



Effects Of Innovation On Trade: New Empirical Evidence From Vietnam

Nguyen Si Minh Hoang¹, Pham Minh Trang², Do Minh Hoang², and Van-Chung Dong^{4*}

^{1, 2, 3, 4} Department of Economics and Management, International School, Vietnam National University, Hanoi, Vietnam

*Corresponding author: chungdv@vnuis.edu.vn

Abstract

Research purpose:

The purpose of this paper aims to empirically explore the impact of innovation on the trade performance of Vietnamese enterprises.

Research motivation:

Innovation is usually considered as a key factor to support trade performance of firms, especially in driven-exporting countries like Vietnam. Few studies have analyzed in depth the impact of innovation on trade activities in Vietnam.

Research design, approach, and method:

The paper uses a panel probit model using the World Bank Enterprise Surveys for the period between 2005 and 2023. The paper provides the estimated results with separate components of trade and aggregate trade. Besides, alternative innovation measurement is used for estimation to check the sensitivity of outcomes.

Main findings:

The key findings show that process innovation and product innovation are the two main drivers of export and import, followed by foreign direct investment (FDI), sunk costs at custom gates, and firm capacity. However, the single factor is that the firm has no impact on the export probability of the enterprise.

Practical/managerial implications:

Given the empirical findings, the paper provides economic insights to contribute to the design of tools and the creation of appropriate work policies to promote trade performance of enterprises through innovation activities in developing countries.

Keywords: Process innovation, product innovation, trade performance, developing country.

1. INTRODUCTION

Innovation, frequently extolled as the engine of economic development, has increasingly become a scholarly focus over recent decades. It is recognized internationally as of major importance in contributing to the competitiveness and productivity level of a nation. However, the elusive definition of innovation has been a considerable problem for empirical research. It is basically understood but difficult to quantify. Consequently, researchers have often had to fall back on proxy measures (such as patent applications), which many feel are an imperfect solution. An important breakthrough in the area may well have been achieved by such innovation scores that involve a much more comprehensive view of innovative capacity on at least 1 state scale index: there are signs for unusual given new creativity indexes from none other than the World Economic Forum. The wider range of factors in these indexes, from innovation to technology transfer and new businesses across different markets such as startups allow them a deeper benchmarking. Both rich and developing countries' economic conditions have drastically changed as a result of the widespread innovation. Trade is also highly active with the global economy, ranging from imports to exports. And for the same reason, the effects of technical progress, including state legal regulations, have a significant impact on these two activities.

The relationship between innovation and export performance is well-documented. Numerous studies highlight a positive correlation, demonstrating that innovation enables firms to overcome domestic market limitations and capitalize on economies of scale in international markets (Silva et al., 2017). Innovating firms can introduce superior products and processes, allowing them to differentiate themselves and gain a competitive edge globally. However, the nuances of this relationship are complex, influenced by factors such as firm size, industry sector, and regional context. From a theoretical perspective, the resource-based view (RBV) of the firm posits that unique internal resources and capabilities, including innovation, serve as sources of sustainable competitive advantage (Barney, 1991). While the link between innovation and export probability is established, further exploration is needed to identify the specific mechanisms that drive this success, particularly in emerging economies facing resource constraints (Wadho & Chaudhry, 2018).

In contrast, equally important is the role of innovation in import activities. For firms, imports are not merely transactions; they provide access to advanced technologies, specialized materials, and global supply chains that are crucial for enhancing innovation. By importing high-quality goods and services, firms can improve their product offerings and operational efficiencies. This process fosters a competitive environment, compelling domestic firms to innovate and enhance their capabilities, thereby contributing to overall economic growth. The interplay between innovation and imports is particularly relevant for developing nations like Vietnam. As the country integrates into the global economy, imports become vital for accessing the technologies and expertise needed to elevate local industries. However, reliance on imports also poses risks, such as overdependence on foreign supply chains and potential unfair competition. Therefore, it is essential for Vietnam to implement policies that support domestic enterprises, develop human capital, and create a conducive business environment to maximize the benefits of imports while mitigating associated risks. However, the government always tries to call for

and support investment funds so that Vietnam can increasingly advance in the fields of scientific and technological innovation and long-term export of goods. By the way, the subsequent sections of this paper will outline a theoretical framework for analyzing the relationship between innovation activities activity and export probability, present the results of empirical analyses, explore the structure of exports in relation to innovation, and conclude with policy implications.

When comparing the effects of innovation on exports and imports, it becomes clear that both activities are interlinked and mutually reinforcing. Innovation enhances exports by enabling firms to develop competitive products for international markets. Simultaneously, imports play a crucial role in providing the resources and technologies necessary for domestic firms to innovate. This dual relationship underscores the importance of a balanced approach to trade policy that encourages both import and export activities. For nations like the United Kingdom, fostering innovation is crucial for maintaining a robust export position. Research consistently shows a positive correlation between innovation and export success, with studies by Fagerberg (1988) and Greenhalgh (1990) emphasizing that innovation significantly influences export behavior beyond relative prices. Similarly, Germany's success in international markets can be attributed to its strong innovation ecosystem, which supports high-quality manufacturing and export performance. Many empirical studies by Wagner (1996), which catch the **microdata from Slovenia**, have discovered that innovation has a favorable effect on exporting. More recently, research has shown that process innovation, as opposed to product innovation, has a favorable impact on productivity growth. Based on this, Constantini and Melitz (2007) recently developed a model that demonstrates how a company may decide to innovate in advance of trade liberalization in order to “dress up” for future involvement in export markets.

