The Impact of Lean Inventory Management on Export Intensity

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This study aims to explore the impact of lean inventory management on export intensity and explain how environmental dynamics and complexity moderate this relationship. The Heckman two-step method was used to examine this relationship during periods from 2000 to 2013. The results reveal an inverted U-shaped relationship between inventory leanness and export intensity. Furthermore, this study indicates that environmental dynamics and environmental complexity weaken the relationship between inventory leanness and export intensity. These findings convey a message to managers which can enhance export intensity and improve international competitiveness by realizing the optimal level of inventory leanness. Managers should pay more attention to inventory management when the intensity of competition is weak or the environment is less dynamic. This paper contributes to understand the relationship between inventory leanness and export intensity by studying the moderating role of environmental dynamics and environmental complexity.

Keywords: *Inventory Leanness; Export Intensity; Environmental Dynamics; Environmental Complexity.*

Introduction

In recent years, the pace of growth in export trade has steadily decelerated, presenting numerous challenges and uncertainties. The imperative task at hand is to adapt to the evolving global economic landscape and foster export growth. Amidst the burgeoning export crisis and operational stresses, it is incumbent upon companies to institute proactive strategies to retain international competitiveness. Melitz (2003) foregrounded the disparities in enterprise productivity, asserting that only high-productivity firms are equipped to shoulder the substantial fixed costs associated with exporting, thereby engaging actively in export ventures. Furthermore, a myriad of scholars have delved into the nexus between export performance and variables such as exchange rate fluctuations (Tunc & Solakoglu, 2024), market segmentation (Zhang *et al.,* 2014; *Manova et al.,* 2015), and product innovation (Rialp-Criado & Komochkova, 2017).

Inventory leanness is particularly important for manufacturing companies, especially those involved in export. One of the critical elements in business production, planning, and control is inventory management, which plays a crucial role in business management. Many sources agree that inventory reduction can free up cash flow (Hameri & Weiss, 2017; Chuang & Zhao, 2019), improve product quality (Blum *et al.,* 2019), and make increase the efficiency of businesses, and help them improve their financial performance (Isaksson & Seifert, 2014). Moreover, many companies maintain a certain amount of inventory to ensure regular and stable levels of business production and meet the needs of their customers with better quality output, thus maintaining the reputation of the companies and consolidating their market share (Modi & Mishra, 2011). Finally, inventory leanness is a crucial inventory management metric described as a company's ability to reduce its inventory compared to similarly-sized firms in the industry (Eroglu & Hofer, 2011).

Several studies of inventory leanness provide valuable insights into its effects, particularly how inventory leanness affects financial performance (Eroglu & Hofer, 2014; Isaksson & Seifert, 2014), credit ratings (Bendig *et al.,* 2017), product quality (Lin *et al.,* 2018), and cost efficiency (Tasdemir & Hiziroglu, 2019). However, a study has yet to be done on how inventory leanness affects export intensity. This paper uses Heckman's two-step estimation to examine the relationship between inventory leanness and export intensity. In addition, environmental dynamics and competition intensity are used to explore the moderating effects.

This scholarly endeavor delivers substantial and impactful contributions to the current research paradigm across three pivotal dimensions. Initially, the study significantly broadens our intellectual horizons concerning the impact of inventory leanness on corporate export performance. Historically, mainstream academia has predominantly posited that adept inventory management can substantially enhance a firm's export performance (Panigrahi *et al.,* 2024). While this perspective has illuminated the beneficial role of inventory management within the realm of corporate performance, it has not yet delved into the nuanced functional aspects of this relationship. Our empirical findings, by revealing a more sophisticated and multifaceted view of this critical nexus, have, for the first time, identified an inverted U-shaped relationship between inventory leanness and export intensity, thereby significantly enriching the discourse in this field.

Subsequently, this paper meticulously examines the moderating influence of environmental dynamism, offering deeper insights into how export-oriented firms navigate the dynamic interplay between inventory leanness and export intensity amidst environmental volatility. Our research aligns with extant studies that underscore environmental dynamism as a significant factor affecting corporate operational strategies and clarify its implications for

inventory management and financial performance (Zhu *et al.,* 2021). Therefore, our empirical results verify the moderating role of environmental dynamics in the relationship between inventory lean and export performance.

Lastly, the study delves into the moderating effect of environmental complexity, investigating how variations in environmental complexity influence the relationship between inventory leanness and corporate export performance. This bold exploration is informed by research highlighting the impact of environmental complexity on inventory management and corporate performance (Zhu *et al.,* 2018). The findings reaffirm the essential role of environmental complexity in modulating the relationship between lean inventory practices and corporate export performance.

The distinctiveness of this research lies in its thorough investigation of the nonlinear effects of inventory leanness on export intensity, diverging from the traditionally assumed linear relationship. Furthermore, by delving into the moderating influences of environmental dynamism and complexity, it reveals the intricate interplay between inventory management practices and corporate performance amidst the uncertainties of international trade. Collectively, these research dimensions shed new light on the underexplored impacts of inventory management on export trade.

The structure of this paper is as follows: In the Literature Review section, we provide an exhaustive examination of the pertinent academic literature. Building upon this foundation, the Hypothesis Development section delineates the evolution of the hypotheses for this study. The Methodology section elucidates the data processing, variable measurement, and research methodologies employed. The Empirical Analysis and Results section presents the meticulously scrutinized empirical findings. The Discussions section delves into the implications of these research outcomes. Finally, the Conclusion and Future Research section discusses the limitations of the study and offers recommendations for subsequent investigative endeavors.

Literature Review

Export Performance

The centrality of exports to economic dynamism is an axiom well-founded in both empirical evidence and theoretical literature. Exports are not just a function of market access or competitive pricing, they also act as a lens through which the intrinsic attributes of a business can be focused. The concept of self-selection in the export context was originally proposed by Clerides et al. in 1998, the foundation was laid for future research on this topic. On this basis, Melitz (2003) pioneered an in-depth study of the nuances of productivity heterogeneity among firms. He believes that exporting is not an indiscriminate activity open to all enterprises; on the contrary, only enterprises with high productivity can bear the higher fixed costs required for enterprise exports and thus devote themselves to export activities. These enterprises have unique advantages and can support the large fixed costs required for export, thus giving these enterprises the ability to actively participate in the export market. The works of scholars such as Besedes and Prusa (2011) further strengthened this academic consensus. They note that a country's export growth can essentially be divided into two main components: the extensive margin and the intensive margin. The extensive margin refers to the addition of new export firms or the introduction of new products to the export market, while the intensive margin involves the expansion of existing firms or product exports. This layered understanding of exports emphasizes the complex interactions between firms. It emphasizes the need for business managers to cultivate high-productivity enterprises that can thrive in the competitive arena of international trade.

