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Firm innovation strategies and integration into the global value chains: how does the local business environment matter?

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Abstract

This study aims to reveal how different innovation strategies affect firms' modes of integration into the global value chains (GVCs). Utilizing the self-selection hypothesis and applying the panel data analysis of 27,664 observations of firms, which were collected in Vietnam from 2012 to 2018, we find that innovation strategies affect the probability and modes of integration into the GVCs. While the firms that prioritize both product innovation and research and development are more likely to export, those that focus on process improvement tend to sell more to foreign invested buyers. These relationships are influenced by the quality of the local business environment. The improved quality of the local business environment enhances the positive effects of these innovation strategies on firms' integration into the GVCs. This enhancement effect is particularly important for small- and medium-sized firms. These findings suggest that to support firms in Vietnam to integrate into the GVCs, the quality of the local business environment should be improved to complement firms' innovation policies.

Keywords: Firm innovation, GVC integration, Local business environment, Vietnam

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1. Introduction

Integration into the global value chains (GVCs) is a driving force for the higher economic growth of developing countries (Nguyen *et al.*, 2020; Reddy *et al.*, 2021). Therefore, it is important to study the determinants of firms' integration into the GVCs. Previous studies posit that firms' integration into the GVCs is determined by both external and internal factors (Meliz, 2003; Amador and Cabral, 2016; Lu *et al.*, 2018). Among many internal factors, innovation is crucial for firms to participate and upgrade in the GVCs (Reddy *et al.*, 2021).

Extant studies have proven that innovative firms are more likely to self-select to join different modes of the GVCs. Innovation increases the likelihood of exporting (Yang *et al.*, 2004; Caldera, 2010; Monreal *et al.*, 2012) and the likelihood of joining the GVCs by either exporting or importing (Reddy *et al.*, 2021). Firms with innovative activities generate competitive advantages in the international markets (World Trade Organization, 2014; Montalbano *et al.*, 2018; Reddy *et al.*, 2021). In the globalization context, foreign direct investment (FDI) firms play a critical role in economic growth and connect local firms in the host countries with the GVCs. FDI linkages are also taken as a mode of integration into the GVCs (Tong *et al.*, 2019; Kimseng *et al.*, 2020; Dovis and Zaki, 2020). Indeed, each innovation strategy of firms may affect their modes of integration into the GVCs differently. Thus, understanding how the innovation strategies of firms affect different modes of integration into the GVCs is important.

In the relationship between innovation and firms' integration into the GVCs, business environment plays an essential role. Firstly, it can support firm engagement in innovation activities (OECD, 2004). Secondly, the local business environment may also influence firms' decisions to join international networks (Berman and Hericourt, 2010; Commander and Svejnar, 2011). Thirdly, the local business environment has moderating effects on the relationship between different innovation strategies and modes of firms' integration into the GVCs, which is not well known in the literature. Our study aims at filling this research gap.

The development of Vietnam's economy is an ideal empirical context to test the role of the business environment in the relationship between firms' innovation and their integration into the GVCs. Local firms have sought to participate and upgrade in the GVCs through export and linkages with FDI firms (Nguyen *et al.*, 2008; Hoang and Pham, 2010; Tong *et al.*, 2019). While encouraging innovative activities of firms is a big concern of the government, understanding the relationship between different innovation strategies and modes of integration into the GVCs is important for the public sector to support firms' innovation more properly. As institutional reform has been a government priority at both the national and sub-national levels in Vietnam (Tran, 2019), it allows us to investigate how firms' innovation affects their integration into the GVCs in different business environment settings.

We aim to uncover how different innovation strategies of firms affect their modes of integration into the GVCs. Employing the longitudinal data from annual surveys of manufacturing firms in Vietnam from 2012 to 2018, we find that firms are more likely to export when they have new products and conduct research and development (R&D). Firms

with a process improvement strategy tend to have more linkages with FDI customers than their counterparts. Noticeably, we discover that the positive impacts of innovation strategies on the firms' integration into the GVCs are significantly enhanced in a favorable business environment. This moderating role of the local business environment is especially crucial for small- and medium-sized firms. Therefore, this study provides the public sector in transition economies with empirical evidence to make appropriate policies to promote the integration of firms into the GVCs through upgrading their innovative capacities and improving the quality of the local business environment.

The remainder of this paper consists of four sections. Section 2 reviews the literature on the relationship between innovation, business environment, and firms' integration into the GVCs. Section 3 presents the methodology and data. The results are given in section 4. Finally, section 5 concludes the paper.

2. Literature review

2.1 A theoretical framework for integration of firms into the GVCs

Integration of firms into the GVCs is viewed as a means for higher economic growth in developing countries (Reddy *et al.*, 2021). The literature on firms' integration into the GVCs has experienced rapid expansion. Existing studies have uncovered that firms' integration into the GVCs is determined by various factors. Innovation has been viewed as an important element to encourage firms to integrate into different modes of the GVCs.

There is a consensus in the literature that innovative firms are more likely to self-select to join international networks. It is argued that the level of competition in international markets is more intense and with higher requirements than in local markets. Therefore, only qualified firms can overcome the barriers to entry (Monreal *et al.*, 2012). Innovation is considered a key driver for firms to penetrate international markets because they can reduce costs and differentiate their products (Guan and Ma, 2003; Tavassoli, 2018; Reddy *et al.*, 2021). Moreover, firms with higher innovation capacity can meet stricter international standards of foreign partners and survive in more competitive international markets (World Trade Organization, 2014; Montalbano *et al.*, 2018; Reddy *et al.*, 2021).

The literature on the relationship between innovation and firms' GVC integration has also distinguished different strategies of innovation and discovered that each strategy differently impacts the propensity to join international markets of firms. Edeh *et al.* (2020) study the case of Nigerian firms to investigate how firms' export performance is influenced by three strategies of innovation, namely product innovation, process innovation, and marketing innovation. The findings indicate that product innovation has a negative impact on the export performance of firms, whereas marketing innovation and process innovation are more likely to increase the export propensity of firms. These results are different from the findings of Rialp-Criado and Komochkova (2017) in the case of China where all three variables of innovation, namely R&D, product innovation, and process innovation, are found to have negative impacts on the degree of export internationalization of Chinese SMEs.

Although the topic of the relationship between firms' innovation and participation in the international market is not new, existing studies mostly focus on export activities. Studies on other modes of integration into the GVCs are limited (Yang *et al.*, 2004; Caldera, 2010; Monreal *et al.*, 2012; Barrios *et al.*, 2003). Reddy *et al.* (2021) are among a few who show that product innovation, process innovation, and R&D positively affect firms' integration into the GVCs.

