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Key Factors affecting Export Intensity in Iranian Pharmaceutical Companies

Alireza Habibi[1], Mohammad Mahdi Kiaeeha[2*]

*1. Assistant Professor, Department of Business Management, Faculty of Economics and Management, Ahlul Bayt International University, Tehran, Iran. (**Corresponding Author**) Email: habibi@abu.ac.ir*

2. Faculty of Economics and Management, UKM, Malaysia. Email: kiaeeha@gmail.com

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ABSTRACT

Export intensity is a key indicator of international competitiveness, particularly in regulated industries such as pharmaceuticals. This study examines how firm-specific factors and macroeconomic conditions jointly influence export intensity among Iranian pharmaceutical manufacturing firms. Using balanced panel data from 20 exporting pharmaceutical companies over the period 2018–2023, the study applies a random-effects panel regression model to assess the impact of firm size, advertising expenditure, R&D investment, firm age, GDP growth, inflation, and exchange rate volatility on export intensity. The results reveal that firm size and advertising expenditure have a positive and statistically significant effect on export intensity, while inflation exerts a significant negative impact. Other firm-specific factors (R&D intensity and firm age) and macroeconomic variables (GDP growth and exchange rate volatility) do not show significant effects. These findings indicate that scale advantages and market-oriented investments are more critical for pharmaceutical exporting than innovation expenditure alone under prevailing economic conditions. The study is subject to limitations related to sample size and the exclusive focus on Iranian firms, which may constrain generalizability. Nevertheless, the findings contribute to the export performance literature by demonstrating that export intensity in regulated industries is shaped by a selective combination of internal capabilities and macroeconomic stability. The study offers practical insights for managers and policymakers seeking to strengthen pharmaceutical export performance in emerging economies.

KEYWORDS: Export Intensity; Pharmaceutical Industry; Firm-Specific Factors; Macroeconomic Conditions; Iran

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1. Introduction

Export intensity, the ratio of a firm's or country's exports to its total output or sales, is a critical indicator of economic performance and competitiveness in the global market (Majocchi et al. 2005; Revindo et al. 2025). The significance of export intensity lies not only in its direct contribution to national income through foreign exchange earnings but also in its broader impacts on economic development, productivity, and innovation.

The relationship between export intensity and economic growth has been widely studied and documented (Lee 2011; Subasat 2002; Chiwira et al. 2023). High export intensity often correlates with higher levels of economic growth, as it encourages firms to achieve greater efficiency, adopt new technologies, and innovate to meet international standards (Cadogan et al. 2003). Moreover, participation in global markets exposes firms to competitive pressures and diverse consumer preferences, driving improvements in product quality and production processes.

An economy with a high export intensity tends to be more resilient and dynamic. It can better withstand domestic economic shocks by leveraging international demand. Additionally, exports provide a critical avenue for developing countries to industrialize, diversify their economies, and reduce dependence on a narrow range of domestic industries (Trindade 2005; Lectard 2023). The revenue generated from exports can be reinvested in infrastructure, education, and healthcare, creating a virtuous cycle of growth and development. For instance, participation in global value chains allows countries to integrate into international production networks, adding value at different stages of the production process and benefiting from technological and knowledge transfers (Kowalski et al. 2015). Similarly, foreign subsidiaries that export tend to exhibit superior performance metrics compared to their non-exporting counterparts, underscoring the advantages of engaging in international trade.

Furthermore, the pressure to compete on a global scale incentivizes firms to continuously innovate and improve (Nuruzzaman et al. 2019). This drive for innovation is crucial for maintaining competitiveness and achieving long-term economic growth. As firms upgrade their capabilities and enhance their productivity, these gains spill over into the broader economy, fostering a more robust and competitive economic environment. export intensity is a pivotal factor in economic development, influencing growth, productivity, and innovation. As economies become increasingly interconnected, the ability to effectively engage in international trade becomes ever more critical. Understanding the dynamics of export intensity and leveraging its benefits can help policymakers and business leaders formulate strategies that promote sustainable economic development and global competitiveness.

In this line, enterprises are often regarded as the backbone of emerging market economies, playing a pivotal role in employment generation, innovation, and economic diversification (Sheth 2011). However, their potential remains underutilized, particularly in the realm of international trade. Export intensity, defined as the proportion of total sales that are derived from exports, serves as a critical metric for understanding the international engagement of companies. Integrating firm-specific characteristics with macroeconomic factors provides a holistic view of the determinants

of export intensity and offers valuable insights for enhancing the global competitiveness of companies in emerging markets (Ceylan 2021).

The export performance of enterprises are influenced by a myriad of factors that span both the micro and macroeconomic landscapes. Firm-specific factors such as size, age, managerial expertise, technological capability, and access to financial resources play a crucial role in determining an enterprise's ability to engage in export activities (Goel et al. 2023). Larger firms, or those with more substantial financial and managerial resources, are generally better equipped to navigate the complexities of international markets. Similarly, firms with advanced technological capabilities and innovative products are more likely to succeed in export markets, leveraging their competitive advantages to gain a foothold internationally.

On the macroeconomic front, the broader economic environment significantly impacts enterprise export intensity. Factors such as exchange rate stability, inflation, GDP growth and access to international markets are critical determinants of export success (Goel et al. 2023). For instance, favorable trade policies and trade agreements can reduce barriers to entry and provide enterprises with the necessary support to compete globally (Tsirekidze 2021). Conversely, volatile exchange rates and inadequate infrastructure can hinder export activities by increasing costs and reducing the predictability of international transactions.

Previous research has largely been limited to examining the influence of firm-specific micro-level factors on export intensity. However, a comprehensive analysis of export intensity in emerging markets requires an integrated approach that considers both firm-specific and macroeconomic factors. (Sahin 2018). By understanding the dynamic interplay between these factors, policymakers, business leaders, and researchers can develop targeted strategies that promote companies export activities, drive economic growth, and enhance global competitiveness. As companies in emerging markets continue to navigate the complexities of international trade, a nuanced and holistic perspective is crucial for unlocking their full potential and contributing to broader economic development.