The rapid rise of export trade as a key component of global economic activity has spawned a wealth of empirical research aimed at demystifying the many factors driving export growth. These academic efforts conduct analyzes at both the macro and micro levels, each providing unique perspectives and insights into export behavior. At the macro level, exchange rate is an important factor affecting export performance, as emphasized by Tunc and Solakoglu (2024). Changes in currency denomination have a direct and often immediate impact on the competitiveness of goods and services on international markets. However, the complex interplay of factors affecting exports goes far beyond purely monetary considerations. For example, regional institutions are seen as another important determinant. Shnyrkov et al. (2019) provide an in-depth study of the role that different regions play in creating an environment that is conducive to (or conversely, hinders) export trade. Their analysis provides a nuanced understanding of how local governance structures and policies facilitate or impede access to export markets. The dimensions of market segmentation are also scrutinized, revealing how different market niches or sectors influence export behavior. Diamantopoulos et al. (2014) enrich our understanding of how firms strategically navigate market segments to optimize export outcomes. The situation is further complicated by political connections, which are investigated in detail by, among others, Sharma et al. (2020). Their literature reveals a symbiotic relationship between political connections and export behavior, illustrating how such connections can serve as both a catalyst and a barrier to export trade. Overall, these literatures provide a multifaceted perspective. By sorting out, we can examine the intricate relationships, analyze the factors that affect exports, and clarify the causes of related effects. This comprehensive understanding is a valuable resource for academics and business managers seeking to realize the full potential of export trade in the marketplace.

In recent academic research, the focus has increasingly shifted towards micro-level studies of exports by obtaining detailed firm-level data. This refined approach provides a deeper understanding of export behavior. We found that productivity has been considered a main feature of corporate export behavior and is a key factor affecting corporate export activities because corporate productivity can increase a company's export probability. Specifically, higher productivity not only increases the likelihood of enterprises engaging in exporting (Gkypali et al., 2021), but also expands the scope of export products and target markets (Qiu & Yu, 2020). Interestingly, some domestic researchers have put forward the opposite view, believing that the productivity of exporting enterprises is actually lower than that of non-exporting enterprises, thus introducing the concept of "productivity paradox" (Chunding & Yin, 2010).

Some scholars believe that export intensity also depends to a large extent on factors such as product innovation and R&D investment. (Maria & Ganau, 2014; Rialp-Criado & Komochkova, 2017). High-quality, innovative products are particularly helpful in meeting consumer preferences and thus increasing export intensity (Tuominen *et al.,* 2022). This shows that innovation and quality play a key role in enhancing a company's competitive advantage in the global market.

In order to expand the heterogeneous enterprise model first proposed by Melitz in 2003, Chaney (2005) introduced the key variable of financial constraints. He believed that this restriction has a significant inhibitory effect on the export intensity of enterprises. Subsequent research by Manova et al. (2015) confirms this view, again highlighting the adverse impact of financial constraints on export-related activities. Xiang (2015) further analyzed how financing constraints affect the quadratic margin of export growth. The study reveals a direct correlation, showing that increased financial constraints have a detrimental effect on intensive editing and expansion margins, while relaxing such constraints has the opposite effect. In addition, the credit reputation of enterprises plays a dual role in this context. It not only directly increases export intensity, but also has an indirect amplifying effect by easing the constraints imposed by financial restrictions (Demena, 2024).

Moreover, existing literature also mentions the role of trade liberalization on exports, with particular emphasis on the reduction of tariffs on intermediate products. Feng et al. (2016) found that companies which increase their imports of intermediate products see an increase in export volumes and also expand their export range. Fan et al. (2018) take a nuanced approach and divide trade liberalization into two categories: output tariff reductions and input tariff reductions. Their findings confirm that such liberalization measures significantly increase firms' export propensity and export intensity. Research by some other scholars emphasizes that foreign direct investment (FDI) is also considered a key driving force affecting exports (Sahoo & Dash, 2022). Apart from these major factors, various other factors also play a role in influencing export outcomes. For example, Srhoj and Wagner (2020) argue that government subsidies have proven to be an effective catalyst in promoting exports. Medeiros et al. (2024) posits that agglomeration economies tend to occur due to knowledge spillovers, labor market pooling, and reduced transportation costs. Proximity to other exporting firms and their knowledge spillovers can help mitigate some of the sunk costs faced by firms in the process of internationalization and facilitate their export activities. Finally, as research results show, the emergence and application of Internet technology can promote export activities (Trąpczyński & Kawa, 2023). In short, various factors ranging from financial constraints and trade policies to technological progress and government incentives have an impact on the export intensity of enterprises. Have more or less influence.

Inventory Leanness

Inventory leanness is a key metric of inventory management, essentially measuring the ability to maintain lower inventory levels compared to similarly sized businesses in the industry. This concept gained academic attention due to Eroglu and Hofer (2011), who defined it as the ability to compare inventory reductions with similarly sized firms in the industry. With the development of lean production models, the appeal of inventory leanness has grown exponentially, with more and more companies incorporating it in pursuit of higher operational efficiency and improved corporate performance. For example, as stated by Lin (2019), retail giants such as Walmart and JC Penney have achieved significant business benefits using inventory lean strategies. These case studies demonstrate that inventory downsizing not only provides a competitive advantage but also has the potential to significantly improve profits.

The traditional view of inventory management holds that reducing inventory levels is an effective strategy to free up tied capital and enhance a company's competitive advantage, a view supported by numerous studies such as Steven and Britto (2016) and Hameri and Weiss (2017). As Schonberger (2019) points out, reducing inventory improves customer responsiveness and contributes to healthier financials. Conversely, high inventory levels are often symptoms of operational pitfalls, including execution errors and systemic inefficiencies within production and distribution channels (Panigrahi *et al.,* 2024). This view is not without its critics, however. As highlighted in Krommyda et al.'s (2015) study, a section of scholars believe that maintaining adequate inventory is essential to meet market demand and drive sales. They believe that overly lean inventory will harm operational and production flexibility (Chuang *et al.,* 2019). Isaksson and Seifert (2014) offer a corresponding caution that this parsimonious approach to inventory may even lead to operational disruptions. In summary, while inventory leanness offers certain advantages, such as financial agility and responsiveness, it also brings inherent risks related to operational agility and markets, such as responsiveness and flexibility. The challenge for businesses, therefore, is to strike the optimal balance between these interacting factors.