Not only in Europe, but also particularly in the African context, The emergence of global value chains (GVCs) has transformed international trade, allowing firms in developing countries to participate in global markets with limited domestic capabilities. GVCs enable technology transfer from developed to emerging economies, enhancing local innovation capacities and competitiveness (Rodrik, 2018). However, challenges such as infrastructure limitations and institutional weaknesses can impede effective participation in GVCs. Thus, understanding the relationship between innovation and trade in the context of GVCs is essential for firms in developing countries. These conditions are not limited to countries in Europe, America, or Africa—many countries in Asia have similar characteristics. We may mention China, the most populated nation in the world (18% of the total population all the world) and one with a significant landmass, according to the statistics in 2024. China can fully utilize the export and import markets thanks to these accessible benefits, independent of the state of the economy. On the other hand, they were driven primarily by low-cost labor; it has increasingly recognized the importance of innovation as a key driver of long-term competitiveness. The Chinese government has implemented policies to promote innovation, including investments in research and development, technology transfer, and intellectual property protection. As a result, Chinese firms have become more innovative, particularly in sectors such as electronics, automotive, and renewable energy. This shift towards innovation has contributed to China's growing export market share and its emergence as a global manufacturing powerhouse. Beyond firm-specific factors, ownership structures and institutional settings play a critical

role in shaping the innovation-export nexus in emerging markets. The prevalence of state-owned enterprises (SOEs) and foreign-owned enterprises (FOEs) introduces a layer of complexity to the analysis. While previous research has explored the differences in innovation capability between these ownership types (Choi et al., 2011; Jiang et al., 2013; Walheer and He, 2020), the moderating influence of ownership on the innovation-export relationship remains understudied.

Theoretically, we fill in the passage and provide more empirical evidence to show the relationships between innovations and imports and exports. Vietnam is also seen as a typical economic model that emerging nations in comparable circumstances might aspire to and emulate. This paper is divided into five sections. The literature that is pertinent to this investigation is reviewed in Section 2. The data and study technique are described in Section 3. Section 4 summarizes the results and offers a discussion of them. A summary of the research's main conclusions, together with any administrative ramifications, are given in Section 5.

2. LITERATURE REVIEW

Theoretical Framework

The intricate relationship between innovation and both export and import has been a subject of extensive scholarly inquiry, particularly in the context of globalized economies. As businesses strive to gain a competitive edge in international markets, the ability to introduce novel products or processes becomes increasingly paramount. This research delves into the multifaceted interplay between innovation and export probability, drawing upon existing literature to establish a theoretical framework and identify key research questions.

A study by Bernard et al. (2007) highlights a striking correlation of 0.87 between industries with high shares of importing firms and those with substantial exporter presence. Their analysis indicates that a remarkable 79% of importers also participate in exporting activities. This finding suggests that firms engaged in international trade often share key performance characteristics, including higher productivity, larger firm size, and greater capital and skill intensity compared to firms without trading relationships with the global market. However, in this case, we tend to discover small and medium-sized enterprises.

Thoroughly, Bernard et al. (2007) do not differentiate firms into distinct groups based on their trading activities, missing an opportunity to explore how firms that engage in both importing and exporting differ from those that do not. Furthermore, their analysis lacks a focus on how firms within different trading groups perform in terms of growth. To fill this gap, Muuls and Pisu (2009) categorize firms into four distinct trading groups in their study of Belgian firms. They find a positive relationship between labor productivity and importing, indicating that firms that import tend to exhibit higher productivity levels. Similarly, Vogel and Wagner (2010) extend this analysis to German manufacturing firms, confirming the positive link between importing and labor productivity. They investigate the direction of causality in this relationship and provide evidence supporting the self-selection hypothesis, which posits that more productive firms are more likely to engage in importing activities. While these studies contribute valuable insights, they fall short of analyzing the growth potential and technological innovation across different

trading activities. The findings that two-way traders are generally more productive and larger only indirectly suggest their higher growth potential. Building on these concepts, empirical analyses often employ proxies for innovation and technology adoption to assess firm evolution. In addition to these proxies, it is crucial to analyze direct measures of firm evolution, including employment, sales, and productivity growth.

This study aims to fill these gaps by integrating both importing and exporting decisions within a dynamic framework to explain the relationship between firm evolution and trade orientation. By focusing on firms that engage in both activities, We seek to demonstrate how importing and exporting complement each other.

The Resource-based View

Several key factors have been identified as drivers of innovation at the firm level. One crucial determinant is **research and development (R&D) investment**. Firms that allocate substantial resources to R&D are more likely to develop innovative products and processes. Wakelin (1998a) found that R&D spending was a significant predictor of export propensity among UK manufacturing firms. However, other studies have shown that the impact of R&D can vary across industries and regions. Another important driver of innovation is **human capital**. Firms with a skilled workforce are better equipped to develop and implement innovative ideas. Mason and Wagner (1994) emphasized.

The drivers of innovation can also vary across different industries. In technology-intensive industries, such as pharmaceuticals and electronics, R&D investment is often a critical factor in driving innovation. In contrast, industries with a focus on product design and customization may rely more on factors like creativity and market orientation. On the other hand, China, where its innovation-export relationship can be traced back to the Melitz model (2003), which posits that the most productive firms are the ones most likely to become exporters due to their ability to cover higher fixed export costs. The resource-based view further emphasizes the role of firm-specific resources and capabilities, such as innovation, in driving export competitiveness. For example, Huawei, a leading global technology company, has invested heavily in R&D to develop innovative products and services. This has enabled the company to compete effectively in international markets and become a major exporter. As well, firms in more traditional industries, such as textiles and apparel, may face challenges in developing innovative products. These firms may need to focus on other strategies, such as improving production efficiency or finding niche markets, to remain competitive in the global marketplace.

Besides, we also find the key aspects from the **impact of innovation on import**. In the context of the RBV, imports serve as a critical resource that can enhance a firm's innovation capacity. Coe and Helpman (1995) established a link between domestic productivity growth and foreign R&D activities through international trade flows. Their research demonstrates that technology spillovers from advanced countries significantly impact the total factor productivity (TFP) of less developed countries. This relationship underscores how importing advanced technologies can bolster domestic innovation efforts. For instance, firms in developing countries that import high-quality inputs or technologies can

significantly enhance their production capabilities. By integrating these advanced resources, firms can innovate more effectively, develop new products, and improve existing ones. This dynamic illustrates how imports are not merely a means of acquiring goods but also a pathway to enhancing a firm's resource base and competitive position in international markets.