Recent empirical studies (2020–2025) demonstrate that export intensity in emerging-economy pharmaceutical sectors is increasingly shaped by a combination of firm-specific capabilities, regulatory conditions, and macroeconomic stability, moving beyond earlier cost-based explanations. Evidence from emerging pharmaceutical exporters shows that innovation and R&D intensity play a central role in enhancing export performance by enabling firms to meet stringent international quality standards and adapt to destination-market regulations, particularly in generic drug markets (Pain and Chakraborty 2023; Mahor and Banerji 2023). Firm size and age further support export intensity by providing the financial capacity, organizational learning, and experiential knowledge required to navigate complex export procedures and regulatory compliance. At the external level, recent studies emphasize that pharmaceutical exports are highly sensitive to trade barriers, non-tariff measures, and regulatory stringency, with regulatory uncertainty and anti-dumping actions significantly constraining export expansion in emerging economies (Anurakti et al. 2025). Macroeconomic instability—especially exchange rate volatility and inflation—has been shown to exacerbate compliance costs and pricing risks, thereby

dampening export intensity in regulated industries such as pharmaceuticals (Talukder and Tripathi 2025). Despite these advances, existing studies largely examine firm-level capabilities or external constraints in isolation, creating a gap in integrated empirical analyses. The present study addresses this gap by jointly examining firm-specific factors and macroeconomic conditions to position pharmaceutical export intensity within current scholarly debates on regulatory barriers and harmonization in emerging economies. Similarly, The export of pharmaceutical manufacturing companies in Iran plays a crucial role in the country's economic landscape, influenced by both firm-specific factors and macroeconomic conditions. From the perspective of pharmaceutical firm-specific factors, Export activities allow these firms to achieve economies of scale, reduce per-unit costs, and increase profitability, which can lead to further investments in innovation and expansion (Tyagi and Nauriyal 2017). Additionally, diversifying into global markets helps mitigate risks associated with domestic economic fluctuations and fosters strategic international partnerships that enhance knowledge and technology transfer. On a broader scale, the macroeconomic conditions significantly underscore the importance of pharmaceutical exports for Iran. The revenue generated from exports provides vital foreign exchange earnings, crucial for stabilizing the national currency and managing inflation amidst economic sanctions. Moreover, the pharmaceutical sector's export activities contribute to improving the balance of payments and fostering economic growth. Thus, the export of pharmaceutical products is not only beneficial for individual firms but also vital for the overall economic health and stability of Iran (Davari et al. 2011).

2. Conceptual framework and review of literature

Export intensity has been extensively studied, particularly in developed nations, with numerous factors examined as its determinants.

The current study measured export intensity as export sales/total sale ratio. This study identifies and incorporates the most significant and relevant variables, which are discussed in this section.

Firm-Specific Factors

firm-specific factors are critical in shaping a firm's export intensity and overall success in international markets. By understanding and leveraging these factors, firms can enhance their global competitiveness and achieve sustainable growth. Policymakers and business leaders must focus on creating an enabling environment that supports firms in building these capabilities, thereby fostering a more vibrant and competitive export sector

Firm Size

The relationship between firm size and export intensity has been a subject of considerable interest in international business research. Generally, firm size is positively correlated with export intensity, suggesting that larger firms tend to have higher levels of export activity (Majocchi et al. 2005). This can be attributed to several factors, including the greater resources and capabilities of larger firms, which enable them to overcome the barriers to entering and sustaining operations in foreign markets.

Larger firms typically have more substantial financial resources, which allow them to invest in the necessary infrastructure and capabilities required for successful export activities (Westhead et al. 2001). These investments might include the development of international marketing strategies, establishment of foreign distribution networks, and compliance with various regulatory requirements in different markets. Additionally, larger firms can benefit from economies of scale, reducing the per-unit cost of production, which can make their products more competitive in international markets (Celli 2013).

Moreover, larger firms often possess more extensive networks and relationships, both domestically and internationally (Lechner and Dowling 2003). These networks can provide valuable information and support, facilitating smoother entry and operations in foreign markets. For instance, connections with international partners, such as distributors, suppliers, and industry associations, can enhance a firm's ability to navigate the complexities of exporting. firm size plays a crucial role in determining export intensity, with larger firms typically demonstrating higher levels of export activity due to their greater resources, extensive networks, and innovative capabilities. Nonetheless, the landscape is evolving, and smaller firms are also making notable strides in international markets, driven by technological advancements and strategic niche marketing. This dynamic interplay highlights the complexity of the relationship between firm size and export intensity, warranting further research to understand the underlying mechanisms fully.

All in all, Firm size positively influences export intensity by enabling firms to absorb fixed export costs, exploit economies of scale, and sustain higher productivity. Larger firms also possess superior financial, organizational, and bargaining capabilities that support systematic and intensive exporting. However, the effect is often non-linear and contingent on industry and firm strategy.

H1: There is a significant positive relationship between Firm Size and export intensity of pharmaceutical manufacturing companies in Iran

Innovation and R&D Intensity

Innovation plays a crucial role in determining the export intensity of firms, which refers to the proportion of total production that is exported (Pla-Barber and Alegre 2007). Research and Development (R&D) is essential for the growth of high-technology sectors. Innovations arising from R&D activities can significantly enhance the competitive edge of firms, allowing them to enter and expand in international markets. This, in turn, increases their export intensity by offering unique products and advanced solutions that meet the specific needs and preferences of foreign consumers. Such high-tech innovations often lead to the development of new products and processes that can capture larger market shares abroad.

The export behavior of cooperatives has also been studied in relation to innovation (De Faria et al. 2010). Innovative practices within cooperatives can lead to improved product quality and

operational efficiencies, which are critical for competing on a global scale (Tomlinson 2010). By fostering a culture of innovation, cooperatives can enhance their export intensity, thereby contributing to the broader economic goals of the regions they operate in. Innovation in cooperatives often involves collaborative efforts, leveraging collective expertise to improve their export capabilities.

Another study analyzed the effects of innovation on the export performance of manufacturing firms (Edeh et al. 2020). It was found that manufacturers who actively seek information on potential foreign markets and adapt their products accordingly tend to have higher export intensities. This proactive approach to innovation includes both technological advancements and market-oriented innovations, such as customizing products to meet the standards and tastes of international customers. The ability to innovate and tailor products for specific markets is a key driver of export success.

Additionally, research has extended the literature on the relationship between innovation and export intensity by examining various moderating factors. These factors include the size of the firm, the industry sector, and the specific type of innovation being implemented (e.g., product vs. process innovation). Larger firms with substantial resources for R&D are often better positioned to innovate and thus achieve higher export intensities (Kiss et al. 2018). Similarly, certain sectors that are more innovation-driven tend to exhibit stronger correlations between their innovative activities and export performance.

Furthermore, from a business and strategic perspective, sustained R&D builds unique capabilities, accelerates learning, and enables continuous product adaptation to foreign market needs. Innovative firms compete on differentiation rather than price alone, achieve stronger brand positioning, and are better able to maintain and scale exports across multiple markets. Overall, higher innovation and R&D intensity systematically enhance a firm's ability to export more intensively, particularly in technology- and knowledge-intensive industries.

In conclusion, innovation is a critical determinant of export intensity across different types of firms and sectors. By investing in R&D, fostering a culture of innovation, and adapting to foreign market demands, firms can significantly enhance their export performance. These findings underscore the importance of innovation as a strategic tool for firms aiming to compete in the global marketplace.