The academic discussion about inventory leanness is mainly biased towards its impact on corporate financial performance. Capkun et al. (2009) conducted a preliminary exploration and revealed a significant positive relationship between inventory performance and financial position. Subsequent research has advanced this understanding by revealing an inverted U-shaped relationship between inventory leanness and overall firm performance (Eroglu & Hofer, 2014; Isaksson & Seifert, 2014). This suggests that there is an optimal level of leanness that maximizes financial performance, beyond which or additional reductions may be counterproductive. Chuang and Zhao (2019) added another layer of complexity by determining that inventory leanness is positively and concavely related to operational efficiency. This means that the benefits of inventory reduction eventually diminish as extreme levels are reached. In addition to financial indicators, scholars have also deeply studied the relationship between inventory leanness and other key operational factors, such as credit ratings (Bendig *et al.,* 2017), product quality (Lin *et al.,* 2018), and supply chain performance (Tasdemir & Hiziroglu, 2019). However, it is worth noting that there is a clear gap in the literature on the direct relationship between inventory leanness and export activity. Despite a large body

of research on the impact of inventory downsizing on various aspects of firm performance, a coherent framework describing its impact on exports remains elusive. This unexplored avenue presents an interesting opportunity for future research, particularly for scholars interested in the intersection of inventory management and international trade.

Environmental Uncertainty

The concept of environmental uncertainty and its impact on organizations has long been the subject of academic research. Emery and Trist (1965), in their seminal work, laid the foundation by introducing the complexity-simplicity dimension as key environmental factors that firms must contend with. This theme was later echoed by other researchers, most notably Lawrence and Lorsch (1967), who incorporated similar dimensions into a scale measuring environmental diversity. When quantifying environmental uncertainty, academic circles usually adopt two methods: objective measurement and perceptual measurement. Objective measures rely on industry-level empirical data (Lawrence & Lorsch, 1967). These measures are intended to provide quantitative indicators that can be generally applied across different sectors or cases. Perception measures, in contrast, aim to measure the level of uncertainty perceived by key organizational members, often focusing on its impact on managerial decisions., Karagozoglu (1993) typify this approach, using qualitative data to develop a more nuanced understanding of how perceived environmental uncertainty affects management practices. Essentially, the choice between objective and perceptual measurements depends on the research question at hand and the specific nuances one wants to reveal. Objective measurements provide general insights, while perceptual measurements provide deeper, more contextual understanding. Both approaches contribute to a comprehensive understanding of how environmental uncertainty affects a business, and can often be used together for a more comprehensive analysis. Most current research on corporate performance considers the impact of the environment, because decision makers in these environments have limited access to information and it is more difficult to predict external changes (Wiengarten *et al.,* 2012). Wernerfelt and Karani (1987) define environmental uncertainty from four dimensions: demand, supply, competition and external uncertainty. These include managers' assessments of the predictability of suppliers, customer behavior, and changes in government regulations. Dess and Beard (1984) believed that environmental uncertainty has three factors: dynamics, complexity and generosity. Of these three factors, dynamism and complexity are the top concerns for manufacturers today.

The critical role of environmental factors in influencing corporate performance has been well established in contemporary research. Wiengarten et al. (2012) emphasize the need to consider the environmental context in which firms operate, given the often limited access to information and the inherent unpredictability of external factors. Different scholars have provided various frameworks to conceptualize environmental uncertainty. Wernerfelt and Karani (1987) proposed a four-dimensional framework including demand, supply, competition, and external factors

such as regulatory changes. The model provides a comprehensive view by integrating multiple elements of the external environment, each with its own set of uncertainties that managers need to assess and navigate. In contrast, Dess and Beard (1984) proposed a tripartite framework consisting of dynamism, complexity, and generosity. In this model, environmental dynamism refers to the rate of change in the environment, complexity relates to the number of elements and their interrelationships, and munificence relates to the richness of the resources available to the organization. Among them, dynamism and complexity are currently the biggest concerns for manufacturers, possibly due to the accelerated pace of technological change and intensifying global competition. Each framework provides unique insights into aspects of environmental uncertainty that impact firm performance. Whether focusing on the unpredictability of demand and supply, or dealing with the complexities of volatile and complex markets, it is clear that understanding environmental uncertainty is essential for effective decision-making in any business environment.

According to the contingency theory, firm competitiveness depends not only on the organizational development strategy, but also on the proper fit between the organizational strategy and the dynamics of the firm's environment (Martinez-Conesa *et al.,* 2017). Dess and Beard (1984) first regarded environmental dynamism as a corporate characteristic, and it was also a modulating factor affecting corporate performance, and did a lot of work to summarize the moderating effect between environmental dynamism and corporate performance (Gligor *et al.,* 2015; Samuel *et al.,* 2020). Environmental dynamics can be defined as the rate of change and instability of the environment (Dess & Beard, 1984), characterized by unpredictable changes in customer preferences, raw material requirements, technologies and processes (Jansen *et al.,* 2006). As technology, customers, and suppliers change frequently and rapidly in a dynamic environment, unchanged products and processes can easily become obsolete and lose their competitiveness (Chan *et al.,* 2015). At the same time, environmental dynamics can provide sufficient motivation for new product development and improvement processes. Empirical research shows that environmental dynamics are an important driver of corporate competitive advantage (Li & Liu, 2014). There is currently no general consensus on a specific definition of environmental dynamics. Some people define environmental dynamics as a static one-dimensional structure (Azadegan *et al.,* 2013; Chan *et al.,* 2015), while most scholars believe that environmental dynamics is multidimensional. Li and Liu (2014) decomposed environmental dynamics into four independent dimensions: industry environment, competitor behavior, technological progress, and customer demand.

Environmental dynamism and complexity are fundamental constructs for understanding the challenges and uncertainties faced by organizations. Environmental dynamics are characterized by the speed and extent of changes in external factors, which may include market trends, technological shifts or regulatory updates. Environmental complexity, on the other hand, refers to the diversity and interconnectedness of external elements (such as suppliers, customers, and competitors) that an organization

must manage. As various studies have pointed out, environmental factors are particularly relevant in today's manufacturing industry. For example, global sourcing, fierce competition, rapid technological advancement, and an increase in suppliers are some of the factors that lead to a more complex environment (Kotabe & Murray, 2018). This complexity is further exacerbated by trends such as increased product diversity and shortened product life cycles, factors that significantly increase the dynamism and complexity of the operating environment (Murakami, 2024). Wiengarten et al. (2012) extend this discussion by stating that firms with greater demand volatility face higher levels of environmental dynamism, which may adversely affect their operations. This highlights the importance of businesses remaining flexible and adaptable, and equipped with strategies that can not only navigate but thrive amid these complexities and dynamic changes. Understanding these dimensions of environmental uncertainty is more than an academic exercise; It is critical for management decisions. Businesses need to develop adaptability and resilience in strategy and operations to effectively respond to the challenges posed by environmental complexity and dynamism.

Environmental munificence refers to the level of critical resources required by manufacturers to continue operating (Castrogiovanni, 1991) and has traditionally been the focus of understanding the conditions under which firms operate. In markets with low generosity, competition is often intense as organizations compete for limited resources and market share (Qiu *et al.*, 2024). However, dynamics have been changing, particularly with the advent of globalization, which has expanded access to cross-border markets and resources. This shift has gradually diluted the impact of environmental generosity on manufacturing companies, making it no longer the constraint it once was. As a result, the traditional emphasis on environmental generosity is giving way to a focus on environmental dynamics and complexity. The research conducted by focusing on these two dimensions aims to explore the more pressing and relevant issues facing modern manufacturers. Environmental dynamism focuses on the speed and magnitude of change, whereas environmental complexity is characterized by the diversity and interconnectedness of external factors and indeed better reflects the challenges and opportunities of today's globalized marketplace. This granular focus should yield timely and relevant insights into the current state of manufacturing operations.