Existing studies offer different definitions of a firm having integration into the GVCs. They are mainly defined as the firms that participate in international trade, which are either exporters or importers (Del Prete *et al.*, 2018; Reddy *et al.*, 2021) or both importers and exporters (Urata and Baek, 2020; Baldwin and Lopez-Gonzalez, 2015). Reddy *et al.* (2021) describe these firms as international traders with an internationally recognized quality certificate.

In the context of integration and the prominent presence of FDI firms, these definitions may be insufficient. Domestic firms can be a part of the GVCs by exporting or importing. They can also join the GVCs by selling intermediate goods to the FDI buyers or buying inputs from the FDI sellers (Kimseng *et al.*, 2020; Dovis and Zaki, 2020). For the host countries, FDI linkages can be important channels for domestic firms to join the GVCs. Thus, excluding this mode in the studies on the integration into the GVCs is a shortcoming. In this study, we follow Kimseng *et al.* (2020) in defining a GVC firm. Accordingly, a GVC firm is those that either export, import, or link with FDI partners.

In Vietnam, the forward GVC participation of firms has played an essential role in economic growth (Nguyen *et al.*, 2008; Hoang and Pham, 2010; Tong *et al.*, 2019). Scholars have paid particular attention to the relationship between the participation of firms in the forward GVCs linkages and firm performance. While the impact of export and FDI forward linkages on firm performance has been extensively examined, little is known about the reverse direction of this relationship. Much more limited evidence is found on the impact of firms' innovation and integration into the GVCs. Nguyen *et al.* (2008) are among the few who stress the positive impact of innovative activities on the export behavior of firms in Vietnam. Nevertheless, studies on other modes of integration into the GVCs are limited. There has been no study that compares how different innovation strategies affect the modes of integration into the GVCs by firms in Vietnam.

2.2 Effects of the quality of the local business environment

The literature has emphasized the critical role of a favorable business environment in firm performance. Scholars agree that a favorable institutional framework positively impacts firm productivity (Isaksson, 2007; Goedhuys *et al.*, 2008; Roxas *et al.*, 2012) and innovation outputs (Krammer, 2009; Gogokhia and Berulave, 2020). A higher-quality business environment can lessen transaction costs, leading to improved firm productivity (North, 1990) and firm engagement in innovation activities (OECD, 2004). A good institution also supports capital formation and incentives for firms to acquire new technologies (Isaksson, 2007).

The role of business environment in determining the participation of firms in the GVCs has also been widely examined. Some studies have proven that an adverse business environment

can deter firms from exporting their goods to the international market (Berman and Héricourt, 2010; Commander and Svejnar, 2011). Analyzing the relationship between business environment and GVC participation of firms, DAVIS and Zaki (2020) find that a favorable business environment has a positive impact on the GVC participation of firms in the Middle East, North Africa, and East Asia and the Pacific.

Even though the existing studies have a consensus on the positive impact of innovation on firms' integration into the GVCs, how this relationship varies in different business environments is still an open question. The business environment plays a role as a background for firms to operate (North, 1990). Therefore, the impact of innovation on firms' integration into the GVCs and the integration modes may vary among different business environments. Rialp-Criado and Komochkova (2017) are among the few who uncover that a favorable business environment can enhance the positive impact of innovation on the export intensity of Chinese firms. Nevertheless, the study has not provided insights into the impact on other modes of GVC participation. Understanding how different innovation strategies impact different modes of GVC participation and the role of the business environment in this relationship can help the public sector formulate policies to encourage firms in developing countries to integrate into the GVCs.

The recent development of Vietnam provides an ideal empirical context for the study of the effect of innovation strategies on firms' integration into the GVCs in various business environments. Export and selling to FDI customers are considered two important modes of GVC participation that significantly impact Vietnam firms' growth (Nguyen *et al.*, 2008; Hoang and Pham, 2010; Tong *et al.*, 2019). Together with internationalization, the policies to encourage innovation are also one of the government's priorities to improve the competitiveness of Vietnamese firms (Nguyen *et al.*, 2008). Comparing the impact of different innovation strategies on two modes of integration into the GVCs, i.e., export and selling to FDI customers, contributes to the literature on innovation and GVC integration and informs policymakers to formulate appropriate policies to support firms. Improvement of the institutional environment has also been a big concern of the government for the last two decades to empower the operation of firms (Tran, 2019). Institutional reforms occur at the national level and sub-national levels, leading to competition in institutional improvement among provinces. The variety of institutional quality at the local level of Vietnam allows us to compare how innovation affects firm GVC integration in different business environments. This comparison may help policymakers empower firms in the process of integration into the GVCs via innovation.

3. Methodology and data

3.1 Methodology

To investigate the impact of a firm's innovation strategies and the local business environment on the likelihood of firm-level integration into the GVCs with the dichotomous nature of dependent variables leads us to use binary choice models.

The empirical evidence also suggests the persistence in a firm's behavior where prior GVC participation experiences may influence the current GVC participation of the firm (Caldera, 2010; Reddy *et al.*, 2021). This phenomenon is widely perceived as a result of the sunk costs of exporting the learning-by-exporting mechanism. Indeed, entering foreign markets require firms to invest intensively in production and market adaptation activities such as market research, distribution channels, negotiating with potential new partners, and product customization (Helpman *et al.*, 2004; Love and Ganotakis, 2013). These sunk costs lead to the persistence in overseas markets of larger and more productive firms, which are in a better position to incur sunk costs of entry. Exporting allows firms to reach and absorb new sources of market knowledge and new technologies, which induces future productivity improvement (Wagner, 2007, 2012; Andersson and Loof, 2009). The learning effect arising from a firm's previous exporting experience is, thus, argued as a source of export persistence.

To reflect this dynamic nature of the analysis, we use a dynamic random effects panel probit model. The empirical specification is as follows:

$$Pr(GVC_{ijt}=1) = \Phi(\beta_0 + \beta_1 GVC_{(i,j,t-1)} + \beta_2 INNOVATION_{ijt} + \beta_3 Z + \beta_4 \ln PCI_{jt} + \alpha_i + \varepsilon_{ijt}) \quad (1)$$

where GVC_{ijt} is a vector of firm i from province j 's participation in GVCs at time t ; $INNOVATION_{ijt}$ represents firm j 's innovation strategy at time t ; $\ln PCI_{jt}$ indicates the quality of the business environment in province j at time t ; Z is the vector of control variables controlling for firms' heterogeneity. We also include dummies for sectors and years to account for industry effects and business cycle effects, respectively; α_i captures the unobservable differences among the firms; and ε_{ijt} is the error term.