H2: There is a significant positive relationship between investment in R&D and export intensity of pharmaceutical manufacturing companies in Iran

Advertisement

Advertising plays a pivotal role in enhancing export intensity by increasing the visibility and appeal of products in foreign markets (Goel et al. 2023). Empirical studies have demonstrated that strategic advertising efforts can significantly boost a firm's presence and competitiveness in international markets (Bartlett 1926). By creating brand awareness and fostering a positive brand image, advertising helps to differentiate products from competitors, making them more attractive

to foreign consumers (Hakala et al. 2012). This differentiation is crucial in markets where consumers may be unfamiliar with the brand or its offerings.

Moreover, advertising can communicate the unique value propositions of a product, such as quality, innovation, and reliability, which are critical factors that influence purchasing decisions in international markets. By effectively conveying these attributes, advertising helps to build trust and credibility, essential for gaining market share and increasing export intensity (Solberg and Nes 2002). Additionally, consistent advertising efforts can establish and maintain brand loyalty among international customers, leading to sustained demand and higher export volumes (Chioveanu 2008).

Furthermore, advertising facilitates market penetration by educating potential customers about the product's benefits and uses, thereby reducing the perceived risks associated with purchasing foreign goods (House et al. 2015). It also supports the development of distribution channels by attracting the interest of local distributors and retailers, who are more likely to partner with well-promoted brands. Overall, a robust advertising strategy is instrumental in driving export intensity by enhancing product visibility, building brand equity, and fostering consumer confidence in foreign markets

From a business perspective, advertising builds brand equity, facilitates market entry, and accelerates customer acquisition in export markets. Effective international advertising improves distribution access, supports premium pricing, and sustains repeat demand, thereby raising the export-to-sales ratio. In sum, advertising is a complementary intangible asset that amplifies export intensity, particularly in consumer goods and brand-sensitive industries.

H3: There is a significant positive relationship between advertisement and export intensity of pharmaceutical manufacturing companies in Iran

The relationship between firm age and export intensity has garnered substantial attention in international business and trade literature. Firm age, often seen as a proxy for accumulated experience, resources, and capabilities, can play a significant role in enhancing a firm's ability to engage in and sustain export activities. This justification explores the underlying reasons why older firms are more likely to exhibit higher export intensity, grounded in theoretical perspectives and empirical evidence.

The resource-based view of the firm provides further insight into how firm age positively impacts export intensity (Westhead et al. 2001). As firms age, they tend to accumulate valuable resources and capabilities, such as financial capital, human resources, and technological know-how. These resources enhance a firm's competitive advantage in foreign markets, allowing them to penetrate and sustain a presence in these markets more effectively. Older firms are also more likely to have established brand reputations and customer loyalty, which can facilitate entry into and expansion within international markets.

From a business perspective, firm age reflects accumulated market knowledge, relational capital, and reputational credibility, facilitating deeper penetration of foreign markets. However, the effect

can be non-linear: younger "born-global" firms may achieve high export intensity early, while older firms may become domestically locked-in. Overall, firm age matters mainly through experience and credibility, but its impact on export intensity depends on strategic orientation and adaptability.

H4: There is a significant positive relationship between firm age and export intensity of pharmaceutical manufacturing companies in Iran

Macroeconomic Conditions

Macroeconomic conditions significantly influence export intensity, with economic stability and exchange rate volatility playing pivotal roles. Economic stability fosters a predictable business environment, enhancing investor confidence and encouraging investment in export-oriented industries. This predictability allows businesses to manage costs effectively, ensuring competitive pricing in international markets. Stable economic conditions also boost consumer confidence and demand, enabling local businesses to scale operations to meet international demand more efficiently.

Exchange rate volatility, on the other hand, can have a destabilizing effect on export intensity. Frequent and unpredictable fluctuations in exchange rates create uncertainty in pricing and profit margins for exporters. This unpredictability can deter investment in export activities, as businesses face difficulties in planning and budgeting. However, if managed well, a favorable exchange rate can make exports more competitive by lowering the relative cost of goods abroad, potentially boosting export volumes. Thus, while economic stability generally promotes increased export intensity, exchange rate volatility presents both challenges and opportunities that exporters must navigate carefully.

GDP Growth

The relationship between GDP growth and export intensity reveals that robust domestic economic expansion can negatively impact a country's reliance on exports. As GDP grows, businesses often prioritize the lucrative domestic market due to increased consumer demand and higher disposable incomes, leading to reduced export intensity. Structural changes in the economy, such as a shift towards less export-oriented sectors, and currency appreciation that makes exports less competitive, also contribute to this trend. Additionally, government policies favoring domestic economic activities can further decrease the motivation for firms to export. Empirical evidence supports this inverse relationship, showing that countries with significant GDP growth often experience a decline in export intensity. Understanding this dynamic is crucial for policymakers and businesses in the context of international trade.

Another factor is the appreciation of the domestic currency that often accompanies GDP growth. As the economy expands, increased foreign investment and confidence can lead to a stronger currency. A stronger currency makes exports more expensive and less competitive on the global market, thus dampening export intensity. This currency appreciation effect can be particularly

pronounced in countries that experience rapid GDP growth, as seen in various emerging economies during their boom periods.

H5- There is a significant negative relationship between GDP growth and export intensity of pharmaceutical manufacturing companies in Iran

Inflation

The relationship between inflation and export intensity is a crucial area of study in international trade and economics. Inflation, defined as the general increase in prices of goods and services over time, can have a significant and negative impact on a country's export intensity (Gylfason 1999). This justification examines the mechanisms through which rising inflation can reduce a country's ability to maintain or increase its exports.

One primary reason for the negative impact of inflation on export intensity is the loss of price competitiveness in international markets. When domestic prices rise due to inflation, the cost of producing goods increases. Consequently, these higher production costs are often passed on to consumers in the form of higher prices for exported goods. As a result, these goods become less competitive compared to those from countries with lower inflation rates. Price-sensitive international buyers may turn to more affordable alternatives, leading to a decline in demand for the higher-priced exports.

Inflation also erodes the purchasing power of consumers and businesses within the exporting country (Halim et al. 2022). This reduction in purchasing power can lead to a decrease in investment in production and innovation, which are critical for maintaining the quality and competitiveness of exports. Additionally, inflation often prompts central banks to increase interest rates to curb rising prices. Higher interest rates can increase the cost of borrowing for businesses, limiting their ability to invest in expansion and export activities. This financial strain can further diminish export intensity as firms struggle to finance their operations and growth.