Moreover, this framework provides a useful lens to analyze the experiences of developing countries in the global trade landscape. For example, India has successfully leveraged imports to enhance its technological capabilities. Research by Goldberg et al. (2009) indicates that access to imported intermediate goods has significantly improved new product innovation in India, demonstrating how imports can facilitate local firms' adaptation and growth. Additionally, countries like Brazil and South Africa have also benefited from importing advanced technologies, which have enabled them to upgrade their production processes and enhance their competitiveness in global markets. By utilizing imported resources, these firms can not only improve their productivity but also position themselves as viable competitors in international trade.

The Interplay of Global Value Chains and Innovation

The concept of innovation lies at the heart of the global value chain (GVC) literature, often intertwined with the broader notion of "upgrading." According to Ponte and Ewert (2009) and Lee et al. (2018), upgrading is the process of making improvements to products, functions, and processes within a value chain. The GVCs paradigm is often used to address four main forms of upgrading: product, process, functional, and inter-sectoral or inter-chain (Humphrey & Schmitz, 2002). The more precise division of work is one such channel. Through GVCs, businesses can focus on their core competencies while outsourcing non-core tasks to other companies that possess a competitive edge. Businesses are able to invest in innovative capabilities and resource allocation more effectively thanks to this specialization. A wider range of inputs is available, which acts as a second channel. GVCs give users access to a more extensive selection of high-quality, reasonably cost inputs, which can spur innovation through embodied technology transfer.

Additionally, via education and the transfer of information and technology, GVCs can promote innovation. Supply chain connections foster a more robust exchange of knowledge and potential for knowledge spillover between international companies and domestic suppliers. This can happen through direct information transfer, in-person interactions, or the assimilation of implicit knowledge present in inputs. In order to ensure the smooth integration of components made in various places, lead businesses frequently contribute their own technology, management, and logistics, as Baldwin and Lopez-Gonzalez (2015) emphasize in their discussion of the significance of foreign know-how in GVCs. Even though GVCs have a lot of room for innovation, not all businesses will automatically profit from them, particularly non-lead businesses (Pietrobelli & Rabellotti, 2011). Firms' ability to reap innovation gains is contingent upon various factors, including the national innovation system and the GVC governance model. A functional national innovation system is essential for aggregating global lead enterprises and establishing a conducive atmosphere for the assimilation and fusion of knowledge. According to Lee et

al. (2018), GVC governance types impact knowledge and technology transfer as well as upgrading opportunities by reflecting the power dynamics among value chain actors.

The article "Global Value Chain Participation and Innovation" highlights that Southeast Asian countries like Vietnam and Thailand, similar to African nations, are actively involved in GVCs. Research suggests that GVCs can positively impact innovation, particularly for firms with high-skill relationships and medium capability levels. Studies by Brancati et al., Delera et al., Piermartini and Rubínová, and Tajoli and Felice have explored this connection, finding that GVCs can foster innovation through knowledge sharing and technology adoption.

The role of state ownership

In every country, Governments can play a crucial role in promoting innovation and facilitating both exports and import through a variety of policies. These policies can be broadly categorized into three main areas: R&D support, education and training, and trade policies. The theoretical underpinnings of this analysis draw from various strands of economic literature. Schumpeterian economics emphasizes the role of innovation in driving economic growth through creative destruction. Government policies can foster innovation by providing incentives for research and development (R&D), protecting intellectual property, and creating a conducive business environment. Porter's Five Forces Model highlights the importance of industry structure in determining competitive advantage. Government interventions can influence industry structure by promoting competition, reducing barriers to entry, and supporting domestic firms. In the UK and Germany, this has been achieved through a combination of tax incentives, grants, and subsidies. For example, the UK's Research and Development Tax Credit scheme has been instrumental in supporting innovation activities among firms of all sizes (OECD, 2020). Moreover, governments can invest in education and skills development to equip the workforce with the necessary capabilities for innovation. Both the UK and Germany have placed a strong emphasis on STEM education and lifelong learning. This has helped to create a pipeline of skilled workers and entrepreneurs.

Additionally, a significant discovery is how innovation affects the likelihood of exporting and importing, and innovative businesses are frequently better positioned to compete in global marketplaces. Businesses can get a competitive edge through product innovation, which sets their products apart from rivals' offerings. Process innovation can lower costs and increase efficiency, which increases a company's appeal to international investors. Innovative manufacturing facilities in Germany and the UK are more likely to export and have a higher propensity to export, according to a study by Anderson et al. (2016). The ability of creative businesses to create new goods and procedures that satisfy the demands of international marketplaces is credited by the writers for this. Conversely, trade facilitation policies like tariffs and quotas can give businesses more access to markets. Governments can also help businesses looking to expand internationally by offering export finance, trade missions, and market research. In order to lower trade obstacles, the UK and Germany have both taken the initiative to negotiate trade agreements. For example, the UK enjoys access to a sizable single market as a member of the European Union (EU), while Germany has negotiated multiple bilateral and multilateral trade agreements.

Similar to the UK and Germany, China, one of the Asian countries heavily influenced by the contemporary government system, is evident in the fact that the impact of legal policies on this country is indisputable. The Chinese government has implemented a range of policies to foster a favorable business environment for innovative firms. These policies include tax incentives, subsidies, and preferential access to government contracts. Such measures have provided crucial support to small and medium-sized enterprises (SMEs), which are often the driving force behind innovation. By reducing the financial burden on these firms and providing them with opportunities to showcase their products and services, the government has encouraged entrepreneurship and innovation (Wang and Wu, 2017). However, excessive government intervention can also have negative consequences for export probability.

For example, if government policies lead to a distorted allocation of resources or hinder market competition, it can reduce the competitiveness of Chinese firms in the global marketplace. Additionally, overreliance on government support can make firms less resilient to external shocks, such as trade disputes or economic downturns. Anyway, to ensure sustainable and inclusive growth, the Chinese government must strike a delicate balance between providing support and allowing market forces to operate freely. China, with its miraculous economic growth, has become one of the world's leading economic powers. Meanwhile, Vietnam again showed that quite well in both exports and imports.