Estimation of Equation (1) is subject to the initial conditions problem as described by Heckman (1981), where GVC_{ij0} is likely to be correlated with firms' unobserved heterogeneity affecting GVC_{ijt} . One approach to address this issue in non-linear models is to model the distribution of the random effect conditional on the initial condition and the other explanatory variables as proposed by Wooldridge (2005). While Wooldridge's model is simple, yet parsimonious, its constrained version which includes within-means of the time-varying explanatory variables (including the first period), has been discussed to perform poorly for short panels (Rabe-Hesketh and Skrondal, 2014). Facing this challenge of estimation bias, we adopt Rabe-Hesketh and Skrondal's proposition (2014), which is an augmenting version of Wooldridge's approach, by adding the initial-period explanatory variables as additional regressors. As such, the issue of unobserved heterogeneity is addressed by the inclusion of the initial period of the response variable (GVC_{ij0}), the initial period of the time-varying explanatory variables, and within-unit averages of the time-varying explanatory variables (Grotti and Cutuli, 2018).

In this paper, we measure firms' integration into the GVCs based on their forward linkages (WTO, 2019). Firms can involve in the GVCs either directly by exporting their products or indirectly by selling their products to foreign-invested firms (FDI firms) operating in Vietnam. Thus, we identify three different dependent variables including: $export_{ijt}$, which is equal to 1

if a firm exports, and 0 otherwise at time t ; Sell to FDI_{ijt} , which is equal to 1 if a firm sells its products to FDI firms, and 0 otherwise; $GVC_forward_{ijt}$, which is equal to 1 if a firm joins the GVCs either by exporting or selling its products to FDI firms, and 0 otherwise.

We use a set of dummy variables to study different innovative strategies followed by firms, including introducing new products, quality improvement, process improvement, and research and development (R&D). The coefficient of interest β_1 indicates whether innovation strategy has a significant impact on firms' integration into the GVCs.

Z is the vector of control variables that includes variables controlling for firms' heterogeneity, i.e., firm size, firm age, capital intensity, ownership status, technology intensity, as well as dummies for sectors and years.

We measured firm size by the total number of employees. Following the Decree 39/2018/ND-CP guiding the Law on Support for Small and Medium Enterprises, the dummy SME takes the value of 1 if a firm has up to 200 employees and 0 if it has more than 200 employees. Firm age is measured as the natural logarithm of the number of years that a firm has been operating (firm age). Previous empirical evidence led us to expect larger firms to have a higher probability to engage in the GVCs (Banga, 2019; Urata and Baek, 2020).

As suggested by Golovko and Valentini (2011), a firm's capital intensity can also affect export positively. In this study, firms' capital intensity is equal to a firm's capital per employee.

The trade literature also points out that foreign-owned firms have better access to resources, knowledge, and technology, and hence are more likely to participate in the GVCs (Rigo 2017; Qiang *et al.*, 2021). This is particularly relevant in the case of Vietnam where the FDI firms contribute up to 67.8% of the total export turnover in 2019 (General Statistics Office of Vietnam, 2020). Much less presence than the FDI firms in terms of the total number, the state-owned enterprises (SOEs), in which the state owns more than 50% of the charter capital, possess considerable advantages ranging from large-scale fixed assets to state-related privileges (Fujita, 2017). The advantages facilitate access to the international market. We, thus, include three dummy variables to control for a firm's ownership status: foreign takes the value of 1 if a firm is 100% owned by a foreign investor or a joint venture with foreign partners, and 0 otherwise; soe takes the value of 1 if a firm is state-owned, and 0 otherwise; and state invest takes the value of 1 if a firm is state-invested, i.e., the state capital accounts for up to 50 percent, and 0 otherwise.

In line with the previous study, we control for the heterogeneity in technological intensity, which may shape firms' integration into the GVCs and innovation behavior across industries (Wang and Tsai, 2003; Bontadini *et al.*, 2022). The industry's technological intensity is evaluated using the classification of manufacturing industries based on technology intensity proposed by the Vietnam Ministry of Planning and Investment (MPI) and the United Nations Industrial Development Organization (UNIDO) which is based on OECD's classification (OECD, 2005). Specifically, we control for the industry's technological intensity by employing dummy variables (medium tech, high tech), which indicate whether a firm belongs to high-technology industries, medium-high-technology industries, or low-technology industries.

Along with firms' internal factors, the external business environment is proven to be a driver of firms' integration into the GVCs (Cusolito *et al.*, 2016; Hong *et al.*, 2020; Dosis and Zaki, 2020). In this study, the quality of the local business environment is measured using the Provincial Competitiveness Index (PCI), which is offered by the United States Agency for International Development (USAID) and the Vietnam Chamber of Commerce and Industry (VCCI). PCI is a composite index evaluating diversified aspects of economic governance among 63 provinces in Vietnam. The higher value of PCI reflects better experiences of private and foreign businesses with local institutions, administrative procedures, and infrastructure in the localities where they operate. The natural logarithm of PCI value ($\ln PCI_{ijt}$) is thus included to capture the effects of the local business environment quality on the firm's GVC integration.

A detailed description of the variable measurement is presented in Table 1.

Table 1. Description of variables

Variable	Short description	Detailed description
Export	Export propensity	1: Have exported; 0: Otherwise
Sell to FDI	Sell to FDI customers	1: Have sold products to foreign-invested customers; 0: Otherwise
GVC forward	GVC forward linkage	1: Either exporting or selling to FDI customers; 0: Neither exporting nor selling to FDI partners
New product	New product strategy	1: Following the strategy of new product; 0: Otherwise
Quality improve	Quality improvement strategy	1: Following the strategy of quality improvement; 0: Otherwise
Process improve	Process improvement strategy	1: Following the strategy of process improvement; 0: Otherwise
RD	R&D dummy	1: Having R&D activity; 0: Otherwise
SME	SME dummy	1: Having up to 200 employees; 0: Otherwise
Firm age	Firm age	Natural logarithm of number of years that a firm has been operating
Capital intensity	Capital intensity	Natural logarithm of the ratio of capital to labor
Foreign	Foreign ownership	1: Firm with 100% foreign capital or joint venture with foreign partners; 0: Otherwise
SOE	State-owned firms	1: Firm with over 50% state-owned capital; 0: Otherwise
State invest	State-invested firms	1: State capital accounting for up to 50%; 0: Otherwise

Table 1. Description of variables (*continued*)

Variable	Short description	Detailed description
Medium tech	Medium-technology industries	1: Belonging to medium-high-technology industries; 0: Otherwise
High tech	High-technology industries	1: Belonging to high-technology industries; 0: otherwise
lnPCI	Local business environment	Natural logarithm of the composite PCI index

Source: Authors' compilation

We also re-estimate the model with sub-samples of the enterprises of different sizes and operating under different conditions of the local business environment. The subsets are specified using the Provincial Competitiveness Index (PCI) rank which varies from the first, which represents the highest quality, to the 63rd, which is the lowest quality. In this study, the province with PCI rank between 1 and 30 is classified as having a relatively better business environment and vice versa. Regarding firm size, two sub-samples include SMEs with up to 200 employees and large firms with more than 200 employees.