Moreover, inflation can create uncertainty and volatility in the economy, making it more challenging for exporters to plan and execute long-term strategies. Unpredictable changes in costs and prices can lead to uncertainty in profit margins, making export ventures riskier and less attractive. This economic instability can deter firms from entering or expanding in international markets, thus reducing export intensity.

H6- There is a significant negative relationship between inflation and export intensity of pharmaceutical manufacturing companies in Iran

Exchange Rate Volatility

standard deviation of exchange rate movements is commonly used as a measure of exchange rate volatility (Serenis and Tsounis 2012). Exchange rate volatility refers to the degree of variation or fluctuation in the value of a currency relative to another over a specific period. The standard deviation is a statistical metric that measures the extent of variation or dispersion of a set of values relative to their mean.

In the context of exchange rates, calculating the standard deviation of exchange rate changes provides an indication of how much the exchange rate fluctuates around its average value. A higher standard deviation indicates greater volatility, meaning the exchange rate experiences larger and more frequent changes. Conversely, a lower standard deviation suggests more stability with smaller, less frequent fluctuations.

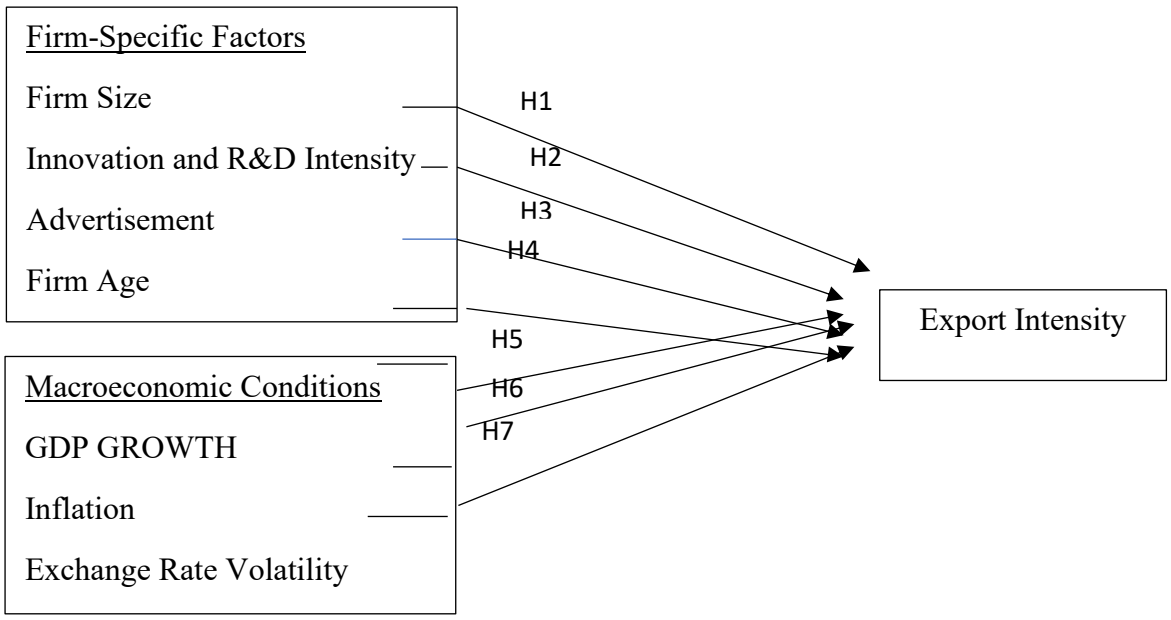
Using standard deviation as a measure of exchange rate volatility is valuable for businesses, investors, and policymakers, as it helps assess the risk associated with currency fluctuations. High exchange rate volatility can increase the uncertainty in international transactions, affect trade balances, and impact economic stability, making it a critical factor to monitor in global economic analysis (Caporale et al. 2015).

Exchange rate volatility can significantly impact export intensity, which is the proportion of a country's total production that is sold abroad (Tunc et al. 2020). When exchange rates fluctuate unpredictably, it becomes challenging for exporters to maintain competitive pricing. This uncertainty can discourage foreign buyers, as they may face unexpected price increases or decreases. As a result, frequent and large swings in exchange rates can reduce the attractiveness of a country's exports, thereby decreasing export intensity.

Additionally, exchange rate volatility affects the profit margins of exporters. When a country's currency depreciates, exporters can benefit from increased competitiveness, as their goods become cheaper for foreign buyers. However, if the currency appreciates, the prices of exported goods rise, potentially making them less attractive in the global market. This unpredictability can make it difficult for exporters to plan and budget effectively, leading to a reduction in export activities. In essence, stable exchange rates provide a more predictable environment for international trade, encouraging higher export intensity, while volatility tends to have the opposite effect

H7- There is a significant negative relationship between Exchange Rate Volatility and export intensity of pharmaceutical manufacturing companies in Iran

Firm-specific factors (like firm size, R&D intensity, advertisement, and firm age) and macroeconomic conditions (GDP growth, inflation, and exchange rate volatility) influence export intensity — can be justified using a combination of Resource-Based View (RBV) and Institutional Theory. RBV posits that a firm's internal resources and capabilities (such as R&D, size, marketing efforts, and age-related experience) are critical to achieving competitive advantage, including in international markets. These internal resources determine how well a firm can adapt, compete, and thrive in export markets. In addition, Institutional theory emphasizes the impact of the external environment — including economic policies, market conditions, and institutional stability — on organizational behavior. In this context, macroeconomic factors like GDP growth, inflation, and exchange rate volatility shape the opportunities and risks associated with exporting.



Theoretical Foundations

This study draws on multiple complementary theoretical perspectives to explain the determinants of export intensity at both the firm and macroeconomic levels. At the firm level, the Resource-Based View (RBV) provides a foundational explanation for how internal resources and capabilities shape firms' export performance. According to RBV, firms achieve superior performance when they possess valuable, rare, inimitable, and non-substitutable resources (Barney 1991; Wernerfelt 1984). In the context of exporting, firm size reflects the availability of financial, human, and organizational resources that enable firms to absorb the fixed and variable costs associated with international market entry. Innovation and R&D intensity represent knowledge-based capabilities that enhance product differentiation and technological competitiveness in foreign markets, while advertising expenditure captures marketing and branding capabilities that support international market penetration. Firm age further reflects accumulated experience, organizational learning, and established routines that facilitate export operations. Collectively, these firm-specific factors constitute strategic resources that enhance export intensity.

