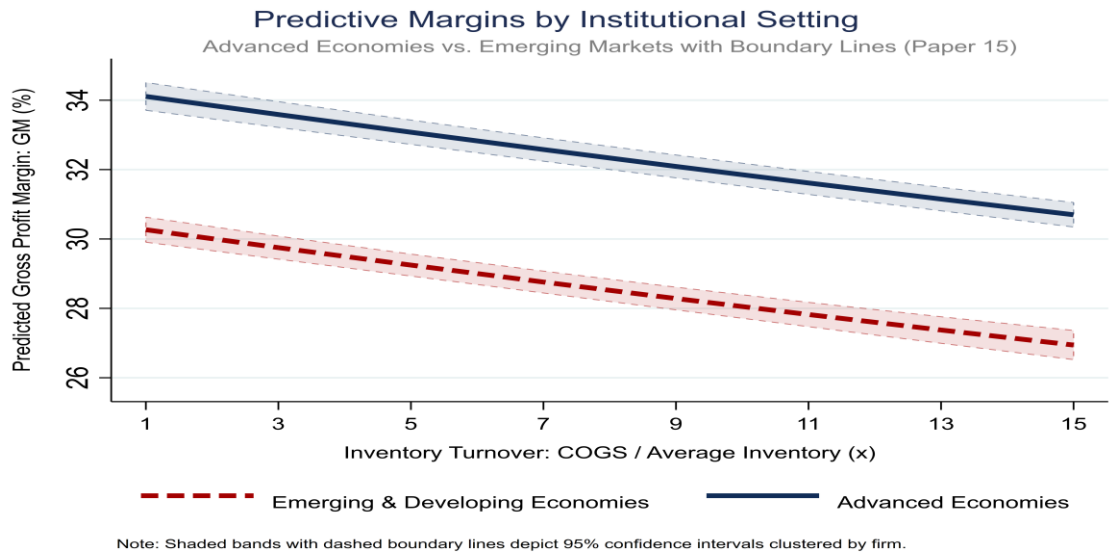
Table 10. Institutional Setting Moderation: Advanced vs. Emerging Economies

Independent Variables	(1) Advanced Economies	(2) Emerging Markets	(3) Fully Interacted
Inventory Turnover (x)	-0.2569*** (0.0144)	-0.2743*** (0.0180)	-0.2654*** (0.0184)
Inventory Turnover Squared	0.0014*** (0.0001)	0.0018*** (0.0001)	0.0017*** (0.0001)
Firm Size: Log(Assets)	-0.1878* (0.0944)	-0.2050* (0.0797)	-0.3797*** (0.0602)
Financial Leverage (%)	-0.0004 (0.0077)	-0.0829*** (0.0071)	-0.0414*** (0.0053)
Cash Holdings Ratio	24.9850*** (1.0883)	15.1625*** (1.1440)	22.2531*** (0.7915)
CapEx Ratio	19.5138*** (2.4878)	12.6819*** (1.8339)	19.5167*** (1.5122)
Return on Assets (%)	0.4162*** (0.0173)	0.9800*** (0.0254)	0.5422*** (0.0148)
Sales Growth Rate (%)	0.0395*** (0.0022)	-0.0040* (0.0020)	0.0245*** (0.0015)
Asset Tangibility (%)	-0.0271** (0.0094)	0.0620*** (0.0079)	0.0150* (0.0062)
Firm Age (Years)	-0.0239*** (0.0061)	0.0180* (0.0069)	-0.0114* (0.0046)
Constant	32.3388*** (1.1545)	25.6690*** (0.9512)	29.9701*** (0.7266)
Optimal Turnover Turning Point (x)	92.7x	75.6x	75.6x
Observations	189,072	160,157	349,229
R-squared	0.0812	0.1484	0.0958
F-statistic / Wald Chi2	85.41	127.48	164.23
Firm Fixed Effects	No	No	No

Note. Models compare Advanced Economies and Emerging Markets. Standard errors are clustered by firm. * p < 0.05, ** p < 0.01, *** p < 0.001.

In Figure 6, the inventory-margin frontier in different institutional settings is compared. The figure illustrates the impact that logistics, supplier reliability, and governance conditions can have on the practical limits of lean inventory.

Figure 6: *Institutional Setting Moderation: Advanced Economies vs. Emerging Markets*



The life-cycle evidence is summarized in figure 7, which presents a synthesis of the life-cycle evidence by comparing the approximate optimal turnover points. The figure illustrates that the inventory goals are dependent on the firm's maturity and the operating environment in the country.