Vietnam Case

There have been several studies on Vietnam's trade situation under the rapid change of technology, especially in reports by authors Hue Thi Hoang, Ngan Hoang Vu, Hang Thu Nguyen, Hanh Thi Hai Nguyen and Bao Quoc Ma have shown that innovation has a positive impact on the export of creative and processing enterprises in Vietnam, along with environmental outcomes that have certain impacts on the relationship between innovation and trading through the implementation of advanced statistical models combined with a random-effects probit (RE Probit) regression model to measure the trend, export intensity and export propensity (binary variable). On the other hand, export trends were also found by performing RE Probit in the research paper of Ayllón and Radicic (3).

Nowadays, Vietnam must make more efforts to innovate to catch up with other modern economies. If most of the research available today in Vietnam often focus on the appreciation of the domestic currency or government policies that greatly affect Vietnam's economy, then in this article we will concentrate on how technological innovation impacts on the country's business activities.

The rapid development of technology has been highlighted as an opportunity for the industrial development of enterprises in developing countries in the international market by Mahdiah Mokhtari Moughari and Tugrul U. Daim (2023) and Vietnam is also one of the typical examples. High-tech agriculture in Vietnam is the use of advanced technologies in production to not only improve productivity and product quality but also aim for sustainable development, meet the high demands of society and protect the environment, and according to experts, technological innovation is one of the essential things to realize that desire.

The application of advanced technologies such as biotechnology, greenhouse technology, drip irrigation technology, sensor technology, and automation... helps agricultural products improve quality and lower costs, increase productivity, protect the environment and especially contribute to meeting the high requirements of foreign markets and open up wider trade opportunities. In general, technological innovation brings enormous benefits to the Vietnamese market if exploited properly. Not only that, it is also a stepping stone for processing agriculture to rise to the top of the world in the coming future. In addition, some studies show that innovation more significantly affects the probability of enterprises with business activities and vice versa, enterprises seeking opportunities in foreign markets often decide to improve their innovation capacity to compete better (1), (2). One of the businesses that successfully applies advanced technology in production is Vinamilk. In its strategy to reach the target of 3 billion USD by 2017, the group has focused on improving technology as a top priority. Thanks to the remarkable development and appropriate strategic changes, a production shift here only needs about 80-100 people, reducing the number of workers by 70% compared to it in the past. As a result, the business has been able to reduce costs such as labor or lower price of products and the US Food and Drug Administration has granted Vinamilk a registration number to export goods to the United States - a potential market, but with very strict requirements on quality and food safety.

However, enterprises in Vietnam still face many difficulties when several government policies are issued related to export and import, which in the past can be mentioned as the policy of only exporting certain agricultural products and raw materials to Socialist countries in the years before 1986. At that time, Vietnam allows exports to only a few countries, leading to product output being dependent on a small market. This limited diversity and flexibility hinder domestic companies from competing with foreign firms, compounded by a centralized planning mechanism. Furthermore, Vietnam mainly exports agricultural products and raw materials, which restricts foreign exchange earnings and affects the ability to import and invest in development. By and large, the Vietnamese government needs to introduce appropriate policies to promote the export economy to gain a certain foothold in the international market and support domestic SMEs to fully develop their abilities.

3. METHODOLOGY

3.1. Theoretical background

In exploring the complex relationship between innovation and export-import probability, a comprehensive approach was used. This approach not only synthesizes existing literature but also incorporates empirical data to shed light on innovation dynamics in different economic contexts.

The foundation of this analysis is built on a dataset collected from Innovate Peru, the national innovation agency. This dataset consists of 237 surveys completed by senior managers of small and medium-sized enterprises. These surveys are part of a mandatory online questionnaire that Innovate Peru applies to companies applying for public funds to support innovation projects. The questionnaire was designed based on the Oslo Manual (OECD, 2018), with necessary adaptations from the Bogota Manual (Jaramillo et al., 2001) to address the specific challenges that innovation faces in developing countries. Such

adjustments recognize that Latin American firms often operate in a weakly institutionalized R&D ecosystem, with informal organizational structures for innovation activities and low levels of collaboration between firms. Furthermore, a significant portion of innovation activities in this context tend to focus on technology acquisition rather than the development of original innovations.

To examine unobserved heterogeneity in the sample, the SmartPLS 3 software was utilized, employing the finite mixture PLS method (FIMIX-PLS). The analysis of information criteria did not converge on a consistent number of segments, leading to the conclusion that there is no significant unobserved heterogeneity within the sample. In parallel, the study of the Chinese context is informed by a dataset that spans the period from 2000 to 2007, just before the global financial crisis of 2008–2010, which notably impacted innovation and trade in many Chinese firms. The focus here is on manufacturing firms, which not only actively engage in exporting but are also more likely to produce measurable outputs from their innovative endeavors, such as patents and new products.

The dataset for China comprises 1,754,537 observations from 495,275 firms, sourced from multiple databases to ensure comprehensive coverage and accuracy. The first source is the Annual Survey of Industrial Firms (ASIF), compiled by the National Bureau of Statistics of China (NBS). This extensive database provides detailed firm-level data for non-state-owned enterprises (SOEs) with annual turnover exceeding five million RMB (approximately USD 680,000) and all SOEs across various manufacturing sectors. The ASIF database captures about 90% of total manufacturing output in China, making it a valuable resource for academic research. Additionally, patent data from the China National Intellectual Property Administration (CNIPA) offers insights into innovation outputs, including information on patent applications and grants. This dataset is regarded as the most thorough and systematic source for tracking innovation in China. Furthermore, province-level data on regional economics and innovation was collected from the CEIC database, which has been validated for its reliability in previous studies.

Data cleaning and preparation involved meticulous checks for coding errors, missing values, and organizational changes, as emphasized in the works of Cai and Liu (2009). To maintain the integrity of the dataset, outliers were addressed through winsorizing at the 1% level for all dependent and independent variables. In terms of analytical focus, the dependent variable for the study is export probability, measured as the ratio of exports to total sales. This measure is crucial for understanding how innovation impacts a firm's ability to engage in international markets. The key explanatory variable, innovation outputs, is quantified by the number of patents granted to each firm annually. To ensure robustness in the analysis, innovation outputs are also adjusted by firm size, measured by employment. This approach is supported by the notion that patents represent a tangible output of a firm's technological efforts beyond mere R&D investments.