3.2 Data and qualitative analysis

The data on the characteristics of firms are extracted from the Vietnam Annual Enterprises Surveys from 2012 to 2018. This dataset provides information on firm age, firm size, type of ownership, and sectors where firms operate. We combine this database with the information on the FDI linkages, exports, and innovation strategies of firms that are withdrawn from the Vietnam Technology and Competitiveness Surveys within the same period. Both datasets are implemented by the General Statistics Office of Vietnam (GSO). We use tax codes of firms to merge and generate a complete database on firm characteristics, forward GVC integration, and innovation activities of Vietnamese enterprises.

The measurement of the quality of the local business environment is obtained from the PCI surveys. Ten sub-indices were combined to generate the PCI composite index, covering an array of local business environment dimensions. The composite PCI index covers various aspects, including entry cost, land access, transparency, time costs of regulatory compliance, informal charges, proactivity of provincial leadership, policy bias, business support services, labor training, and legal institutions. The business environment quality of 63 provinces is ranked from the 1st for the best to the 63rd for the poorest, using the composite index. We use these ranks of the provincial business environment to classify the sample into two groups of higher-quality and lower-quality local business environments. We use the province codes to merge the PCI ranks with the datasets mentioned above to have the final database containing 27,664 observations. Table 2 presents the statistical summary of variables. It is noted that the usage of lagged values in the dynamic probit model reduces the number of observations to 27,664 in regressions.

Table 2. Statistic summary

Variable	Obs	Mean	Std. Dev.	Min	Max
Export	37,768	0.41	0.49	0	1
Sell to FDI	37,768	0.26	0.44	0	1
GVC forward	37,768	0.53	0.50	0	1
New product	37,768	0.40	0.49	0	1
Quality improve	37,768	0.75	0.43	0	1
Process improve	37,768	0.67	0.47	0	1
RD	37,767	0.06	0.24	0	1
SME	37,766	0.67	0.47	0	1
Firm age	37,581	2.35	0.51	0	4.29
Capital intensity	37,755	6.12	1.21	0.06	13.36
Foreign	37,768	0.28	0.45	0	1
SOE	37,768	0.01	0.07	0	1
State invest	37,768	0.41	0.49	0	1
Medium tech	37,768	0.30	0.46	0	1
High_tech	37,768	0.18	0.39	0	1
lnPCI	37,768	4.10	0.06	3.81	4.26

Source: Authors' calculation

As a preliminary analysis, we would test the equality of the proportion of firms engaging into GVCs in the two groups of innovative and non-innovative firms. The two-sample test of proportion was performed to compare the proportions of firms engaging in GVCs between groups of firms adopting innovation strategies (innovative firms) and the group of firms which do not follow innovation strategies (non-innovative firms).

We have found statistical evidence to reject the null hypothesis H_0 that the difference between the proportions is zero². Specifically, firms that do not engage in new product strategy have a statistically significantly lower proportion of export (0.398) than firms that adopt a new product strategy ($z = -8.61$; $p = 0.0$). Similarly, firms that do not follow a process improvement strategy have a statistically significantly lower proportion of export (0.382) than firms that adopting a new product strategy ($z = -9.4$; $p = 0.0$). Firms that have R&D activities have statistically significantly higher proportion of export (0.507) than firms that do not have R&D activities ($z = -8.94$; $p = 0.0$). In contrast, firms that engage in quality improvement strategy have a statistically significantly lower proportion of export (0.41) than firms that adopting a quality improvement strategy ($z = -5.39$; $p = 0.0$).

² The null hypothesis is $H_0: \text{diff} = \text{prop}(0) - \text{prop}(1) = 0$ where $\text{prop}(0)$ denotes the proportion in group of non-innovative firms and $\text{prop}(1)$ presents the proportion in group of innovative firms. The results of all two-sample test of proportion are available upon request.

Regarding the GVC integration in form of selling to FDI firms, the group of firms that do not follow the new product strategy has statistically significantly lower proportion of seller to FDI (0.253) than the group firms that adopting a new product strategy ($z = -6.25$; $p = 0.0$). Firms that do not follow a process improvement strategy have a statistically significant lower proportion of selling to FDI firms (0.251) than firms that adopt a new product strategy ($z = -4.32$; $p = 0.0$). Firms that have R&D activities have a statistically significant higher proportion of selling to FDI firms (0.311) than firms that do not have R&D activities ($z = -5.05$; $p = 0.0$). However, in the case of quality improvement strategy, we do not find statistical evidence to reject the null hypothesis of H_0 .

Using the complex index of GVC integration (GVC forward), the results of two-sample test of proportion remains consistent as above. These results provide basic and positive evidence that firms pursuing an innovation strategy are more likely to engage in GVCs. However, the statistical test does not take into consideration the panel structure of the data as well as the persistence in the firm's behavior. A more rigorous assessment of this relationship using a dynamic random effect probit model will be presented in the following section.

4. Empirical results

4.1 Firm innovation strategies and integration into the GVCs

Table 3 presents the regression results on how firm innovation strategies affect its likelihood of export. The results presented in Column (1) show that firms following the new product strategy are more likely to export their products to foreign markets. Similarly, quality improvement and process improvement strategies increase the probability of exporting. Firms with a quality improvement strategy are more likely to export, while the likelihood of exports increases when firms implement the strategy of process improvement. The strategy of R&D has the most substantial influence on firms' export behavior when the result confirms that the firms having R&D activity has higher probability to export their products than those without an R&D strategy. Overall, this finding is consistent with the previous studies about the positive impact of innovation on the export propensity of firms (Lachenmaier and Woessmann, 2006; Nguyen *et al.*, 2008; D'Angelo, 2012; Uyar and Oralhan, 2017). Firms can increase their efficiency and generate competitive advantages in foreign markets with fiercer competition than in domestic markets when following innovation strategies. The process improvement strategy is a way to reduce production costs, improve productivity and help firms to compete in foreign markets. Cassiman and Martínez-Ros (2007) suggest that Vietnam is still a small and developing market where the customers' demand has not been well developed with differences compared to international markets. The strategies of new products or R&D may be necessary for firms to develop novel products when penetrating foreign markets. It may explain why the impacts of new product strategy and R&D on the export propensity are substantially large. Similarly, the positive effect of a quality improvement strategy on the export behavior of firms can also explain by the fact that the international markets may have higher requirements for product quality. Thus, a quality improvement strategy is vital for firms to fit their needs and penetrate foreign markets.