Extending beyond static resource endowments, Dynamic Capabilities Theory emphasizes firms' abilities to integrate, reconfigure, and renew resources in response to rapidly changing environments (Teece, Pisano and Shuen 1997). Export markets are characterized by uncertainty arising from demand fluctuations, competitive pressures, and macroeconomic volatility. Firms with strong innovation and R&D capabilities are better positioned to sense international opportunities, adapt products and processes, and respond to environmental changes, thereby sustaining higher levels of export intensity. Similarly, investment in advertising enables firms to dynamically adjust their market positioning and communication strategies across different foreign markets. From this perspective, export intensity is not only a function of resource ownership but also of firms' adaptive and learning capabilities.

At the intersection of firm-level and country-level determinants, the Eclectic Paradigm (OLI framework) offers an integrative explanation of export behavior (Dunning 1988, 2000). The OLI framework posits that international involvement is influenced by ownership advantages, location advantages, and internalization incentives. In this study, firm-specific factors such as size, innovation, advertising, and age represent ownership advantages that enhance firms' competitiveness abroad. Macroeconomic conditions—namely GDP growth, inflation, and exchange rate volatility—constitute location-specific factors that shape the attractiveness and feasibility of export activities. Favorable macroeconomic conditions can encourage firms to expand export operations, whereas instability increases uncertainty and risk, potentially constraining export intensity.

In addition, Institutional Theory underscores the role of the broader economic environment in shaping firms' strategic decisions (North 1990; Scott 1995). Macroeconomic stability influences firms' expectations regarding costs, revenues, and risk exposure in international markets. GDP growth signals economic vitality and production capacity, supporting export expansion. In contrast, high inflation increases cost uncertainty and undermines price competitiveness, while exchange rate volatility exposes exporters to financial risk and revenue instability. Consequently, macroeconomic conditions serve as critical external constraints or enablers of firms' export intensity.

Finally, insights from Internationalization Theory, particularly the Uppsala model, suggest that firms increase their commitment to foreign markets gradually as they accumulate experiential knowledge (Johanson and Vahlne 1977, 2009). Firm age and size facilitate learning, resource accumulation, and risk absorption, enabling firms to expand export activities more intensively over time. This evolutionary view complements the RBV and institutional perspectives by highlighting the dynamic and path-dependent nature of export behavior. Taken together, these theoretical perspectives provide a comprehensive foundation for the proposed conceptual framework, explaining how firm-specific resources and capabilities, together with macroeconomic conditions, jointly influence export intensity.

3. Methodology

"The objective of this research is to estimate the effect of "firm specific factors and macroeconomic conditions" on "export intensity" in Iranian pharmaceutical firms. Twenty active pharmaceutical companies in Iran with export activities, whose statistical information is available in the Codal system, were selected as samples for this study. These companies are: Abouraihan, Exir, Alborz Darou, Amin, Avicenna, Tolid Darou, Jam Darou, Darou Pakhsh, Dana, Daru Pars, Razi, Rooz Darou, Zahravi, Sobhan, Sina Darou, Shaheed Ghazi, Farabi, Pharmed Pars, Caspian, and Loghman. The present study is based on the time-series secondary data, mainly taken from the financial report of firms and Iran central bank database for period of 2018 till 2023 (solar year 1397 till 1402) (latest available period for this study).

Table 1. Variables Details

Main Equation			
Variables	**Proxy**	**Role**	**Sources**
Log of export intensity	lnexpinten	DV	financial reports of firms
log of firm size	lnsize	IV	financial reports of firms
log of firm selling and advertising expenditure	lnads	IV	financial reports of firms
log of firm R&D expenditure	lnrd	IV	financial reports of firms
log of firm age	lnage	IV	financial reports of firms
GDP growth rate of country	gdpgrowth	IV	Iran central bank
log of Exchange rate devation	lnstder	IV	Iran central bank
log of inflation	lninf	IV	Iran central bank

$$lnexpinten_{it} = \beta_0 + \beta_1 \text{lnsize}_{it} + \beta_2 \text{lnads}_{it} + \beta_3 \text{lnrd}_{it} + \beta_4 \text{lnage}_{it} + \beta_5 \text{gdpgrowth}_{it} + \beta_5 \text{lnstder}_{it} + \beta_5 \text{lninf}_{it} + \grave{e}_{it}$$

Where β_0 are intercepts, "Log of export intensity" represent the dependent variable, and "log of firm size, log of firm selling and advertising expenditure, log of firm R&D expenditure, log of firm size, GDP growth rate, log of exchange rate deviation, and log of inflation" are independent variables, respectively, β_i are the coefficient relating the independent, and e_i are residuals.

4. Findings

In this section, we estimate the impact of "firm specific factors and macroeconomic conditions" on "export intensity" in Iranian pharmaceutical firms.

"The analysis of this study begins with descriptive statistics. Summary descriptive statistic of all variables is provided in Table 2. The average" of the dependent variable of this study (lnexpinten) is -4.672 and it disperses from -8.697 to -1.006.

Also, the descriptive statistics of independent variables provided here. The mean and standard deviation of dependent variable are -4.672 and 1.61 respectively. Table 2 additionally presents other characteristics of the variables examined in this study, including standard deviation, as well as the minimum and maximum values of all the variables analyzed.

Table 2. Descriptive Statistics of all variables in model

Variables	**Mean**	**Std. Dev**	**Min**	**Max**
lnexpinten	-4.6727	1.61718	-8.6975	-1.0068
lnsize	2.73676	0.07389	2.54263	2.94991
lnads	12.4656	0.94364	10.0481	16.0506
lnrd	9.97807	1.65515	5.07517	13.1693
lnage	3.46878	0.44747	2.56495	4.14314
gdpgrowth	1.61	2.96392	-3.07	4.71
lnstder	8.09768	1.17985	6.24647	9.89339
lninf	3.60993	0.1679	3.29036	3.82325

Following the descriptive statistics, the correlation among the variables used in this model is presented in Table 3. It can be inferred that the correlation between all independent variables are not relatively high and as a result they are not causing any issue.

"Table 3. Correlation coefficients between DV and IV variables"

	lnexpinten		lnsize		lnads		lnrd		lnage	gdpgrowth		lnstder	lninf
lnexpinten	1												
lnsize	0.284	***	1										
lnads	0.312	***	0.463	***	1								
lnrd	-0.001		0.378	***	0.337	***	1						
lnage	-0.096		-0.088		-0.118		0.003		1				
gdpgrowth	-0.052		0.249	***	0.317	***	0.276	***	0.066	1			
lnstder	-0.038		-0.087		-0.082		0.103		-0.007	0.013		1	
lninf	-0.235	**	0.383	***	0.378	***	0.349	***	0.117	0.312	***	0.017	1

Source: Output of STATA software

"Since interpreting multicollinearity analysis solely from a correlation matrix can be challenging, this study calculates the variance inflation factors (VIF) for all the independent variables used, as shown in Table 4. Determining the VIF is also a method for assessing the level of collinearity between the independent and control variables in a regression analysis" (Gujarati and Porter 2009). "According to the data in Table 4, all VIF values are below 10, indicating that multicollinearity is not a significant concern. Therefore, there are no multicollinearity issues, and no variables will be excluded from the model.