Moreover, the review incorporates the share of new product sales in total sales as an additional measure of innovation. NPS serves as a valuable indicator because it encompasses both market acceptance of new products and non-patentable innovations. This dual approach allows for a more nuanced understanding of how innovation translates into export capability. To further explore the effects of ownership structures on innovation and export outcomes, two moderators are included in the analysis. State ownership is defined

as the ratio of state-owned paid-in capital to total paid-in capital, while foreign ownership is operationalized as the ratio of paid-in capital owned by foreign investors. The analysis deliberately excludes capital from Hong Kong, Macau, and Taiwan from the foreign ownership calculations, following the methodologies established by previous research.

In the second equation of our bivariate probit model, we explore the determinants of innovation, building on the frameworks established by Aw et al. (2005) and Girma et al. (2007). We assume that the factors influencing innovation are consistent with those affecting exporting behavior. The lagged export status serves as a focal variable, allowing us to evaluate whether exporters are more likely to engage in innovative activities than non-exporters. A positive coefficient on this variable would suggest that exporting contributes to the generation of new knowledge and innovation, highlighting the concept of learning-by-exporting.

It is important to note that our findings differ from previous studies due to our focus on actual innovation outcomes rather than expenditures that may or may not lead to innovation. This distinction is essential, as it allows us to better understand the direct impact of exporting on the innovation process, as opposed to merely assessing investment in potential innovation activities. Given the high degree of serial correlation between export status and innovative activity, it is likely that the error terms of the two equations are correlated. Since both export status and innovation serve as both dependent and explanatory variables, simultaneous estimation of the equations is necessary. Thus, we utilize maximum likelihood estimation techniques to estimate the bivariate probit model, providing a comprehensive understanding of the interdependencies between exporting and innovation.

By employing this robust methodology, our study aims to shed light on the complex relationship between exporting and innovation. The insights gained from this analysis have significant implications for firms seeking to enhance their competitiveness in international markets. Understanding how innovation can drive exporting success, and vice versa, can inform strategic decisions that foster growth and innovation in a globalized economy.

3.2 Empirical specification

For this study, there are two main treatment effects of interest, namely technological innovation and firm export probability and are studied according to the following model:

$$trade_{it} = \beta_0 + \beta_1 innovation_{it} + \beta_2 X + \gamma_t + \gamma_i + \varepsilon_{it}(1)$$

Where, *trade* is a vector of trade components including export, import and two-trade while *trade* presents for each component volume of trade (*export* and *import*) and aggregate trade flows (*two-trade*). The variable *sell abroad will* take the value 1 if the firm has export activities, otherwise 0 and *two-trade* takes value of 1, if the firm simultaneously exports and imports, otherwise 0. In the innovation activities, we concentrate on two main factors: Process innovation (*newprocess*) and Product innovation (*newproduct*). Furthermore, to control a firm's characteristics, we use some control variables including *custom*, *capacity*, *fdi*, *firmage*.

3.3 Data

In this research, we use the firm level data from World Bank Enterprise Surveys (WBES) and in which total operation businesses are divided into three main categories. WBES database is a comprehensive data collection initiative aimed at assessing the business environment in various countries. WBES gathered information directly from private sector firms on key aspects such as operations, performance, challenges, and perceptions of the business climate. The surveys cover topics like infrastructure, finance, regulations, and workforce skills, providing valuable insights for policymakers, researchers, and businesses. Therefore, WBES allows to conduct the interested variables in this study.

The purpose of this study is to examine the impact of innovation on the trade capability of Vietnamese enterprises. This study has two main objectives. The first objective is to examine the relationship between innovation (product innovation, process innovation) and trade abroad capability directly through other variables, while the second objective is to examine the role of R&D in enterprises in the relationship between innovation and sell abroad probability.

Table 3. Summary of Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
export	4,227	266.146	441.994	0	1
import	4,227	261.888	439.714	0	1
twotrade	4,227	123.965	329.581	0	1
newproduct	4,227	232.553	422.509	0	1
newprocess	4,227	245.564	430.472	0	1
RD	4,227	203.927	402.963	0	1
fdi	4,227	123.019	328.498	0	1
firmage	4,227	1.414.005	4.492.293	1	115
custom	4,227	273.717	445.918	0	1
capacity	4,227	5.682.877	384.289	1	150
year	4,227	2012.73	6.826.297	2005	2023

The first major aspect of the data is the variability in trade engagement, specifically in exports and imports. The mean export value is 266.146, with a standard deviation of 441.994, while the mean import value stands at 261.888, with a similar level of variability. These figures suggest that firms in the dataset exhibit a broad range of trade activities, with some heavily involved in both importing and exporting, while others have no trade engagement at all. Such variability can be attributed to several factors. Smaller firms or those operating in industries with less global exposure may not have the resources or market access to engage in international trade. On the other hand, firms with stronger international connections or those in sectors such as manufacturing or technology might be more deeply involved in trade.

Additionally, the variable “twotrade” highlights this phenomenon, with a mean of 123.965, indicating that a subset of firms are actively engaged in both import and export activities.

On the other hand, the mean values for new products and new processes are 232.553 and 245.564, respectively, which underscores the fact that many firms are actively introducing innovations. However, the high standard deviations for both variables (422.509 and 430.472) indicate significant disparities among firms in their innovation capacities. This wide variation in innovation could be linked to differences in firm size, industry, or market conditions. Larger firms, for example, may have more resources to dedicate to research and development (R&D) and are thus able to innovate at a higher rate. The mean R&D investment of 203.927, with a standard deviation of 402.963, further supports the idea that not all firms are investing equally in innovation. Firms that invest more heavily in R&D are likely to introduce more new products and processes, giving them a competitive edge in their respective industries.