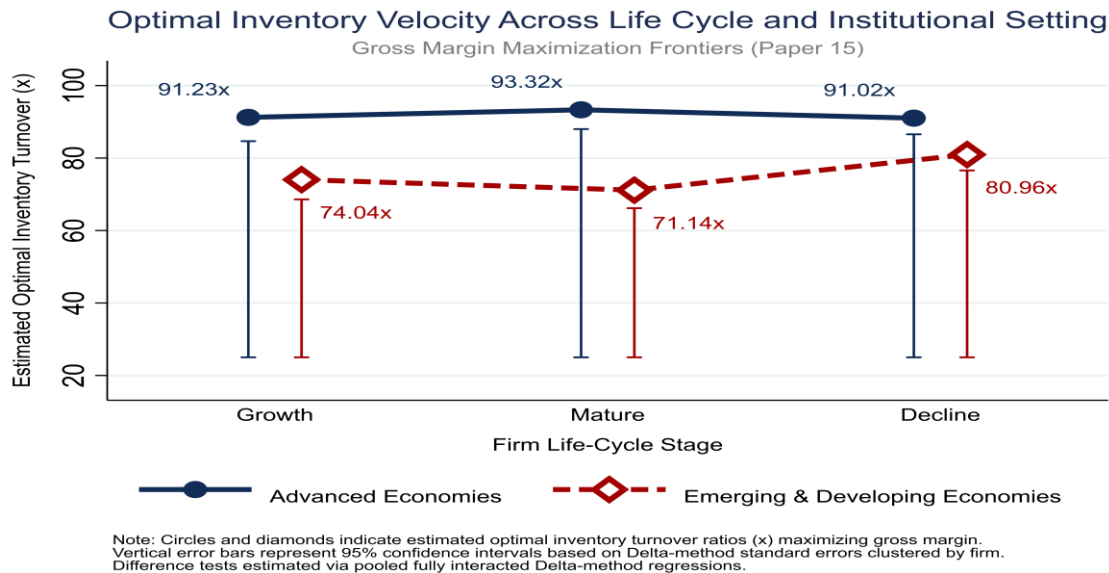


Figure 7 Optimal Inventory Turnover Frontiers Across Life Cycle and Institutional Settings

The robustness evidence also confirms the primary interpretation: The nonlinear inventory-margin relationship is present with different lag structures, an instrumental-variable logic, partitions of the tangibility, and sample restrictions after the crisis. The tests have shown that the reported relationship is not only due to any one specification and is not only due to observations during periods of crisis. Similar evidence comes from recent studies of Industry 4.0 and supply-chain capability showing that capability to be resilient under alternative operating conditions continues to sustain performance (Spieske & Birkel, 2021; Huang et al., 2023).

Table 11 reports robustness checks using lagged specifications, instrumental-variable logic, high-tangibility partitions, and crisis-adjusted samples. These checks examine the central nonlinear result's sensitivity to timing, identification and asset structure, and macroeconomic disruption.

Table 11. Robustness Checks: Dynamic Panel 2SLS, High Tangibility, and Crisis Regimes

Independent Variables	(1) Lagged Specification	(2) Dynamic 2SLS IV	(3) High Tangibility	(4) Post-2010 Non-Crisis
Lagged Turnover (t-1)	-0.2246*** (0.0117)			
Lagged Turnover Squared (t-1)	0.0013*** (0.0001)			
Inventory Turnover (x)		-0.2717*** (0.0146)	-0.1464*** (0.0156)	-0.2551*** (0.0118)
Inventory Turnover Squared		0.0017*** (0.0001)	0.0009*** (0.0001)	0.0015*** (0.0001)
Firm Size: Log(Assets)	-0.2111** (0.0620)	-0.1878** (0.0638)	-0.3283*** (0.0774)	-0.3102*** (0.0612)
Financial Leverage (%)	-0.0416*** (0.0057)	-0.0421*** (0.0059)	-0.0383*** (0.0068)	-0.0297*** (0.0060)
Cash Holdings Ratio	23.5264*** (0.8292)	23.3141*** (0.8733)	26.9817*** (1.3895)	24.2867*** (0.8511)
CapEx Ratio	18.9927*** (1.6148)	18.2006*** (1.7340)	12.4759*** (1.6064)	17.7748*** (1.7826)
Return on Assets (%)	0.5241*** (0.0168)	0.5540*** (0.0189)	0.8635*** (0.0204)	0.5188*** (0.0166)
Sales Growth	0.0167***	0.0198***	0.0138***	0.0243***

Rate (%)				
	(0.0017)	(0.0018)	(0.0022)	(0.0018)
Asset Tangibility (%)	0.0048	0.0071	0.1881***	0.0020
	(0.0064)	(0.0067)	(0.0099)	(0.0066)
Firm Age (Years)	0.0014	0.0031	0.0177**	-0.0052
	(0.0046)	(0.0047)	(0.0055)	(0.0046)
Constant	29.5233***	30.1990***	20.0450***	30.2724***
	(0.7555)	(0.8061)	(0.9986)	(0.7587)
Optimal Turnover Turning Point (x)	83.7x	79.8x	87.2x	—
Observations	317,824	288,774	176,379	247,223
R-squared	0.0866	0.0904	0.1284	0.0885
F-statistic	/ 150.88	4402.10	132.77	198.05
Wald Chi2				
Firm Fixed Effects	No	No	No	No