Table 4. Result of Multicollinearity test

Variable	Centered VIF
lnads	4.15
lnsize	4.08
lninf	1.32
lnrd	1.29
gdpgrowth	1.22
lnage	1.05
lnstder	1.05
Mean VIF	2.02

Source: Output of STATA software

"This research assesses the assumption of regression for the equation of research analysis, as explained before, The outcomes indicating no autocorrelation issues, no heteroscedasticity issues, and the normality of residuals are presented in Table 5 , 6 and 7.

Table 5 illustrates the result Breusch-Pagan test for detecting heteroscedasticity issue. The result of heteroscedasticity test, probability of Chi-square is insignificant and hence, it has no issue of heteroscedasticity."

Table 5. Diagnostics Tests. Part1

Heteroskedasticity Test: Breusch-Pagan test		
Main Equation	**Chi-Square**	0.300
	Prob	0.583

Source: Output of STATA software

In the next step (table 6), to detect autocorrelation issues, the study employed the Wooldridge method, with the null hypothesis stating no autocorrelation and the alternative hypothesis indicating the presence of autocorrelation. (Wooldridge 1991).

Based on the test results, the probability value for the main equation is not significant. This implies that the null hypothesis of no autocorrelation is not rejected, indicating that there is no autocorrelation issue in this model."

Table 6. Diagnostics Tests. Part2

Wooldridge: Autocorrelation test		
Main Equation	**Chi-Square**	0.667
	Prob	0.430

Source: Output of STATA software

Lastly, all three step equations were analyzed for the normality of residuals. The Doornik-Hansen test was employed to assess whether the residuals follow a normal distribution. If the P-value of the Doornik-Hansen test is significant, it indicates that the residuals are not normally distributed; otherwise, they are considered to be normally distributed (Gujarati 2003). According to the normality test results presented in Table 7, the insignificant P-value supports the acceptance of the null hypothesis, indicating that the residuals are normally distributed. Therefore, it has normal distribution of residual."

Table 7. Diagnostics Tests. Part3

Normality of Residuals		
Main Equation	**Doornik-Hansen chi2**	22.283
	Prob	0.0468

Source: Output of STATA software

Given that the equations in this study are based on panel data, it is essential to conduct three mandatory tests for panel data analysis to choose between the Pooled OLS, Fixed Effect, and Random Effect methods (Vijayamohanan Pillai 2016). These tests include the F-test (to compare Pooled OLS and Fixed Effect (FE) models), the Breusch-Pagan test (to compare Pooled OLS and Random Effect (RE) models), and the Hausman test (to compare RE and FE models).

Table 8 demonstrate the outcome of these three tests for the regression analysis. As the outcome of F-test shows, null hypothesis is rejected and the alternative "hypothesis which is Fixed effect (FE) is accepted. Then, the result of Breusch-Pagan test shows that the null hypothesis is rejected too and implies the acceptance of Random effect (RE). So, the Hausman test will clarify the final selection (Pace and LeSage 2008). Finally, the result of the Hausman test indicates that the probability is not significant, meaning the null hypothesis cannot be rejected. Therefore, the null

hypothesis, which favors the Random Effect (RE) model, is accepted. This confirms that the most appropriate method for the main equation is the Random Effect panel method.

Table 8. F-test, BP-LM and Hausman Tests

	Tests	Statistic	Prob.
Main Equation	F-test	14.53	0.000
	BP-LM test	113.6	0.000
	Hausman test (Chi-Sq.)	3.77	0.806

Source: Output of STATA software

Table 9 explains the finding of the analysis. According to the table 9, the result of analysis indicates that "lnsize (log of firm size) and lnads (log of firm selling and advertising expenditure)" has significant and positive impact on "lnexpinten (Log of export intensity)" with 10% significance level and "lninf (log of inflation)" has significant and negative effect on on "lnexpinten (Log of export intensity)" with 1% significance level correspondingly. The rest of independent variables do not show any significant impact on "Log of export intensity".

Table 9. Panel data outcome of the equation. (DV: lnexpinten)

Variable	Coefficient		Std. Er	z-Stat	Prob.
lnsize	4.69006	*	2.51787	1.86	0.063
lnads	0.33884	*	0.1921	1.76	0.078
lnrd	-0.1042		0.08172	-1.28	0.202
lnage	-0.8593		0.78291	-1.1	0.272
gdpgrowth	-0.0093		0.0333	-0.28	0.78
lnstder	0.08537		0.0732	1.17	0.244
lninf	-3.1201	***	0.63071	-4.95	0
Constant	-7.3059		5.18225	-1.41	0.159
Wald chi2	60.53				
Prob > chi2	0				

"Source: Output of STATA software"

To approve the main finding, the robust equation is inspected. In this equation, "inflation (lnINF) and GDP growth rate of country (GDPgrowth)" are replaced with "broad money (lnMoney), GDP per capita (LnGDPperCap)" respectively as independent variable and the rest variables are the same as the main equation.

Robust equation:	$lnexpinten_{it} = \beta_0 + \beta_1 \text{lnsize}_{it} + \beta_2 \text{lnads}_{it} + \beta_3 \text{lnrd}_{it} + \beta_4 \text{lnage}_{it} + \beta_5 \text{lnGDPperCap}_{it} + \beta_6 \text{lnstder}_{it} + \beta_7 \text{lnMoney}_{it} + \grave{e}_{it}$

Based on the table 10, in the same line with the key findings of the main equation, the finding confirmed the significant positive effect of "selling and advertising expenditure (lnads)", and "GDP growth (here known as lnGDPperCap)" and the significant positive impact of firm size (lnsize) on export intensity at 10%, 1%, 5%, and 5% accordingly.7

Table 10. Regression outcome of robust model

Variable	Coefficient		Std. Er	z-Stat	Prob.
lnsize	4.971	**	2.478	2.01	0.045
lnads	0.332	*	0.187	1.78	0.076
lnrd	-0.086		0.080	-1.08	0.280
lnage	-0.711		0.779	-0.91	0.362
lngdppercap	2.963	***	0.853	3.47	0.001
lnstder	-0.209	**	0.092	-2.27	0.023
lnmoney	-33.967	***	6.422	-5.29	0.000
Constant	156.33		32.328	4.84	0.000
Wald chi2	65.76				
Prob > chi2	0.0001				

Source: Output of STATA software.