Inventory Leanness and Export Intensity

Upon a meticulous and exhaustive synthesis of the extant scholarly literature, it has become evident that the corpus of research delineating the interplay between lean inventory practices and export performance is notably sparse. To elucidate the intricate relationship between the caliber of inventory management and export performance with greater clarity, the scope of this section's literature review has been deliberately expanded to encompass a more inclusive array of studies that scrutinize the impact of inventory management on export performance, with the ultimate goal of achieving a nuanced and profound understanding of the salient influence exerted by inventory management.

Within the academic discourse, three predominant yet divergent perspectives have emerged concerning the nexus between inventory management and export performance. Firstly, a contingent of scholars posits that the adept execution of inventory control mechanisms can mitigate operational uncertainties, enhance the efficiency of production and distribution processes, and ensure the prompt availability of products in the marketplace during periods of heightened demand (Smith *et al.,* 2018). Empirical inquiries have substantiated a positive correlation between the sophistication of inventory management and the vigor of export performance. For instance, the research conducted by Jones and Liang (2021) discloses that American manufacturing enterprises that have adopted advanced inventory management systems have demonstrated a markedly superior export performance. This superiority is attributed to the capability of these systems to facilitate real-time inventory monitoring and rapid responses to the exigencies of international market demands, thereby bolstering export volumes and expanding market share.

Secondly, an opposing viewpoint suggests that elevated inventory levels may engender resource idleness and capital immobilization, thereby exacerbating the financial burden borne by enterprises (Thompson, 2017). Furthermore, it is contended that high inventory levels may compromise the liquidity of enterprises, constricting their capacity to invest in novel opportunities and, consequently, adversely affecting export performance (Zhao & Chen, 2020). Empirical research on small businesses in Spain has provided credence to this perspective, revealing a negative correlation between subpar inventory management—particularly the maintenance of high inventory levels—and export performance. Enterprises characterized by low inventory turnover rates exhibit diminished export capabilities, primarily due to the disproportionate allocation of capital to inefficient inventory, which in turn impedes their export response velocity and market adaptability (Garcia *et al.,* 2019).

Thirdly, an alternative perspective posits a nonlinear relationship between inventory management and export performance, suggesting the existence of an optimal inventory threshold that maximizes export performance. Scholars advocating this view argue that a judicious inventory level can augment production efficiency and market response velocity; however, an excess of inventory may precipitate increased costs and managerial complexity (Baldwin *et al.,* 2020). Empirical research by Lee and Park (2022) in the South Korean electronics manufacturing industry has unveiled an inverted U-shaped relationship between inventory management and export performance, indicating that inventory levels enhance export performance within a specific range, beyond which export performance suffers. This finding underscores the necessity of considering industry-specific characteristics and market demand volatility when devising inventory strategies to preempt the detrimental consequences of inventory levels that are either excessively high or insufficient on export performance.

In conclusion, the impact of inventory management on export performance is multifaceted and complex, with no consensus reached to date. Inventory leanness, as a significant inventory management strategy, plays a notable role in reducing costs and enhancing efficiency (Baldwin *et*

al., 2020). By implementing lean inventory management, enterprises can improve product quality (Lin *et al.,* 2018), increase competitiveness (Atnafu & Balda, 2018), and optimize supply chain processes (Issah *et al.,* 2024), all of which are key factors in enhancing export performance. However, there is a striking absence of empirical research in the existing literature, particularly regarding the direct impact of lean inventory management on export intensity. Given the potential of lean inventory management to amplify export sales and curtail product defects (Venkataraman *et al.,* 2014; Kaur *et al.,* 2016), an increasing number of enterprises are embracing lean inventory practices. However, empirical research on the impact of lean inventory management on export performance is strikingly lacking, and this void in the extant literature represents an uncharted research frontier. This study endeavors to conduct an in-depth exploration of the impact of lean inventory management on export performance. Considering the intricate relationship between inventory leanness and export activities, such research is poised to offer valuable strategic insights for enterprises aspiring to compete in high-potential and competitive global markets.

Hypothesis Development

Inventory Leanness and Export Intensity

Not only in terms of corporate efficiency and product quality but also in terms of cash flow, a lot of work has been done, which is all related to export volume. And there is sufficient evidence to show that improving inventory leanness can promote corporate cash flow and efficiency, which has a positive effect. Insufficient inventories could affect exports in several ways.

First, studies have found that increasing inventory leanness can lead to lower operating costs and better financial performance. Inventory leanness can reduce operating costs and enable companies to have more funds for outputting sunk costs (Hofer *et al.,* 2012). Firms that generate greater liquidity from domestic sales that cover the fixed costs of entering the market are more likely to export (Chaney, 2016). In addition to operating costs, financial constraints, and credit ratings may also be included. Gu et al. (2017) implied credit rating has a direct impact on corporate debt costs and financing costs. Several studies have shown positive and negative relationships between relative leanness and credit ratings (Bendig *et al.,* 2017). Firms with fewer financial constraints are more likely to enter export markets and overcome export sunk costs. The expansion of financing channels and scale is expected to lead to an increase in the number of firms entering the market, which in turn should increase export expansion (Xiang & Worthington, 2015).

Second, many previous studies provide evidence that larger inventory leanness can lead to higher efficiency (Zhu *et al.,* 2018; Tasdemir & Hiziroglu, 2019) and better quality (Lin *et al.,* 2018), thus affecting export. On the one hand, enterprise productivity is the decisive factor for enterprises to export (Melitz, 2003). Firms that are more productive will generate more revenue and thus be able to cover the fixed costs of entering the market. As a result, the fewer inventories, the greater the volume of exports. On the other hand, it is well known that increasing inventory leanness not

only avoids the degradation of product quality over time (Steven & Britto, 2016) but also helps to detect problems in the production process (Modi & Mishra, 2011; Steven & Britto, 2016). Empirical evidence shows that lean inventories improve product quality. The level of product quality directly determines whether an enterprise exports. In other words, only products with a minimum quality threshold can be exported (Gervais, 2015). To some extent, the improvement in product quality will encourage trading partners to import more goods and improve export performance (Bekele & Mersha, 2019). All in all, there is a correlation between lower inventories and higher export volumes.