Table 3. Impact of different innovation strategies on export propensity of firms

	Export (1)	Export (2)	Export (3)	Export (4)
SME	-0.196*	-0.195*	-0.196*	-0.194*
	(-1.67)	(-1.66)	(-1.67)	(-1.66)
Capital intensity	-0.0590	-0.0584	-0.0610	-0.0632
	(-1.51)	(-1.49)	(-1.56)	(-1.61)
Firm age	0.0925	0.0935	0.0947	0.0933
	(1.09)	(1.09)	(1.11)	(1.09)
Foreign	1.086***	1.097***	1.086***	1.105***
	(14.59)	(14.57)	(14.57)	(14.72)
SOE	0.142	0.151	0.142	0.0798
	(0.52)	(0.56)	(0.53)	(0.30)
State invest	0.259***	0.266***	0.260***	0.263***
	(4.78)	(4.88)	(4.80)	(4.82)
High tech	-0.975***	-0.974***	-0.974***	-0.991***
	(-6.12)	(-6.08)	(-6.11)	(-6.06)
Medium tech	-0.759***	-0.768***	-0.769***	-0.758***
	(-3.67)	(-3.70)	(-3.72)	(-3.60)
lnPCI	1.149**	1.195**	1.171**	1.147**
	(2.27)	(2.34)	(2.31)	(2.25)
New product	0.106***			
	(2.59)			
Quality improve		0.136***		
		(2.86)		
Process improve			0.0882**	
			(2.09)	
RD				0.394***
				(4.57)
Export_{t-1}	1.668***	1.661***	1.663***	1.663***
	(26.85)	(26.76)	(26.84)	(26.82)
Export₀	2.091***	2.125***	2.099***	2.112***
	(16.93)	(16.93)	(16.96)	(17.02)
i.industry_dummy	YES	YES	YES	YES
i.year	YES	YES	YES	YES
Observations	27664	27664	27664	27664

Notes: z statistics are in parentheses; *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Source: Authors' calculation

The estimation results of other variables in Table 3 indicate that firm size significantly impacts the export likelihood of firms. Accordingly, large firms are more likely to export their goods than SMEs. This finding is in line with the previous studies (Monreal *et al.*, 2012; Vinh and Duong, 2020). Perhaps, large firms with richer resources can easily overcome the export barriers. The results show that foreign firms and firms accounting for up to 50% of state capital are more likely to export their goods than privately-owned firms. Meanwhile, firms with over 50% of state capital are indifferent in export propensity compared to the remaining firms. Compared with privately-owned firms, foreign and state-invested firms may have more capacity and resources to overcome entry barriers in the international markets (Rigo, 2017; Fujita, 2017; Vinh and Duong, 2020; Qiang *et al.*, 2021). Nevertheless, firms in the high-tech and medium-tech sectors are less likely to export than others. These findings are consistent with the situation of Vietnam's economy, where it is more likely to export products to low-tech industries or labor-intensive industries (Nguyen *et al.*, 2008). The firm age and capital-to-labor ratio variables show no or inconsistent impact on firms' export activities.

The results indicate that the firms operating in the provinces with high PCI scores, i.e., a higher-quality business environment, are more likely to engage in export activities. These findings are in line with the results of the previous research (Wan and Hoskisson, 2003; He and Lin, 2012; Hernández *et al.*, 2022). The institutional environment is more likely to influence the local access to resources of firms, which can impact the abilities of firms to compete in both local and global markets. More transparent rules and market efficiency also reduce the transaction and agency costs of firms, which encourages them to access foreign markets. Additionally, firms are more likely to boost their efficiency and productivity in a favorable business environment, strengthen their competitive advantages in international markets, and promote exports.

The impact of different innovation strategies on the forward FDI linkages is shown in Table 4. While all innovation strategies positively affect the export propensity of firms, not all strategies affect the likelihood of selling to FDI firms. The firms that follow the strategies of quality improvement or conducting R&D activities are similar to those without these strategies in selling products to FDI firms. Reversely, firms having a process improvement strategy are more likely to have FDI customers. The new product strategy also increases the likelihood of export of firms. The process improvement strategy allows firms to reduce production costs and improve their productivity to meet the high requirement of foreign partners. The most significant positive impact of process improvement may imply that FDI customers tend to find existing qualified products in the domestic market (Tong *et al.*, 2019). This may explain why the strategies of quality improvement, R&D, and new products have no or less impact on the likelihood of selling to the FDI of firms in Vietnam.

Table 4. Impact of different innovation strategies on firms' likelihood of selling to FDI

	Sell to FDI (1)	Sell to FDI (2)	Sell to FDI (3)	Sell to FDI (4)
SME	0.00792 (0.09)	0.00641 (0.07)	0.00625 (0.07)	0.00789 (0.09)
Capital intensity	-0.0843** (-2.49)	-0.0846** (-2.50)	-0.0847** (-2.49)	-0.0853** (-2.52)
Firm age	-0.159*** (-2.65)	-0.159*** (-2.65)	-0.159*** (-2.64)	-0.160*** (-2.66)
Foreign	0.599*** (12.14)	0.598*** (12.10)	0.601*** (12.14)	0.600*** (12.13)
SOE	0.269 (1.29)	0.269 (1.29)	0.265 (1.27)	0.262 (1.26)
State invest	0.0668* (1.65)	0.0677* (1.67)	0.0685* (1.69)	0.0675* (1.67)
High tech	0.268** (2.45)	0.270** (2.47)	0.267** (2.44)	0.266** (2.44)
Medium tech	0.347** (2.52)	0.346** (2.50)	0.343** (2.48)	0.346** (2.50)
lnPCI	0.256 (0.65)	0.272 (0.69)	0.278 (0.70)	0.263 (0.67)
New product	0.0543* (1.75)			
Quality improve		0.0341 (0.98)		
Process improve			0.0877*** (2.71)	
RD				0.0567 (0.89)
Sell to FDI_{t-1}	1.382*** (31.55)	1.382*** (31.55)	1.382*** (31.51)	1.381*** (31.53)
Sell to FDI₀	1.224*** (18.81)	1.223*** (18.81)	1.224*** (18.78)	1.224*** (18.82)
industry_dummy	YES	YES	YES	YES
Year dummy	YES	YES	YES	YES
Observations	27664	27664	27664	27664

Notes: z statistics are in parentheses; *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Source: Authors' calculation

Variables of other firm characteristics show some different patterns in the effects on the FDI linkages compared to export behavior in Table 3. According to, firm size shows no significant relationship with the probability of selling goods to FDI firms. Meanwhile, the results imply that the ratio of capital to labor and firm age negatively affect the FDI linkages of firms. Capital-intensive firms and older firms are less likely to sell their products to FDI partners. Similar to the effect on firm export activities, the findings indicate that foreign firms and state-invested firms are more likely to link with foreign-invested customers. The results indicate the obstacles of privately owned firms in Vietnam in integrating into the GVCs due to their lack of resources and capacities. Interestingly, high-tech and medium-tech firms are more likely to provide goods to FDI partners than low-tech firms. This trend is opposite to the export behavior of firms in Table 3. Regarding the role of the local business environment, it implies that the quality of the local business environment has no impact on the FDI forward linkages of firms.