In the dataset, the mean FDI value is 123.019, with a high standard deviation of 328.498, suggesting that only a subset of firms are receiving or making significant FDI investments. FDI plays a crucial role in enhancing firms' ability to access new markets, technologies, and resources, which can, in turn, spur innovation and increase capacity for trade. Firms that attract FDI often benefit from the influx of capital, which allows them to scale their operations, invest in new technologies, and compete in international markets. This may also explain why certain firms are more active in both exports and imports, as FDI can provide the financial backing needed for international expansion. Firm age is a variable that exhibits a particularly large range in the dataset, from 1 to 2019 years, with a mean of 1,414.005 and a significant standard deviation of 4,492.293. This suggests that the dataset includes firms at various stages of their lifecycle, from startups to well-established companies. Older firms may benefit from greater experience, customer loyalty, and established market positions, while younger firms might be more agile and better equipped to innovate rapidly. Firms that operate informally may face difficulties in accessing formal financing, attracting foreign investment, or complying with international trade regulations. On the other hand, informality can offer firms flexibility and cost advantages, particularly in emerging markets where regulatory frameworks might be less developed.

4. RESULTS AND DISCUSSION

In Table 1 below, we examine the impact of new product (newproduct) and new process (newprocess) innovations on trade activities, the analysis reveals critical insights into how firms' innovative efforts influence their export and import capacities. Additionally, the study explores other contributing factors, such as customs procedures, foreign direct investment (FDI), firm capacity, and age, offering a well-rounded view of what drives international trade. Through regression analysis across four models, it becomes clear that innovation consistently enhances a firm's likelihood of engaging in international markets. The basic results reveal that innovation significantly enhances a firm's likelihood of engaging in both export and import activities, with particularly strong effects on twotrade.

Table 1: The Basic Result

	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Variables	export	export	export	export	import	import	import	import	twotrade	twotrade	twotrade	twotrade
newproduct	0.140***	0.117***			0.497***	0.480***			0.237***	0.200***		
	(0.053)	(0.056)			(0.052)	(0.055)			(0.060)	(0.066)		
newprocess			0.172***	0.138***			0.328***	0.306***			0.256***	0.223***
			(0.059)	(0.064)			(0.060)	(0.064)			(0.067)	(0.075)
firmage		0.000		0.000		-0.000		-0.000		0.001		0.001
		(0.000)		(0.000)		(0.001)		(0.001)		(0.001)		(0.001)
custom		0.605***		0.604***		0.810***		0.817***		0.781***		0.780***
		(0.049)		(0.049)		(0.049)		(0.049)		(0.059)		(0.059)
capacity		0.008***		0.008***		-0.006***		-0.006***		0.005***		0.005***
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
FDI		0.938***		0.943***		0.770***		0.761***		0.955***		0.962***
		(0.064)		(0.065)		(0.065)		(0.065)		(0.070)		(0.070)
Constant	-0.350***	-1.272***	-0.402***	-1.309***	-0.594***	-0.423***	-0.588***	-0.401***	-0.826***	-1.592***	-0.891***	-1.648***
	(0.044)	(0.073)	(0.055)	(0.080)	(0.045)	(0.070)	(0.056)	(0.077)	(0.049)	(0.091)	(0.062)	(0.099)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	4,227	4,227	4,227	4,227	4,227	4,227	4,227	4,227	4,227	4,227	4,227	4,227
Number of id	3,604	3,604	3,604	3,604	3,604	3,604	3,604	3,604	3,604	3,604	3,604	3,604

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

Source: Authors' estimation.

To begin with, the study underscores the significant role of newproduct innovation in promoting international trade. Specifically, it is shown that introducing new products has a strong and positive effect on a firm's probability of exporting and importing. For instance, the estimated coefficients for

newproduct range from 0.14 to 0.117 (from Export Model 1 and 2 respectively) for exports, while for imports, in Import Model 1, the value is 0.497, indicating a significant positive relationship between importing and the introduction of new products. This finding remains robust in Import Model 2, with a value of 0.480, suggesting that access to foreign technology, materials, and ideas through imports spurs product innovation domestically. Moreover, newprocess innovations also exhibit a positive influence on trade. The coefficients, ranging from 0.172 to 0.138 for exports and 0.328 to 0.306 for imports, demonstrate that process improvements are equally important. Process innovations help firms reduce costs, improve productivity, and enhance product quality, making them more competitive in foreign markets. This is especially relevant for accessing high-demand regions such as Europe, Japan, and the United States, where stringent quality standards must be met. In addition, the study aligns with previous research, such as that by Becker and Egger (2013) and Evangelista and Vezzani (2010), which highlights how product innovation broadens firms' market offerings, facilitates entry into new markets, and boosts sales in existing ones. Similarly, process innovations, as noted by Evangelista and Vezzani (2010) and Lee et al. (2019), allow firms to increase operational efficiency, enhance product quality, and meet the expectations of more discerning markets.

Furthermore, the analysis highlights the critical role of innovation in driving both activities. The findings suggest that firms engaged in double financing are more likely to develop new products and processes. One of the most critical findings in this analysis is the effect of newproduct on trade. Across all four models, the introduction of new products shows a positive and highly significant impact on trade, reinforcing the idea that firms innovating their product offerings are more likely to engage in exports and imports. The coefficient for newproduct is positively shown at 0,237 in Model 1 and 0,200 in Model 2. The significance and consistency across all models suggest that introducing new products is a robust determinant of trade activities. Firms that develop new products are able to differentiate themselves in the marketplace, making them more competitive both domestically and internationally. Similarly, for newprocess variable, the coefficient of 0.256 in Model 3 implies that introducing new process is associated with a 25.6% increase in trade activities (both exports and imports), holding other factors constant. This substantial effect underscores how crucial product innovation is for firms looking to expand into or enhance their presence in international markets. The slightly varying coefficients across models even when controlling for other variables like foreign direct investment (FDI), firm capacity, and customs facilitation, the effect of new products remains strong.

In addition to innovation, several other factors influence international trade. Customs procedures, for instance, have a strong positive impact on trade. The coefficients of 0.781 in Model 1 and 0.780 in Model 4 indicate that streamlined customs processes significantly boost firms' engagement in international trade. Simplified customs procedures make it easier for firms to navigate cross-border transactions, reducing barriers to trade. Another key factor is foreign direct investment (FDI), which also has a substantial positive effect on trade, with coefficients ranging from 0.955 to 0.962 across the models. FDI enables firms to access foreign capital, facilitating their entry into international markets and boosting their trade activities. Conversely, the influence of firm capacity is relatively small, with coefficients of

0.005 across the models. While capacity plays a role, it appears to be less significant compared to innovation and FDI. Firm age, on the other hand, remains insignificant across all models, suggesting that a firm's age does not meaningfully affect its international trade behavior.