Note. Robustness checks use lagged explanatory variables, instrumental-variable logic, high-tangibility firms, and the post-2010 subsample. Standard errors are clustered by firm. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Discussion of Findings

The results offer a coherent explanation to the lean inventory paradox. While inventory turnover is beneficial due to its effect on idle working capital and cost savings associated with storing inventory, it is not costless associated with operational effectiveness. When stock levels fall too low, companies face hidden expenses including disruption, expedited shipping, missed sales opportunities, reduced leverage for suppliers, and decreased service reliability. The study thus demonstrates the need to strike a balance between efficiency and resilience in inventory strategy. This is aligned with recent resilience research that demonstrated that the probability of survivability and disruption responses for the sectors need buffers as well as efficiency (Ivanov & Dolgui, 2020; Belhadi et al., 2021).

The life-cycle evidence enhances the theoretical contribution. Growth companies are dealing with an increased demand for products and services, and increased uncertainty, making buffer inventory a strategic piece of an asset and not just a cost to be avoided. Companies that are mature can leverage forecasting systems, supplier experience and consistent demand to continue lean operations. High turnover for a company in the Shakeout or Decline stage should be taken with a pinch of salt as it may be a sign of distress or perhaps possibly a forced liquidation. This separation enhances the economic interpretation of working-capital ratios.

The analysis is extended beyond the firm boundary in the institutional evidence. Roads, ports, customs and the reliability of contracts, and the depth of suppliers are all critical to lean

operations. Firms operating in less favorable logistical conditions do not have the ability to safely emulate the turnover of other firms in more favorable institutional conditions. The result is important for commerce and social-science studies because it demonstrates the effect of national infrastructure and governance on the operating results of firms. The overall literature on resilience also points to the need to view supply chains as adaptive systems which are linked to institutional and relational environments (Wieland & Durach, 2021; Wieland, 2021). Other evidence on natural resource wealth and firm-level innovation also suggests that governance discipline influences firm-level strategic adaptation (Ghazali et al., 2026).

The results imply that inventory policy is a contingent strategic decision. Managers should evaluate the product-market volatility, supplier reliability, financial flexibility, life-cycle stage, and institutional conditions when assessing inventory velocity. Higher turnover should not be regarded as automatically better by investors and lenders. A high turnover ratio can be a good indicator of discipline; however, outside of the sustainable zone it may indicate fragility and margin vulnerability. This is echoed in recent research which has been advocating for the need for post-disruption supply-chain management in bridging the gap between resilience research and management (van Hoek, 2020; Scholten et al., 2020).

Conclusion and Policy Implications

Conclusion

The aim of this research is to examine the impact of inventory turnover velocity on gross profit margins in different phases of corporate life cycle and in the different institutional environments. The evidence suggests that there is a nonlinear relationship: the discipline of having less inventory raises profitability if it lowers the cost of carrying inventory and the operational slack, but if it causes disruption exposure, margins fall. The results also indicate that the sustainable inventory frontier is different for each organizational phase and country context, thus revealing that a single metric is not suitable for assessing lean operations.

The manuscript contributes to operations, corporate finance and international business research through its connection of working-capital management and life-cycle theory and institutional capacity. It reveals that inventory turnover is not only an accounting efficiency measure, but also an operating frontier determined by the interplay of uncertainty in customer demand, power of supply chain, financial flexibility and logistics capabilities. This interpretation will give managers and academics a better basis for their research and decision-making.

Policy Implications

Managers need to set inventory targets that illustrate both resilience as well as efficiency. Aggressive turnover targets that can jeopardize availability and reliability should be avoided by growth-oriented firms and firms in weaker logistical environments. Even with stable demand and robust supplier relationships, mature companies can implement leaner systems, but it is important to keep an eye on early warning signs like stock out rates, emergency purchases and delivery times.

Policymakers can alleviate institutional frictions that increase the risk of lean inventory, which can enhance firm performance. Domestic companies can increase their sustainable inventory frontier through investments in transport infrastructure, customs efficiency, digital logistics systems, contract enforcement and developing their supplier markets. Financial regulators and lenders should also consider working-capital metrics as part of the whole picture because a sufficient inventory cushion could safeguard profitability and jobs in times of stress in the supply chain.

Limitations and Future Research Directions

Future studies should be guided by a number of limitations. The analysis uses the annual data on financial statements only and therefore cannot record within-year stockouts, inventory changes by product or sales delay. The mechanisms could be tested more directly with future research using transaction level inventory data, sector specific logistics measures or the information on supplier networks. Other projects might investigate the impacts of artificial intelligence, predictive analytics, and regional warehousing on the trade-off between inventory and economic growth, as well as the industry and economic sectors affected.

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