Table 5. Impact of innovation strategies on firms' integration into the forward GVCs linkages

	GVC_forward (1)	GVC_forward (2)	GVC_forward (3)	GVC_forward (4)
SME	-0.193** (-2.09)	-0.198** (-2.14)	-0.198** (-2.14)	-0.195** (-2.10)
Capital intensity	-0.112*** (-3.65)	-0.113*** (-3.68)	-0.114*** (-3.70)	-0.115*** (-3.74)
Firm age	0.00610 (0.09)	0.00736 (0.11)	0.00811 (0.12)	0.00654 (0.09)
Foreign	1.308*** (19.63)	1.312*** (19.59)	1.312*** (19.64)	1.318*** (19.65)
SOE	0.191 (0.92)	0.194 (0.93)	0.189 (0.91)	0.167 (0.80)
State invest	0.155*** (3.94)	0.158*** (4.00)	0.157*** (3.99)	0.157*** (3.98)
High tech	-0.620*** (-5.29)	-0.617*** (-5.26)	-0.624*** (-5.30)	-0.630*** (-5.32)
Medium tech	-0.335** (-2.16)	-0.340** (-2.18)	-0.345** (-2.22)	-0.336** (-2.15)
lnPCI	0.495 (1.20)	0.515 (1.25)	0.512 (1.24)	0.492 (1.19)
New product	0.0860** (2.57)			
Quality improve		0.0861** (2.27)		

Table 5. Impact of innovation strategies on firms' integration into the forward GVCs linkages (*continued*)

	GVC_forward (1)	GVC_forward (2)	GVC_forward (3)	GVC_forward (4)
Process improve			0.110*** (3.20)	
RD				0.244*** (3.44)
GVC forward_{t-1}	1.365*** (28.92)	1.364*** (28.89)	1.364*** (28.85)	1.362*** (28.85)
GVC forward₀	1.452*** (19.38)	1.459*** (19.37)	1.456*** (19.34)	1.460*** (19.38)
Industry dummy	YES	YES	YES	YES
Year dummy	YES	YES	YES	YES
Observations	27664	27664	27664	27664

Notes: z statistics are in parentheses; *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Source: Authors' calculation

Table 5 presents how different innovation strategies influence the firms' participation in the GVCs by forward linkages, either by exporting or selling to FDI partners. Overall, the results indicate that all innovation strategies are positively correlated to the likelihood of joining forward GVCs linkages of firms. The firms following a new product strategy are more likely to export or sell to FDI partners. The firms with quality improvement and process improvement strategies also have a higher probability to engage in the forward GVCs linkages. R&D is the most influencer of the propensity of integrating into the GVCs. The results imply that the firms having R&D activities are more likely to integrate into the forward GVCs linkages.

The effects of other variables on the integration into the forward GVCs have similar patterns to the effects on export probability. It means that foreign ownership and state ownership have positive impacts on the integration into the forward GVCs, which is different from the effects of SME, capital-labor ratio, firm age, and high-medium sector classification. Nevertheless, the impact of the local business environment is the same in the regressions of FDI forward linkages. The business environment does not affect the likelihood of joining the forward GVCs.

4.2 Effects of firms' innovation strategies on integration into the GVCs in different local business environments

To study how the influence of a firm's innovation strategies on its forward GVCs participation varies in different local business environments, we divide the sample into two groups, which are the higher and the lower-quality local business environments. Based on the PCI ranking provided by annual PCI reports, we classify provinces ranked from the 1st to the 30th to the group of higher-quality local business environments. The remaining localities are in the group of lower-quality local business environments.

Table 6. Impact of different innovation strategies on the export propensity of firms in different local business environment

	Export	Export	Export	Export
<i>Higher quality local business environment</i>				
New product	0.131*** (2.75)			
Quality improve		0.137** (2.45)		
Process improve			0.0905* (1.81)	
RD				0.347*** (3.35)
Export _{t-1}	1.648*** (23.53)	1.643*** (23.40)	1.642*** (23.52)	1.637*** (23.23)
Export ₀	2.188*** (15.84)	2.214*** (15.76)	2.196*** (15.88)	2.218*** (15.78)
Control variables	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES
Year dummy	YES	YES	YES	YES
Observations	20141	20141	20141	20141
<i>Lower quality local business environment</i>				
New product	0.0391 (0.49)			
Quality improve		0.0602 (0.67)		
Process improve			0.0881 (1.07)	
RD				0.373** (2.41)
Export _{t-1}	1.550*** (14.41)	1.549*** (14.37)	1.550*** (14.37)	1.563*** (14.57)
Export ₀	2.531*** (10.54)	2.541*** (10.55)	2.530*** (10.53)	2.523*** (10.55)
Control variables	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES
Year dummy	YES	YES	YES	YES
Observations	7523	7523	7523	7523

Notes: z statistics are in parentheses; *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Source: Authors' calculation

We re-estimate the impact of innovation on the integration into the forward GVCs with two sub-samples. The results of the two sub-samples are presented in Table 6. Innovation strategies only positively affect the likelihood of exporting in a good business environment. In the sub-sample of the good local business environment, the impact of all innovation strategies on export propensity remains the same in direction but different in magnitudes. Specifically, the impacts of new products, quality improvement, and process improvement on firms' export engagement are all enhanced in an improved-quality local business environment. Firms with a new product strategy are more likely to integrate into export activities. The estimated coefficients of quality improvement and process improvement increase slightly compared to the regression over the whole sample.

In the sub-sample of firms operating in the lower-quality local business environment, most innovation strategies have no impact on the export engagement of firms, except for R&D activities. Specifically, the strategies of new products, quality improvement, and process improvement show an insignificant impact on the export propensity of firms. Nevertheless, the results indicate that in a lower-quality business environment, the firms with R&D activity have a higher probability to export their product to international markets. The effect of R&D on the export propensity of firms in a poor local business environment is even higher than those in a favorable business environment. This result is consistent with the previous studies (Rialp-Criado and Komochkova, 2017; Hernández *et al.*, 2022), which suggest the important role of breakthrough innovation in reducing the negative impact of a hostile business environment on export. It implies that in a hostile business environment, to increase the likelihood of exports, firms have to innovate novel products through R&D activities rather than the improvement of existing products.