However, studies have shown that extreme levels of lean inventory management allow firms to absorb increasing shortage costs and unit manufacturing costs, which will reduce operating profits and financial performance (Isaksson & Seifert, 2014). Research also shows that overemphasizing inventory leanness increases the likelihood that firms will face supply-demand mismatches and that it makes sense to maintain a certain level of safety stock (Jonsson & Mattsson, 2019). More seriously, it will lead to supply chain disruption, damage corporate reputation, and credibility, and adversely affect corporate financial performance (Chuang & Zhao, 2019). Maintaining moderate inventories can protect firms from such difficulties and reduce the negative impact of supply chain disruptions and keep production stable (Ali *et al.,* 2017). Therefore, excessive inventory leaning can lead to a loss of cash flow and reputation and hinder the growth of exports.

Furthermore, excessive inventory leanness also limits the flexibility (Colledani *et al.,* 2014) and corporate efficiency needed to produce optimal batches. Moderate slack in inventory enables firms to be more flexible in offering a wider range of products to meet customers' changing demands and can improve total profits and reduce supply risks (Chen *et al.,* 2023). Low lean inventory management limits the richness of products and cannot stimulate sales through the variety effect. Thus, excessive inventory leanness hinders export growth at the margin of new product export expansion (Cachon *et al.,* 2019). And firms with lower inventories require more frequent replenishment and shipping, which reduces operational efficiency (Chuang & Zhao, 2019) and exports. Therefore, the relative leanness of inventory is associated with a higher amount of exports in a concave relationship. In summary, we propose the following hypotheses:

H1: Inventory leanness has an inverted U-shaped relationship with export intensity.

The Moderating Role of Environmental Dynamics

Environmental dynamics are an important factor affecting inventory management decisions (Dess & Beard, 1984). In the case of fluctuations in the environment, it is often difficult for managers to make decisions, which can easily lead to inventory backlog or inventory shortage, resulting in losses. Under such circumstances, firms usually hold a certain amount of inventory to avoid the risk of shortages (Chen *et al.,* 2023).

Salomon and Wu (2012) believe that firms face disadvantages when exporting. Disadvantages refer to the additional costs incurred by companies that need to become

more familiar with the foreign market environment and environmental dynamics. Market research points to environmental dynamics as a driver of failure. Faced with the dynamics of the environment, companies generally adopt the method of holding a certain amount of inventory (Abbasi *et al.,* 2017). At the same time, firms tend to adopt low-cost strategies to avoid risks (Qalati *et al.,* 2021) and start with less export intensity due to less information and environmental fluctuations (Yu *et al.,* 2022). Businesses operating in an industry environment with a less dynamic environment will be more likely to deviate from optimal lean inventory management. We make a second hypothesis:

H2: Environmental dynamics weaken the relationship between inventory leanness and export intensity.

The Moderating Role of Competitive Intensity

Competitive intensity is one of the critical environmental complexity factors that has been identified widely in the fields of firm performance (Kovaleva & Vries, 2016), inventory management (Eroglu & Hofer, 2014), business strategy (Wilden *et al.,* 2013), exporting (Martin *et al.,* 2016). As is known from the theory of inventory management, from the perspective of inventory management theory, intensified competition will erode product profits (Huang, 2023), causing companies to face additional corporate performance losses.

In an environment where competition is excessively fierce, it is difficult to obtain and fully utilize resources (Li & Liu, 2014). In such situations, companies may need to focus more on human capital, organizational capital, and management capabilities (Lahiri, 2013) to maintain competitiveness, rather than inventory management. In other words, the escalation of competition has increased the requirements for managerial efficiency within enterprises. At the same time, the range of unknown risks faced by companies has expanded, making strategic decision-making and operational planning more complex. These factors highlight the need for companies to adopt more agile and adaptive management practices in order to navigate and thrive in such a competitive environment. Based on the earlier discussion, we propose the following hypothesis:

H3: The intensity of competition weakens the relationship between inventory leanness and export intensity.

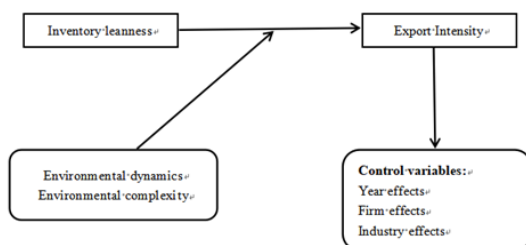Figure 1 summarizes our conceptual model and associated hypotheses.

Figure 1. Conceptual Framework

Methodology

Data Resource

Data was gathered from the Chinese Annual Survey of Industrial Firms (CASIF) database, which covers all state-owned and non-state-owned enterprises with sales of more than 5 million yuan during the 2000-2013 year. In view of errors and exceptions in the database, we draw on the experience of Nie (2012) and remove some unsatisfied observations as follows: (1) Obvious unreasonable observations that the fixed assets of the enterprise are higher than the total assets of the enterprise, and the statistical time of the enterprise is earlier than the establishment time of the enterprise; (2) Some variables are defined as positive values, so the inventory, total assets, and sales revenue are deleted Negative or missing values for key indicators such as export value, and foreign investment.

Dependent Variable-- Export Intensity

Following previous literature, the concept of export performance is inconsistent in the literature. Export intensity is one of the most widely used measures of export performance, which is defined as the proportion of exports in the total sales of the firm (Maria & Ganau, 2014; Reis & Forte, 2016).

Based on our theoretical point of view, we distinguish between two important outcomes: whether the firm exports (export propensity) and export value (export intensity), taking into account that the determinants of these two outcomes are not exactly the same.

The export propensity of a firm was delineated based on its demonstrable export activities. Should a firm register zero exports in a given year, its export propensity for that year was deemed to be zero; conversely, a positive export figure indicated an export propensity of one.

The analysis of export intensity ensued from the determination of export propensity. In instances where a firm's export propensity was zero in a particular year, its export intensity was likewise considered zero, owing to the absence of export activities. Conversely, when a firm exhibited an export propensity of one in a given year, the export intensity was computed by rationing the total exports to the overall sales for that period.

Independent Variable--Inventory Leanness

There are generally two measures to represent inventory leanness in recent empirical literature. One is inventory turnover (Elking *et al.,* 2017), which pointed out that it ignored the economies of scale (Murakami, 2024), and the other is Empirical Leanness Indicator (ELI) (Eroglu & Hofer, 2014; Lin *et al.,* 2018), which overcame this shortcoming (Isaksson & Seifert, 2014).

The ELI is developed by Eroglu and Hofer (2011) and takes the firm's economic scale into account. In order to calculate ELI, the regression model is initially established as follows:

$\ln(\text{inventory}\_{ijt}) = \alpha\_{jt} + \beta\_{jt} \llbracket \ln(\text{sale}) \rrbracket\_{ijt} + \mu\_{ijt}$

Where inventory_ijt represents the inventory level of firm i in the industry j and year t, and sale_ijt represents the scale level of firm i in the industry j and year t. After that, ELI is equal to the residuals( ) that are studentized and multiplied by -1. ELI directly influences the degree of the firm's inventory leanness. The bigger the ELI coefficient, the higher the level of inventory leanness.