5. Conclusion

This study aimed to answer the research question "What are the firm-specific factors that play important roles in the exporting of pharmaceutical manufacturing companies, and what are the key specific factors under macroeconomic conditions that can decrease the export intensity of these companies? The findings of this study indicate that two firm-specific factors, namely firm size and advertising, can significantly impact export intensity. On the other hand, inflation, as a macroeconomic condition, can decrease the export intensity.

The findings of this study indicate that firm size has a positive and significant impact on export intensity among pharmaceutical manufacturing companies in Iran. Larger firms are better positioned to engage in export activities due to several inherent advantages. Firstly, they possess greater financial resources, enabling them to invest in the necessary infrastructure, technology, and market research required for successful international operations. This financial robustness allows larger firms to absorb the costs associated with entering and maintaining a presence in foreign markets, such as regulatory compliance, marketing, and distribution.

Additionally, larger firms benefit from economies of scale, which reduce the average cost of production and increase their competitiveness in the global market. The ability to produce at lower costs without compromising quality gives these firms a substantial edge over smaller competitors, enhancing their export performance. Moreover, large firms typically have more extensive networks and established relationships with foreign partners, distributors, and suppliers. These networks facilitate smoother entry into new markets and better access to critical market intelligence, further driving export intensity. This result of this study is consistent with Pace and LeSage (2008).

The study's findings that investment in R&D by pharmaceutical manufacturing companies in Iran does not significantly impact export intensity can be attributed to several contextual factors. Firstly, Iran's pharmaceutical industry operates under stringent international sanctions that limit access to global markets, thereby constraining the potential for exports regardless of R&D investments.

Additionally, the regulatory environment in Iran may not fully align with international standards, making it difficult for Iranian pharmaceutical innovations to gain acceptance abroad. Furthermore, the local market focus of many Iranian pharmaceutical firms means that their R&D efforts are primarily geared towards addressing domestic health needs and regulatory requirements rather than meeting the diverse and stringent demands of international markets. Consequently, despite substantial R&D investments, these efforts do not translate into increased export intensity due to the combined effects of sanctions, regulatory misalignment, and a predominantly domestic orientation.

The impact of pharmaceutical manufacturing companies' advertisements on export intensity in Iran presents a multifaceted dynamic worth academic exploration. Advertising, as a pivotal marketing strategy, can significantly enhance the visibility and perceived credibility of pharmaceutical products in international markets. In the context of Iran, where economic sanctions and regulatory challenges often constrain market access, effective advertising can serve as a strategic tool to differentiate products and build trust among global buyers. Empirical studies suggest that advertising contributes to brand recognition, which in turn fosters customer loyalty and can lead to increased demand in foreign markets. Additionally, targeted advertising campaigns that highlight compliance with international standards and certifications can reassure potential international clients about the quality and reliability of Iranian pharmaceutical products. Consequently, this enhanced market presence and credibility can drive higher export intensity, enabling Iranian pharmaceutical firms to expand their market share and achieve sustainable growth in the competitive global pharmaceutical industry. This result of this study is consistent with (Goel et al. 2023).

The relationship between firm age and export intensity in the pharmaceutical manufacturing sector in Iran presents a counterintuitive dynamic. Conventional wisdom suggests that older firms, with their established market presence, extensive networks, and accumulated experience, would exhibit higher export intensity. However, recent empirical findings indicate that firm age does not significantly impact export intensity in this context. This phenomenon can be attributed to several factors unique to the Iranian pharmaceutical industry. Firstly, younger firms may possess a greater propensity for innovation and agility, allowing them to adapt more swiftly to international market demands and regulatory changes compared to their older counterparts. Secondly, the rapid evolution of global pharmaceutical markets and technologies may level the playing field, enabling newer firms to compete effectively without the disadvantage of lacking historical market presence. Furthermore, government policies and incentives aimed at promoting exports might equally benefit firms regardless of their age, thus diminishing the potential age-related advantages. Consequently, these dynamics suggest that other factors, such as technological capabilities, strategic partnerships, and marketing strategies, play a more critical role in determining export intensity than firm age.

The relationship between GDP growth and the export intensity of pharmaceutical manufacturing companies in Iran reveals an intriguing economic interplay. Contrary to the intuitive assumption that a growing domestic economy might reduce the export intensity of local firms due to increased domestic demand, empirical evidence suggests that no significant negative relationship exists

between GDP growth and export intensity in this sector. This can be attributed to several factors specific to the Iranian pharmaceutical industry and its economic environment. Firstly, pharmaceutical products often have inelastic demand, driven by consistent health care needs both domestically and internationally, which buffers against fluctuations in export intensity. Secondly, as the Iranian economy grows, firms may leverage improved economic conditions to enhance production capacities and invest in quality improvements, thereby increasing their competitiveness in global markets. Additionally, GDP growth can lead to better access to financial resources, enabling firms to invest in export-oriented strategies and marketing efforts. Furthermore, the Iranian pharmaceutical sector, facing ongoing global demand and often insulated from local economic cycles due to its essential nature, might prioritize maintaining and expanding its international market share. These dynamics collectively suggest that GDP growth does not significantly deter export activities; rather, it may provide an environment that supports sustained or even enhanced export intensity

The analysis of the impact of inflation on the export intensity of pharmaceutical manufacturing companies in Iran reveals a significant and negative correlation. This suggests that rising inflation rates adversely affect the export activities of these firms. Several key factors contribute to this dynamic. Firstly, inflation increases the cost of raw materials, production, and overall operational expenses, which can erode profit margins and make products less competitively priced in international markets. Consequently, Iranian pharmaceutical companies may struggle to maintain their export volumes due to higher production costs and the inability to competitively price their products abroad. Secondly, inflation can lead to currency depreciation, which, while potentially making exports cheaper, also increases the cost of importing necessary inputs for pharmaceutical production, thus affecting the overall cost structure negatively. Additionally, high inflation creates economic uncertainty, discouraging long-term investments in export infrastructure and international marketing efforts, which are crucial for sustaining export intensity. Furthermore, inflation often leads to tighter monetary policies and higher interest rates, increasing the cost of capital and financing for export activities. This financial strain can hinder the ability of pharmaceutical firms to invest in scaling up production and meeting international demand. Therefore, the significant negative impact of inflation on export intensity underscores the importance of stable economic policies and inflation control to ensure that Iranian pharmaceutical companies can remain competitive in the global market. This result of this study is consistent with (Ilmas et al. 2022).