Table 7 presents the effects of different innovation strategies on the forward FDI linkages of firms in two sub-samples of the local business environments. The findings imply that process improvement strategies are still the most significant influencer in the linkages between firms in Vietnamese markets. The quality improvement strategy also shows a positive impact on the likelihood of selling to FDI firms, compared to the statistically non-significant impact found in the whole sample.

Nonetheless, in the sample of the poor local business environments, none of the innovation strategies are found to have an impact on the forward FDI linkages of firms. The results imply the vital role of the local business environment in increasing the positive impact of innovation strategies on the export behaviors of firms. It can be explained by the fact that with the linkages between firms in Vietnam, both sides are affected by the local business environment. In contrast, for exporting activity, the local business environment only affects the performance of exporters. Therefore, a favorable business environment has a more considerable impact on encouraging the linkages between Vietnamese firms and FDI firms.

Table 7. Impact of different innovation strategies on firms' likelihood of selling to FDI customers in different local business environments

	Higher quality local business environment				Lower quality local business environment			
	Sell to FDI	Sell to FDI	Sell to FDI	Sell to FDI	Sell to FDI	Sell to FDI	Sell to FDI	Sell to FDI
New product	0.0395 (1.08)				0.0740 (1.27)			
Quality improve		0.0879** (2.14)				-0.0862 (-1.27)		
Process improve			0.0946** (2.48)				0.0660 (1.09)	
RD				0.109 (1.45)				-0.120 (-0.96)
Sell to FDI_{t-1}	1.368** (28.81)	1.368** (28.82)	1.369** (28.83)	1.366** (28.75)	1.177** (16.10)	1.177** (16.10)	1.177** (16.11)	1.181** (16.15)
Sell to FDI₀	1.447** (19.60)	1.450** (19.62)	1.446** (19.58)	1.449** (19.61)	1.652** (12.86)	1.660** (12.83)	1.652** (12.83)	1.652** (12.86)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES	YES	YES
Year dummy	YES	YES	YES	YES	YES	YES	YES	YES
Observations	20141	20141	20141	20141	7523	7523	7523	7523

Notes: z statistics are in parentheses; *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Source: Authors' calculation

The estimation of the effects of innovation strategies on the firm participation in GVCs in different local business environments is shown in Table 8. The results support the important role of the business environment in encouraging firms to integrate into the forward GVCs linkages by enhancing innovative capacities. The findings indicate that all innovation strategies positively affect participation in the GVCs in a higher-quality business environment. In addition, a favorable business environment also enhances the positive impact of all innovation strategies on the integration into the GVCs when their coefficients in the sub-sample of high PCI are slightly larger than those in the whole sample. Meanwhile, in the lower-quality business environment, most innovation strategies have no impact on the integration into the GVCs, except for process improvement innovation. Nevertheless, the coefficient of process improvement strategy is only significant at the 10% significance level.

Table 8. Impact of different innovation strategies on firms' GVC forward integration in different local business environments

	Higher quality local business environment				Lower quality local business environment			
	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward
New product	0.0994** (2.49)				0.0113 (0.17)			
Quality improve		0.152*** (3.35)				-0.0883 (-1.20)		
Process improve			0.118*** (2.86)				0.111* (1.69)	
RD				0.261*** (3.02)				0.161 (1.23)
GVC forward_{t-1}	1.226*** (23.41)	1.226*** (23.40)	1.224*** (23.43)	1.219*** (23.22)	1.394*** (17.82)	1.393*** (17.81)	1.391*** (17.77)	1.395*** (17.85)
GVC forward₀	1.767*** (20.34)	1.781*** (20.29)	1.769*** (20.34)	1.782*** (20.28)	1.851*** (12.55)	1.858*** (12.56)	1.855*** (12.53)	1.848*** (12.52)
Control variables	YES	YES	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES	YES	YES
Year dummy	YES	YES	YES	YES	YES	YES	YES	YES
Observations	20141	20141	20141	20141	7523	7523	7523	7523

Notes: z statistics are in parentheses; *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Source: Authors' calculation

4.3 Additional analysis

SMEs account for the majority of firms in Vietnam. Nonetheless, they are weaker than large firms in terms of capacities and vulnerability to the business environment (Le, 2018). To understand the differences between SMEs and large firms in the integration into the forward GVCs, we divide the sample by firm size and local business environment and re-estimate the models. In general, the results in Table 9 show the essential roles of a favorable business environment and breakthrough innovation in the export propensity of SMEs. The findings indicate that in a better local business environment, SMEs with quality improvement and process improvement strategies are more likely to export than others. Meanwhile, in a poor local business environment, there is no difference between those with and without these innovation strategies. In addition, these strategies make no difference in exporting for large firms regardless of the quality of the local business

environment. Nevertheless, a better business environment encourages large firms with a new product strategy to export while having no impact on SMEs' export behaviors. Interestingly, the results show that R&D activities always have a positive impact on the SMEs' likelihood of export regardless of the business environment quality. Surprisingly, in a poor local business environment, the difference in export propensity between the SMEs with and without R&D is even more prominent than in a better business environment. This finding is consistent with the arguments in the previous studies (Rialp-Criado and Komochkova, 2017; Hernandez *et al.*, 2022) on the role of novel innovation activities in enhancing the export likelihood of firms in a hostile business environment. Compared to other innovation strategies, R&D activities can bring a completely new product to a firm. The results imply that although SMEs have lower capacities and are more vulnerable to the business environment, they can narrow the gap with large firms in export propensity by implementing R&D activities to generate strong competitive advantages in international markets.

Table 10 presents how innovation strategies' impacts on the propensity of selling to FDI firms vary in different business environments and firm size groups. Overall, it shows that a favorable business environment is crucial in encouraging SMEs to link with FDI customers. The findings show that only in a high PCI context do innovation strategies, including process improvement and R&D activities, positively affect the likelihood of selling to FDI firms. Meanwhile, a favorable business environment for large firms also plays a vital role in encouraging their linkages with FDI buyers of those who follow the quality improvement strategy.

The estimation of the effects of innovation strategies on the forward GVC integration of firms by the local business environment and firm size is presented in Table 11. The results indicate that a poor local business environment deters innovative firms from joining the forward GVCs. For both large firms and SMEs, the findings show that in a favorable business environment, the firms that follow innovation strategies are more likely to integrate into the forward GVCs. In a higher-quality business environment, the SMEs following the strategies of new products, quality improvement, process improvement, and R&D are more likely to join the forward GVCs. Meanwhile, a favorable business environment plays a positive role in encouraging large firms with quality improvement and process improvement strategies to engage in the forward GVCs.