Moderator Variables

In this paper, two moderator variables are designed to examine the impact of environmental dynamics and environmental complexity, respectively. Based on previous research (Eroglu & Hofer, 2014), we use the mean squared error in the total industry sales model to measure environmental dynamics. In terms of competition intensity, industry concentration is an indicator to measure the degree of competition in an industry, which is measured by the Herfindahl-Hirschman Index (HHI) (Wiengarten & Ambrose, 2017). Specifically, HHI is equal to the sum of the squares of the company's revenue in the industry's total revenue. We use the inverse of HHI to measure competitive intensity, so higher numbers indicate a more competitive environment.

Control Variables

To account for firm heterogeneity, we identify the following variables that are likely to influence export intensity. We first consider the financing ability. Previous literature has shown that financing constraints severely limit the export of enterprises (Manova *et al.,* 2015). Therefore, the financing ability (FA) of a business is calculated by dividing the interest expense by the sales revenue.

In addition, the asset structure of the enterprise may also affect the export of the enterprise. The second control variable we use is the debt ratio (DR) of the enterprise, which is obtained by dividing the total liabilities of the enterprise by the total assets, that is, the asset-liability ratio of the enterprise.

The third control variable is foreign ownership (FOREIGN), measured as a percentage of foreign settlement and paid-in capital. Likewise, we also control for each firm's proportion of state capital (SC), measured as a percentage of state capital and paid-in capital.

As a further control, we introduce firm size (SIZE) and firm age (AGE), calculated as the natural logarithms of total employees and firm age, respectively.

Descriptive Statistics

After removing firms with missing or incomplete data, the final dataset contains 473612 observations from 2000 to 2013. Table 1 lists descriptive statistics and correlation analyses for the variables used in the analysis. Among them, the correlation coefficient between financing ability (FA) and export intensity (Export) is -0.1021, that is, the financing ability of enterprises will have a certain hindering effect on export intensity. There is also a negative correlation (-0.1744) between financing ability (FA) and inventory leanness (ELI). The higher the financing ability of the enterprise, the lower the inventory leanness. There is a significant positive correlation (0.0567) between foreign capital (FOREIGN) and export intensity (Export). Enterprises with a higher proportion of foreign capital have higher willingness to export and higher export intensity. However, the proportion of foreign capital will inhibit the financing ability of enterprises, because foreign capital (FOREIGN) and financing ability (FA) are significantly negatively correlated (-0.0745). Different from the impact of foreign capital on financing ability, state capital (SC) and financing ability (FA) are significantly positively correlated, with a correlation coefficient of 0.1085. State capital (SC) is negatively correlated with export intensity (-0.1458). It can be seen that enterprises with a lower proportion of state capital have higher export intensity, and state capital also has the effect of inhibiting inventory leanness (-0.0940). The debt ratio (DR) has a positive impact on export intensity (0.0092) and a negative impact on inventory leanness (ELI) (-0.1105). Companies with higher debt ratios have higher export intensity and lower inventory leanness. We found that the longer a company was established, the lower its export intensity and inventory leanness, because firm age (AGE) has a significant negative correlation with export intensity (Export) and inventory leanness (ELI), with coefficients of -0.0181 and -0.1056. However, firm age (AGE) has a promoting effect on financing ability (0.2576). Older companies have stronger financing capabilities. The firm size (SIZE) is also a very important control variable. It has a significant positive correlation with export intensity (Export) (0.0746) and a significant negative correlation with inventory leanness (ELI) (-0.1242). inhibition. There is a positive correlation between firm size (SIZE) and financing ability (FA), with a coefficient of 0.0830. Export intensity (Export) has a mean of 0.4833 with a standard deviation of 0.4124, and Inventory leanness (ELI) has a mean of -0.1440 with a standard deviation of 1.4023.

Table1

Correlation Analysis

	1	2	3	4	5	6	7	8
1. Export intensity	1.0000							
2. Inventory leanness	0.0064*	1.0000						
3. Financing ability	-0.1021*	-0.1744*	1.0000					
4. Foreign capital	0.0567*	-0.0052*	-0.0745*	1.0000				
5. State capital	-0.1458*	-0.0940*	0.1085*	-0.0643*	1.0000			
6. Debt ratio	0.0092*	-0.1105*	0.2576*	-0.1091*	0.0271*	1.0000		
7. Firm age	-0.0181*	-0.1056*	0.0932*	-0.0774*	0.1622*	-0.0242*	1.0000	
8. Firm size	0.0746*	-0.1242*	0.0830*	-0.0413*	0.1411*	0.0458*	0.2488*	1.0000
Mean	0.4833	-0.1440	0.0093	0.1514	0.0572	0.5354	2.1683	5.4748
Standard Deviation	0.4124	1.4023	0.0156	0.3361	0.2008	0.2455	0.6216	1.0391

[sample size = 473612. *p<0.01]

Empirical Analysis and Results

Models

Looking back at previous relevant literature, we can find that not all enterprises choose to export. Therefore, the export behaviour of enterprises is likely to be endogenous. If we use ordinary least squares meothd for regression, there will be self-selection bias, the regression will become meaningless, and the research results will not be convincing. To this end, we employ a Heckman two-step estimation procedure that can deal with potential sample selection bias (Krammer et al., 2018) to investigate the relationship between lean leanness and export intensity.

In order to analyze the moderating effect of environmental dynamics and competitive intensity, we add the interaction terms of environmental dynamics, competitive intensity, and inventory leanness to the model to verify how they affect the relationship between inventory leanness and export intensity.

Empirical Result

Table 2 lists the estimation results of the Heckman two-step estimation model with the export intensity index as the dependent variable. The lambda coefficient is significant at the 1% level, indicating that the Heckman two-step model is suitable for analysis to overcome self-selection bias.

From column (1) in the table, we can see that foreign capital positively affects inventory leanness and export intensity (0.0800) and is extremely significant (p<0.01). The significance of the debt ratio is not that high (p<0.05), but it also has a positive impact. The same is true for company age and company size, which contribute to the relationship between the independent variable and the dependent variable (0.0082 and 0.0241). We found that inventory leanness is positively correlated with export intensity (0.0036), and the quadratic coefficient of inventory leanness is significantly (p<0.01) and negatively correlated with export intensity (-0.0007), thus supporting hypothesis H1. This supports our argument that there is an optimal level of inventory leanness that maximizes export intensity, beyond which the marginal effect of inventory leanness on export intensity becomes negative.