Given these findings, several policy implications emerge. First and foremost, the strong and consistent impact of innovation on both exports and imports suggests that governments should prioritize fostering innovation within firms. Encouraging the development of new products and processes can significantly enhance a firm's ability to compete internationally. Governments could support this by reducing barriers to trade, such as lowering tariffs and simplifying customs procedures, while also providing incentives for firms to adopt foreign technologies and innovations. Moreover, the distinct ways in which imports affect product and process innovation suggest that policies should be tailored to specific industries. For instance, encouraging product innovation may be particularly beneficial for consumer-facing sectors, while promoting process innovation could be more valuable for manufacturing and technology-driven industries. Importing advanced machinery and technologies should also be encouraged as it enables firms to enhance their production processes and reduce costs.

Regarding R&D, many firms reported cooperating with industry players, such as consultants, experts, and suppliers. We add a dummy variable to indicate whether or not the company engages in R&D. The model suggests that if the firm's R&D status is not included in the study, the coefficients indicating international exposure may be skewed upward because firms with foreign exposure are more likely to conduct R&D due to their greater levels of efficiency. We use the alternative innovation measurement based on expenditure on research and development (R&D) in Table 2 below:

Table 2: Alternative innovation measurement - expenditure on RD - Export, Import, Twotrade

Models	(1)	(2)	(1)	(2)	(1)	(2)
VARIABLES	export	export	import	import	twotrade	twotrade
RD	0.198***	0.168***	0.515***	0.490***	0.280***	0.219***
	(0.055)	(0.059)	(0.055)	(0.058)	(0.063)	(0.069)
firmage		0.000		-0.000		0.001
		(0.000)		(0.001)		(0.001)
custom		0.605***		0.817***		0.785***
		(0.049)		(0.049)		(0.059)
capacity		0.008***		-0.006***		0.005***

		(0.001)		(0.001)		(0.001)
FDI		0.937***		0.753***		0.950***
		(0.064)		(0.065)		(0.070)
	(0.063)	(0.071)	-0.609***	-0.433***	-0.851***	-1.597***
Constant	-0.378***	-1.297***	(0.046)	(0.071)	(0.051)	(0.091)
	(0.045)	(0.074)	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	yes	yes	yes	yes
Individual fixed	yes	yes	yes	yes	yes	yes
Observations	4,227	4,227	4,227	4,227	4,227	4,227
Number of id	3,604	3,604	3,604	3,604	3,604	3,604

Note: Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Authors' estimation.

Similar to the results drawn from Table 1, Table 2 shows that R&D also has positive impacts on Vietnam's sell abroad. The analysis of regression models consistently shows a strong positive relationship between R&D investments and import activities. In Model 1, the coefficient for R&D is 0.515 (with a standard error of 0.055), indicating that a one-unit increase in R&D spending correlates with a 51.5% increase in imports. This trend is further reinforced in Model 2, where the coefficient is slightly lower at 0.490 (with a standard error of 0.058). Despite the introduction of additional variables, such as firm capacity and foreign direct investment (FDI), R&D remains a significant driver of import behavior. The consistent significance of R&D suggests that firms investing in R&D are more likely to tap into global markets to acquire advanced technologies and specialized materials necessary for innovation. In contrast, the relationship between R&D and export activities, while positive, is not as robust as that observed with imports. In the analyzed data, the coefficients for R&D in relation to export activities are 0.280 in Model 1 and 0.219 in Model 2. These figures indicate that R&D investment positively impacts export performance, but to a lesser degree than imports. The marginal effect of R&D on exports is higher in Model 1, suggesting that under certain conditions, R&D may facilitate stronger export capabilities. This variance may arise from the nature of products being developed—while some innovations are geared towards improving domestic production, others may cater specifically to international markets. While the TwoTrade metric, encompassing both exports and imports, offers a comprehensive view of a firm's trade engagement. The coefficients for R&D in relation to TwoTrade activities echo the patterns observed in both imports and exports. The positive influence of R&D on TwoTrade highlights the interconnectedness of these trade activities. Firms heavily invested in R&D not only enhance their import capabilities by sourcing advanced materials but also position themselves to leverage these innovations for export

opportunities. The data indicates that firms integrating into global trade networks through TwoTrade are more likely to experience growth, productivity gains, and enhanced creativity.

When comparing the effects of R&D on imports, exports, and TwoTrade, the data reveals a clear hierarchy of influence. Imports emerge as the most significantly affected variable, with R&D demonstrating a strong correlation of 0.515 in Model 1. Exports, while still positively impacted, show a lower coefficient of 0.280 in Model 1 and 0.219 in Model 2. TwoTrade, representing the combined effects, illustrates a synergy where R&D investments enhance overall trade engagement. One critical takeaway is the importance of importing advanced technologies and materials for R&D-driven firms. These firms are often reliant on global supply chains to maintain their innovation momentum, reinforcing the notion that R&D is a key enabler of not just import activities but also of competitive positioning in international markets.

Overall, the estimation findings reveal that, despite the firm, industry, and country-level controls, there is a strong positive link between firms' trade orientation and evolution. enterprises that are integrated into global markets expand faster and are more likely to adopt new technology than enterprises that only serve domestic markets.

5. CONCLUSION

In this study, we examine whether companies with foreign exposure expand more quickly than local companies using a comprehensive firm-level dataset from seven different nations. Along with exporting, we also examine the role of imports when studying overseas exposure. Numerous investigations have demonstrated that, particularly when employing the probit model, importers and exporters have evolved in very similar ways. Therefore, a thorough analysis of both activities is necessary to provide a reliable explanation for the relationship between trade and the advancement of innovation.