Table 9. Impact of different innovation strategies on firms' likelihood to export in different local business environments (LBE), by firm size

	Higher-quality LBE		Lower-quality LBE		Higher-quality LBE		Lower-quality LBE		Higher-quality LBE		Lower-quality LBE	
	large	SMEs	large	SMEs	large	SMEs	large	SMEs	large	SMEs	large	SMEs
New product	0.258*** (2.77)	0.0783 (1.38)	-0.179 (-1.25)	0.138 (1.43)	0.0243 (0.26)	0.130** (2.18)	0.170 (1.11)	0.0511 (0.51)	0.259 (1.57)	0.396*** (2.96)	-0.00841 (-0.04)	0.731*** (3.82)
Quality improve		0.184 (1.61)	0.124* (1.92)	0.0673 (0.40)	0.0592 (0.55)							
Process improve												
RD												
Control variables	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.570*** (4.05)	0.917*** (7.10)	0.535* (1.96)	0.908*** (4.65)	0.498** (1.97)	0.922*** (4.65)	0.480* (1.94)	0.916*** (4.64)	0.602*** (4.18)	0.934*** (7.07)	0.500** (1.97)	0.972*** (4.62)
Observations	5719	14422	1857	5666	1857	5666	1857	5666	5718	14422	1857	5666

Notes: z statistics are in parentheses; *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Source: Authors' calculation

Table 10. Impact of different innovation strategy on firms' likelihood to selling to FDI customers in different local business environment (LBE) by firm size

	Higher-quality LBE			Lower-quality LBE			Higher-quality LBE			Lower-quality LBE			Higher-quality LBE			Lower-quality LBE		
	large	SMEs	large	SMEs	large	SMEs	large	SMEs	large	SMEs	large	SMEs	large	SMEs	large	SMEs	large	SMEs
	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to	Sell to
	FDI	FDI	FDI	FDI	FDI	FDI	FDI	FDI	FDI	FDI	FDI	FDI	FDI	FDI	FDI	FDI	FDI	FDI
New product	-0.0194	0.0631	0.0332	0.0332	0.0686													
	(-0.30)	(1.43)	(0.31)	(0.95)														
Quality improve						0.158**	0.0530	-0.128	-0.0941									
						(2.04)	(1.09)	(-0.94)	(-1.18)									
Process improve										0.106	0.0980**	0.0231	0.0818					
										(1.48)	(2.16)	(0.20)	(1.14)					
RD														-0.0370	0.189*	0.174	-0.265	
														(-0.33)	(1.86)	(0.96)	(-1.48)	
Control variables	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.447**	0.614***	0.589***	0.484***	0.488***	0.454***	0.619***	0.598***	0.488***	0.447***	0.620***	0.591***	0.483***	0.447***	0.623***	0.614***	0.485***	
	(5.53)	(9.13)	(3.91)	(4.82)	(4.89)	(5.52)	(9.15)	(3.90)	(4.89)	(5.52)	(9.14)	(3.89)	(4.81)	(5.52)	(9.14)	(3.89)	(4.85)	
Observations	5719	14422	1857	5666	5719	14422	1857	5666	5719	14422	1857	5666	5719	14422	1857	5666	5719	5666

Notes: z statistics are in parentheses; *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Source: Authors' calculation

Table 11. Impact of different innovation strategy on firms' GVC forward integration in different local business environment (LBE) by firm sizes

	Higher-quality LBE		Lower-quality LBE		Higher-quality LBE		Lower-quality LBE		Higher-quality LBE		Lower-quality LBE		
	large	SMEs	large	SMEs	large	SMEs	large	SMEs	large	SMEs	large	SMEs	
	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward	GVC forward	
New product	0.129 (1.36)	0.0986** (2.26)	-0.294** (-1.98)	0.103 (1.41)									
Quality improve		0.341*** (3.00)	0.116** (2.36)	-0.0505 (-1.05)	-0.0846 (-1.05)								
Process improve						0.224** (2.47)	0.116*** (2.58)	0.141 (0.97)	0.0903 (1.22)				
RD								0.0151	0.368***	0.236	0.178		
Control variables													
Industry dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Year dummy	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	
Constant	0.354*** (2.97)	0.606*** (8.96)	0.586** (2.37)	0.680*** (5.67)	0.401*** (3.03)	0.615*** (8.95)	0.497** (2.33)	0.677*** (5.70)	0.351*** (3.01)	0.616*** (8.99)	0.491** (2.30)	0.673*** (5.64)	0.509** (2.28)
Observations	5719	14422	1857	5666	5719	14422	1857	5666	5718	14422	1857	5666	
Observations	5719	14422	1857	5666	5719	14422	1857	5666	5718	14422	1857	5666	

Notes: z statistics are in parentheses; *, **, *** denote statistical significance at 10%, 5%, and 1%, respectively.

Source: Authors' calculation

5. Conclusion

This study examines the impact of different innovation strategies on the firms' integration into the forward GVCs. The results strongly support the self-selection hypothesis as it shows that firms with innovation strategies are more likely to join the forward GVCs. Nevertheless, different innovation strategies affect the likelihood of exporting and selling to FDI firms differently. The firms following the strategies of new products, quality improvement, and R&D are more likely to export than others. Firms tend to join the GVCs indirectly by selling to FDI customers when they have a process improvement strategy.

Furthermore, this study emphasizes the role of the local business environment in the relationship between innovation and integration into the forward GVCs. It confirms that a favorable business environment facilitates innovative firms to export and sell to FDI firms. A low-quality business environment weakens the effect of innovation strategies on firms' integration into the GVCs. The results also indicate that a favorable business environment can enhance the positive impact of innovation strategies on firms' engagement in linkages with FDI customers and export propensity. The role of a favorable business environment is even more critical to SMEs when the findings show that the positive impacts of most innovation strategies on the likelihood to export and FDI linkages are increased in a better business environment.

These findings provide important implications for the public sector to have institutional improvement to encourage firms to engage in the GVCs and innovation activities. First, the government can boost the participation of firms in the forward GVCs by encouraging their innovation activities. Moreover, the Vietnamese government should improve its business environment further to enhance the positive impact of innovation strategies on the GVC participation of firms. The public sector should also notice SMEs' vulnerability to the local business environment to have proper regulations to facilitate their participation in the forward GVCs.

One limitation of the study is that we have not discovered the impact of different innovation outputs on the forward GVC integration of firms due to the unavailability of data. Studies in the future should focus on discovering the relationship between different innovation outputs on firms' integration into the forward GVCs. Additionally, the availability of other measurements for the integration into the forward GVCs, such as export intensity or the percentages of output selling to FDI customers, is desired. These shortcomings should be dealt with in future studies.

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