Next to discuss the moderating effects, we test the moderating effects of environmental dynamism and environmental complexity on inventory leanness and export intensity respectively and report them in columns (2) to (3). In column (2) of Table 2, we found that after adding ELI×ED and ELI2×ED, the coefficient of foreign capital increased to 0.0815. That is to say, under the influence of environmental dynamics, foreign capital has a positive impact on inventory lean and export. The positive impact between intensity has increased. Similarly, the positive impact of debt ratio (0.0087) and company age (0.0102) on this study has also increased. Different from the above control variables, the coefficient of company size is reduced to 0.0240. We can know that under the influence of environmental dynamics, the impact of company size on inventory leanness and export intensity becomes smaller. We focus primarily on the coefficients of the interaction terms. Specifically, the linear and quadratic terms of inventory leanness and environmental dynamism (ELI×ED and ELI2×ED) are positive and significant at the 1% level. From the results we can see that in most cases the export intensity decreases with increasing environmental dynamics. In other words, as environmental dynamics increase, firms will experience a decrease in export intensity due to deviations from optimal inventory leanness, a finding that supports hypothesis H2.

Column (3) adds ELI×EC and ELI×EC2. In the case of complex environment, the coefficient of foreign investment is reduced to 0.0798, the impact of company size is also reduced (0.0234), and the relationship between debt ratio and company age is The influence increases, and the coefficients are 0.0108 and 0.0101 respectively. Environmental complexity has a significant negative impact on export intensity, that is, competition intensity weakens the entry and product diversity of potential entrants. In addition, the interaction coefficients of the linear and quadratic terms (ELI×EC and ELI2×EC) between competition intensity and inventory reduction are both positive and significant at the 1% level. Under the same level of lean inventory management, the export intensity of enterprises with weak industry competition intensity is lower than that of enterprises with lower competitive intensity. As competitive intensity increases, the relationship between inventory reduction and export intensity weakens. Therefore, hypothesis H3 is supported.

Table 2

Results of the Moderation Analysis

	(1) Export intensity	(2) Export intensity	(3) Export intensity
Inventory leanness	0.0036***	0.0247***	0.0397***
(ELI)	(0.0005)	(0.0017)	(0.0020)
Inventory leanness^2	-0.0007***	-0.0033***	-0.0051***
(ELI^2)	(0.0001)	(0.0004)	(0.0005)
Foreign capital	0.0800***	0.0815***	0.0798***
(FOREIGN)	(0.0018)	(0.0019)	(0.0018)
Debt ratio	0.0073**	0.0087**	0.0108***
(DR)	(0.0024)	(0.0026)	(0.0025)
Firm age	0.0082***	0.0102***	0.0101***
(AGE)	(0.0010)	(0.0011)	(0.0010)
Firm size	0.0241***	0.0240***	0.0234***
(SIZE)	(0.0006)	(0.0006)	(0.0006)

	(1) Export intensity	(2) Export intensity	(3) Export intensity
Environmental dynamics (ED)		0.0186*** (0.0007)	
ELI×ED		-0.0062*** (0.0004)	
ELI^2×ED		0.0008*** (0.0001)	
Environmental complexity (EC)			0.0394*** (0.0008)
ELI×EC			-0.0101*** (0.0005)
ELI^2×EC			0.0013*** (0.0001)
Year fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
R-squared	0.1301	0.1344	0.1377

*[***p<0.01, **p<0.05, *p<0.1. t statistics in parentheses.]*

Robustness Checks

We also conduct multiple rigorous inspections to ensure our results. First, we select the sample period from 2000 to 2005 as a subsample for repeated estimation to avoid the potential impact of the financial crisis on our results. Similarly, the results are basically consistent. Inventory leanness is significant (p<0.01) and positively affects export intensity (0.0259). The quadratic coefficient of inventory leanness (ELI2) is significant (p<0.01) and negatively related to export intensity (-0.0026) and is reported in column (1) of Table 3 .

Secondly, we employed alternative indicators to measure the explanatory and dependent variables in order to minimize the impact of measurement methods on our results. Consistent with previous literature, inventory leanness is measured by the ratio of cost of sales to average inventory, that is, inventory turnover (Elking *et al.,* 2017), and the logarithm of export volume is used instead of export intensity to represent export performance. Column (2) uses the logarithm of export volume to represent export performance, and the measurement standard of inventory leanness has not changed. As shown in column (2) of Table

3, inventory leanness is significant (p<0.01) and positively affects exports. Intensity (0.1043), the quadratic term coefficient of inventory leanness (ELI2) is significant (p<0.01) and negatively correlated with export intensity (-0.0233), and the results are basically consistent. Column (3) uses inventory turnover rate as a measure of inventory leanness, and the logarithm of export volume represents export performance. We can see that inventory leanness is significant (p<0.01) and positively affects export intensity (0.3867), and the quadratic term coefficient (Inv2) of inventory leanness is significant (p<0.01) and negatively related to export intensity (-0.0088) . The results we obtained were not significantly different.

Finally, we replaced inventory turnover with ELI to measure inventory leanness, and the measure of export intensity did not change. The results show that inventory leanness is significant (p<0.01) and positively affects export intensity (0.0394), and the quadratic term coefficient (Inv2) of inventory leanness is significant (p<0.01) and negatively correlated with export intensity (-0.0026). In line with these results from the robustness tests, we find strong evidence for an inverted U-shaped relationship between inventory leanness and export intensity.

Table 3

Results of the Robustness Checks

	(1) Export intensity	(2) Export intensity	(3) Export intensity	(4) Export intensity
Inventory leanness (ELI)	0.0259*** (0.0010)	0.1043*** (0.0022)		
Inventory leanness^2 (ELI^2)	-0.0026*** (0.0002)	-0.0233*** (0.0005)		
Inventory turnover (Inv)			0.3867*** (0.0043)	0.0394*** (0.0011)
Inventory turnover^2 (Inv^2)			-0.0088*** (0.0002)	-0.0026*** (0.0001)
Control variables	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
R-squared	0.1474	0.2982	0.3193	0.1490

*[***p<0.01, **p<0.05, *p<0.1. t statistics in parentheses.]*

Discussion

Theoretical Significance

This scholarly endeavor offers substantial contributions to the extant academic discourse in multiple dimensions. Initially, it underscores the pronounced nonlinear influence of inventory leanness on export performance. Numerous studies focus on the relationship between lean inventory management and internal business performance, such as productivity (Bubber *et al.,* 2023), financial performance (Liu *et al.,* 2024), and financing constraints (Wang *et al.,* 2024), and reveal the existence of an inverted U-shaped pattern. However, in terms of export performance, there had been no relevant research efforts delving into this aspect prior to our study. Consequently, our analysis based on the data of Chinese enterprises provides empirical support for the existence of an inverted U-shaped relationship between inventory leanness and export intensity. This research finding not only strongly validates the existing understanding that excessive inventory leanness may exert adverse impacts, but also makes substantial progress in the construction of the theoretical framework for nonlinear research as well as the expansion of empirical studies.