The relationship between firms' development and trade orientation by categorizing them into three types: two-way traders, solely exporters, and only importers. This classification helps us to determine if ship in or exports are more strongly associated with quicker company growth. To identify growth, we employ a variety of direct and indirect measurements. As direct measures, we consider employment, sales, and productivity growth rates. As indirect measures, consider the innovations that corporations introduce. There is an extensive amount of theoretical and empirical data linking technological advances to company growth. We also demonstrate a high link between these variables in the data. Measuring business evolution with a large number of variables makes the analysis more precise.

Motivated by the analytical framework presented, we estimate a reduced form model that excludes the "firm-size" variables. The findings indicate that globally involved enterprises are larger, more productive, capital intensive, and pay higher wages than solely domestic firms. Two-way traders outperform all other types of organizations in terms of growth and innovation. They are followed exclusively by exporters. This study demonstrates that not only are all firms diverse, but so are exporters, with the greatest performers importing intermediate products. Two dimensions of trading complement each other. Two-way traders and solely exporters are ranked higher in terms of performance than only importers. Besides,

the study also discovered a link between state ownership and export development, which is significant given the relatively high innovation tendencies in those developing countries. Firms with some amount of governmental ownership expand faster than domestic firms. However, they are no more innovative than domestic enterprises. This finding indicates that enterprises with foreign ownership use technology that is closer to the frontier, and hence have less incentive to develop in order to thrive. In terms of other factors of relevance, R&D and training are positively and strongly associated with growth and innovation.

In fact, to ensure the findings' robustness, an additional firm characteristics as control variables, such as firmage, custom, a more detailed FDI variable, capacity utilization, and membership in a multi-plant firm are generated, which are likely to be correlated with the firm's growth, innovation, and trade orientation. By generating those tables of Alternative innovation measurement - expenditure on R&D on exporting, importing, and two-way trading, I also include factors to adjust for the firm's market rivalry. The positive association between trade and growth is unaffected by these extra restrictions. I further test the findings using a panel dataset created from the original dataset. Evidence from the panel data supports the main estimation results.

To conclude, owing to the small panel dataset, interpreting the relationships as causal is difficult. Nonetheless, the considerable association discovered between direct and indirect measures of firm evolution and trade under a variety of control factors highlights the significance of this interaction. The implications for trade policy are enormous. Reforms that increase enterprises' global participation in both importing and exporting are likely to result in more jobs being generated. Developing nations may be able to attain long-term growth through increased and expanded trade.

6. REFERENCES

- Golovko, E. and Valentini, G., 2011. Exploring the complementarity between innovation and export for SMEs' growth. *Journal of international business Studies*, 42, pp.362-380.
- Wadho, W. and Chaudhry, A., 2018. Innovation and firm performance in developing countries: The case of Pakistani textile and apparel manufacturers. *Research Policy*, 47(7), pp.1283-1294.
- Ayllón, S. and Radicic, D., 2019. Product innovation, process innovation and export propensity: Persistence, complementarities and feedback effects in Spanish firms. *Applied Economics*, 51(33), pp.3650-3664.
- Palangkaraya, A., 2012. The link between innovation and export: Evidence from Australia's small and medium enterprises. *ERIA Discussion Paper*, 8.
- Ortigueira-Sánchez, L.C., Welsh, D.H. and Stein, W.C., 2022. Innovation drivers for export performance. *Sustainable Technology and Entrepreneurship*, 1 (2), 100013.
- Wakelin, K., 1998. Innovation and export behavior at the firm level. *Research policy*, 26(7-8), pp.829-841.

- Dong, G., Kokko, A. and Zhou, H., 2022. Innovation and export performance of emerging market enterprises: The roles of state and foreign ownership in China. *International Business Review*, 31(6), p.102025.
- Roper, S. and Love, J.H., 2002. Innovation and export performance: evidence from the UK and German manufacturing plants. *Research policy*, 31(7), pp.1087-1102.
- Damijan, J.P., Kostevc, Č. and Polanec, S., 2008. From innovation to exporting or vice versa? Causal link between innovation activity and exporting in Slovenian microdata. *Causal Link between Innovation Activity and Exporting in Slovenian Microdata*.
- Şeker, M., 2012. Importing, exporting, and innovation in developing countries. *Review of International Economics*, 20(2), pp.299-314.
- Palangkaraya, A., 2012. The link between innovation and export: Evidence from Australia's small and medium enterprises. *ERIA Discussion Paper*, 8.
- Liberto, D., Kindness, D., & Reeves, M. (2022). Who Was Joseph Schumpeter, and What Was He Known For
- Cooper, R. G. (2005). *Product innovation* (pp. 120-156). Basic books
- Yoon, S., & Mormont, M. (2023). What makes China's innovation ecosystem unique
- Durham, N. C. The Battle for Chips Semiconductors Crucial Role in AI Development and its Implications for US-China Strategic Competition.
- Hakimi, A., Hamdi, H., & Inglesi-Lotz, R. (2024). To innovate or to import innovation? Evidence from African countries. *Regional Science Policy & Practice*, 16(3), 12594.
- Niu, P., Yang, Y., & Sun, L. (2023). High quality imports and green innovation. *Innovation and Green Development*, 2(2), 100049.
- Wang, K., & Tao, W. (2019). Exploring the complementarity between product exports and foreign technology imports for innovation in emerging economic firms. *European Journal of Marketing*, 53(2), 224-256.
- Sandu, S., & Ciocanel, B. (2014). Impact of R&D and innovation on high-tech export. *Procedia Economics and finance*, 15, 80-90.
- Liu, J. (2014). The impact of innovation on imports. *AEP-80433 [MSc Thesis, Agricultural Economics and Rural Policy]*. Wageningen University.
- Chen, Z., Zhang, J., & Zheng, W. (2017). Import and innovation: Evidence from Chinese firms. *European Economic Review*, 94, 205-220.
- Gao, X. and Dong, Z., 2022. Technological innovation and the complexity of imported technology: Moderating effects based on environmental regulation. *Frontiers in Environmental Science*, 10, p.996867.

Şeker, M., Ulu, M.F. and Rodriguez-Delgado, J.D., 2024. Imported intermediate goods and product innovation. *Journal of International Economics*, 150, p.103927.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