The investigation into the impact of exchange rate volatility on the export intensity of pharmaceutical manufacturing companies in Iran reveals that there is no significant negative impact. This finding suggests that fluctuations in exchange rates do not substantially deter the export activities of these firms. Several factors may explain this resilience. Firstly, the pharmaceutical industry often deals with inelastic demand for essential medicines, which means that international buyers continue to purchase these products despite currency fluctuations. Secondly, many pharmaceutical companies engage in hedging practices and utilize financial instruments to mitigate the risks associated with exchange rate volatility, thereby stabilizing their

export revenues. Moreover, government support and incentives aimed at promoting exports can also help mitigate the adverse effects of currency volatility. This lack of significant negative impact highlights the robustness of the pharmaceutical sector's export strategies in the face of financial uncertainties

The results of this study offer concrete export strategies for Iranian pharmaceutical firms operating in highly regulated international markets. The significant effect of R&D expenditure indicates that firms should prioritize export-oriented R&D, particularly investments in bioequivalence studies, stability testing, and Common Technical Document (CTD) preparation required for approval by stringent regulators such as the FDA and EMA. Establishing in-house regulatory affairs units or outsourcing to specialized regulatory consultants can substantially shorten approval timelines and increase export intensity.

The positive role of firm size suggests that smaller pharmaceutical firms can enhance export capacity by forming export consortia or engaging in contract manufacturing partnerships to meet minimum production, documentation, and pharmacovigilance requirements demanded by international regulators.

The significance of advertising expenditure implies that pharmaceutical firms should shift marketing resources toward regulatory-compliant promotion, including participation in international pharmaceutical exhibitions, scientific detailing, and B2B digital platforms targeting licensed distributors in destination markets rather than mass consumer advertising.

Regarding macroeconomic conditions, exchange rate volatility underscores the need for export contracts denominated in stable currencies and cost structures aligned with long regulatory approval cycles. Additionally, Iranian pharmaceutical firms can leverage Iran’s membership in the Organization of Islamic Cooperation (OIC) to access less regulated and culturally aligned markets, where mutual recognition of standards and government-to-government agreements reduce entry barriers compared to FDA/EMA markets.

This research reflects the broader scope of the study, emphasizing the integration of both micro-level firm specifics and macroeconomic influences to provide a more nuanced understanding of what drives export intensity among pharmaceutical companies in emerging markets. This approach not only extends the current understanding but also offers practical insights for policymakers and business leaders to foster a more export-oriented sector. The integration of both firm-specific factors and macroeconomic conditions provides a comprehensive analysis that considers internal and external influences on export intensity. This dual perspective is crucial for developing a well-rounded understanding of the dynamics at play. Other titles might focus solely on internal factors or external conditions, but by examining both, this research can identify how these elements interact and impact export performance. This holistic approach can inform more robust and effective policies and business strategies, enhancing the overall competitiveness of Iranian pharmaceutical companies in the global market.

This study has identified that firm size has a significant and positive impact on export intensity in Iranian pharmaceutical manufacturing companies implies that larger firms, with their greater resources and capabilities, are better positioned to engage in and sustain export activities. For

policymakers, this suggests the importance of supporting small and medium-sized enterprises (SMEs) in their growth through incentives, subsidies, and access to financing. Larger firms should strategically invest in scaling up their operations, enhancing their production capacities, and developing international marketing strategies to capitalize on their export potential. Additionally, industry associations and trade organizations could focus on fostering collaborations and partnerships among smaller firms to help them achieve the scale necessary for successful export ventures.

This study also has found that advertisement has significant impact on export intensity of Iranian pharmaceutical companies. For business leaders, this underscores the importance of investing in robust advertising strategies to build brand awareness, credibility, and consumer trust in foreign markets. Pharmaceutical companies should allocate substantial resources to targeted advertising campaigns that highlight their products' quality and compliance with international standards. For policymakers, this finding suggests the need to support these companies through initiatives that facilitate access to international marketing platforms and provide incentives for advertising expenditures. By leveraging strong advertising efforts, Iranian pharmaceutical companies can enhance their competitive edge and increase their export performance.

The most obvious finding to emerge from this study is that inflation has negative and significant influence on export intensity in the context of Iranian pharmaceutical companies. For business leaders, this underscores the importance of implementing cost-control measures and efficiency improvements to mitigate the adverse effects of inflation on production costs. Companies may need to explore strategies such as forward contracts and other financial instruments to hedge against inflation risks. For policymakers, this finding suggests the urgent need to implement macroeconomic policies aimed at stabilizing inflation. This could involve monetary policies that control inflation and fiscal policies that support industrial productivity. Additionally, providing subsidies or financial support to pharmaceutical companies can help offset inflationary pressures, thereby sustaining export levels. In essence, firms that recognize and actively manage the interplay between their internal resources and the broader economic environment are more likely to thrive in global markets. Export intensity, therefore, is not merely a function of ambition—it is a product of strategic alignment between what a firm is capable of and what the macro context enables. Trade associations should also consider advocating for regulatory reforms that enhance the ease of doing business and reduce operational costs. By addressing the inflation challenge, Iranian pharmaceutical companies can maintain their export intensity and remain competitive in the global market.

In sum, the result of this study approves the first and third and sixth hypotheses which implies the significant impact of firm size, advertisement and inflation on export intensity. On the other hand, second, fourth, fifth and seventh hypotheses are reject which means that insignificant impact of investment in R&D, firm age, GDP growth and exchange rate volatility on export intensity.

This study has several limitations. First, the sample consists of only 20 Iranian pharmaceutical firms over the period 2018–2023, which may limit the generalizability of the findings. Second, the

exclusive focus on Iran—a context characterized by sanctions and macroeconomic instability that means the results may not be directly transferable to other emerging or developed economies.
Third, the study relies on secondary financial data, which does not capture qualitative factors such as managerial international experience, regulatory capabilities, or export market diversification. Fourth, export intensity is measured only as the ratio of export sales to total sales, without distinguishing between types or quality of export markets.
Finally, although a random-effects panel model is employed, potential endogeneity and interaction effects between firm-specific and macroeconomic variables are not fully addressed. Future research may apply dynamic models and broader cross-country samples to enhance robustness and generalizability.
Furthermore, future research could adopt a cross-country comparative framework by benchmarking the export intensity of Iranian pharmaceutical firms against regional and emerging-economy peers such as Turkey, India, and Egypt. Such a comparative approach would improve the interpretability of the findings by clarifying whether the identified firm-level and institutional determinants of export performance are country-specific or reflect broader structural patterns within emerging pharmaceutical sectors. Incorporating cross-national data would also allow researchers to assess the role of regulatory environments, market scale, and integration into global value chains in shaping export behavior across comparable economies. Also, Future research should employ longitudinal designs to reflect the dynamic nature of export intensity, enabling analysis of how determinant factors differ between initial market entry and later expansion stages—an aspect not captured by cross-sectional data.

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Authenticity of the texts, honesty and fidelity has been observed.

CONFLICT OF INTEREST

Author/s confirmed no conflict of interest.