Subsequently, this study empirically substantiates the moderating influence of environmental dynamism on the relationship between inventory leanness and export intensity. Although previous studies have emphasized that environmental dynamism plays a moderating role in the relationship between inventory leanness and firm performance (Eroglu & Hofer, 2014), there has been little exploration of whether environmental dynamism similarly affects the relationship between inventory leanness and export performance. Our empirical findings reveal that the influence of inventory leanness on export intensity is contingent upon environmental volatility. Specifically, we discern that as environmental dynamism escalates, the propensity of inventory leanness to bolster export intensity diminishes. This outcome aligns with the contention that within a context of heightened environmental dynamism, enterprises must sustain a certain inventory level to mitigate potential risks, such as supply chain disruptions or abrupt demand shifts, thereby attenuating the impact of inventory management on corporate performance (Katsaliaki *et al.,* 2022). The third pivotal contribution of our research accentuates the moderating role of environmental complexity in the interplay between inventory leanness and export intensity. The existing literature has highlighted that environmental complexity exerts a negative moderating effect between inventory leanness and corporate productivity (Zhu *et al.,* 2018). However, until now, few studies have probed how environmental complexity influences the nexus between inventory leanness and export performance. Through our empirical results, we ascertain that the impact of inventory leanness on export intensity is subject to the intensity of competition. Notably, we find that as environmental complexity intensifies, the capacity of inventory leanness to enhance export intensity declines. Consistent with previous literature, under high competitive intensity, companies may need to focus more on human capital, organizational capital, and management capabilities (Lahiri, 2013) to maintain competitiveness. Furthermore,

our study lays the theoretical groundwork for future research to delve deeper into the broader ramifications of the interconnections among inventory leanness, export intensity, and environmental complexity.

Managerial Significance

This study provides pivotal insights for enterprises and senior executives endeavoring to augment the efficacy of their export operations. Our research underscores the imperative of employing a balanced strategy in lean inventory management to bolster export intensity. While organizations are cognizant of the merits of lean inventory management in reducing costs and enhancing product quality, thereby amplifying their export competitiveness, an overzealous pursuit of inventory leanness can engender deleterious outcomes. Our findings elucidate the merits of adept inventory management practices that can markedly elevate export performance. However, it is imperative to note that an excessive drive towards inventory leanness may deplete vital resources and disrupt inventory management processes, ultimately proving detrimental to export activities. In consideration of these insights, we advise managers to approach inventory leanness with prudence and to diligently seek a equilibrium that ensures the realization of cost-efficient inventory management without compromising the reliability of export supply chains.

In contexts characterized by heightened environmental dynamism, enterprises are confronted with a myriad of challenges and uncertainties. Market demands may pivot abruptly, the velocity of technological innovation is accelerating, and regulatory frameworks are subject to frequent revisions. Under such circumstances, if a company aggressively reduces its inventory, it may find itself ill-equipped to swiftly scale production in response to a surge in demand due to shortages in raw materials, thereby forfeiting export opportunities. Conversely, when policy shifts or regulatory changes impose restrictions on the importation of specific raw materials or elevate export product standards, a dearth of inventory buffers may impede the rapid recalibration of production processes and product attributes to align with these new stipulations, potentially plunging the export business into a precarious position. Consequently, companies must vigilantly monitor indicators of environmental dynamism, such as the frequency of market demand oscillations, the pace of technological evolution, and the amplitude of policy and regulatory alterations, and institute a dynamic inventory surveillance and adjustment mechanism. By doing so, they can promptly recalibrate inventory levels and configurations to maintain a relatively stable export intensity amidst the vicissitudes of rapid environmental transformations.

In scenarios of heightened environmental complexity, companies grapple with intense pressures from various quarters. Ferocious competition renders the contest for market share exceedingly challenging. Rivals within the same industry incessantly roll out novel products, refine pricing strategies, and enhance service quality in an attempt to capture a larger share of the export market. Under such intense competitive pressures, an enterprise that places undue emphasis on inventory leanness may find itself

unable to respond nimbly to market fluctuations due to insufficient inventory resources. For instance, when a competitor introduces a highly competitive product coupled with price reductions, a company with limited inventory may be unable to swiftly adjust its product mix or pricing in kind, leading to customer attrition and a diminution in export orders. Moreover, heightened competition intensity may also precipitate supply chain instability. Suppliers may prioritize orders from more formidable enterprises for their own gain, and logistics firms may delay cargo shipments due to overwhelmed operations. This necessitates that enterprises fully contemplate the impact of competition intensity on all facets of the supply chain when managing inventory, fortify deep cooperation and strategic alignment with suppliers and logistics partners, and establish a resilient supply chain mechanism to ensure that inventory management can adapt flexibly to market shifts and provide robust support for enhancing export intensity in a highly competitive milieu.

For senior managers, there is a critical need to focus on talent development and team building to cultivate a cadre of professionals adept in both inventory management and international export operations. Such individuals can accurately dissect the intricate relationships between inventory management and export business within a complex environment and render informed and rational decisions. They can adjust inventory strategies in response to market fluctuations, optimize export product portfolios, and bolster the competitiveness of their enterprises in the global marketplace. By navigating the challenges of high environmental dynamism and complexity, enterprises can achieve a harmonious development of inventory management and export operations, thereby enhancing their overall performance and international competitiveness.

Conclusions

The principal objective of this scholarly endeavor is to ascertain the presence of a nonlinear relationship between inventory leanness and export intensity. To address this research query, an empirical analysis was executed utilizing a dataset encompassing Chinese enterprises from the period 2000 to 2013. This investigation aspires to elucidate the complex interplay among inventory leanness, export intensity, environmental dynamism, and environmental complexity. Our analysis delineates an inverted U-shaped relationship, suggesting that an overemphasis on inventory reduction may paradoxically impede a firm's export endeavors.

Employing moderated regression models, we discerned that the influence of inventory leanness on export intensity is contingent upon the levels of environmental dynamism and complexity. These revelations offer pivotal insights for managerial and policy-making entities, advocating for a nuanced inventory management strategy that accounts for the environmental uncertainties inherent in international trade markets. Nonetheless, as with any research endeavor, this study is not without its limitations, which in turn present fertile ground for future investigative pursuits. A principal limitation is the reliance on a singular metric-export intensity-as a gauge of export performance. In the context of escalating globalization, a high export intensity does not invariably signify a positive export performance. Future research endeavors may benefit from exploring a spectrum of alternative indicators, such as the rate of export growth, to provide a more holistic assessment of export performance.

Furthermore, the study's exclusive reliance on Chinese data raises concerns regarding the generalizability of the findings to other global contexts. Future studies could enrich the body of knowledge by replicating this research framework across diverse international settings. This comparative approach would yield a more robust understanding of the manner in which societal and cultural factors modulate the nexus between inventory leanness and export intensity. By juxtaposing findings from various regions, researchers may glean deeper insights into the contextual subtleties that shape these dynamics.

In summary, future research should aim to overcome these limitations by incorporating multiple performance indicators and conducting cross-cultural investigations, thus building a more comprehensive and universally applicable theoretical framework for lean inventory management and export performance.

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