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Global Value Chain Participation and Labour Productivity in Manufacturing Firms in Viet Nam: Firm-Level Panel Analysis

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Abstract: *This study describes the status of global value chains (GVCs) in Viet Nam and examines the roles of GVC participation and technology in enhancing labour productivity in manufacturing firms. The estimation method is a panel fixed-effect regression employing unique firm-level data matching the Vietnam Technology and Competitiveness Survey and Vietnam Enterprise Survey, 2009–2018. The findings show the positive effect of backward GVC participation when considering firm GVC participation status (i.e. whether they engage with backward linkages). However, when accounting for GVC participation degree (i.e. GVC participation index), the results show a stark contrast, revealing the negative effect of backward GVC participation on labour productivity. The results, therefore, partly reject the learning-to-learn hypothesis. On the other hand, regardless of GVC indicators, forward GVC participation positively impacts labour productivity, confirming the views of learning-by-exporting and learning-by-supplying. The findings also suggest the significance of research and development, digital technology, and foreign investment in enhancing labour productivity. Therefore, policies promoting forward GVC participation should be the priority, while policies to promote backward GVC participation should be well designed and accompanied by policies that ensure technology transfer and domestic technology development to avoid the trap of a subordinate role.*

Keywords: Global value chain participation; Labour productivity; Learning-by-exporting; Learning-to-learn; Viet Nam

JEL Classification: F13; F14; F16; O19; O24

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1. Introduction

The development of global value chains (GVCs)[1] has changed the approach of analysing the relationship between trade and labour, as international trade has become more sophisticated. Primitive trade mainly served domestic demand for foreign goods and services while handling the whole production process for exports domestically. Modern trade, however, is increasingly characterised by the fragmentation of production across borders, known as the second unbundling (Baldwin, 2015). Individual countries along GVCs specialise in particular roles in production, significantly affecting domestic firm operations and productivity.

A firm can directly participate in a GVC through either backward or forward GVC participation, reflecting the upstream or downstream link in the chain (Korwatanasakul, Baek, and Majoe, 2020). Backward GVC participation (i.e. backward linkage) is when a firm imports foreign input to produce intermediate or final goods and services for export. Conversely, forward GVC participation (i.e. forward linkage) occurs when a firm feeds intermediate goods to foreign firms for further processing and export.

Participation in GVCs presents opportunities for and challenges to domestic firms, particularly small and medium-sized enterprises (SMEs) (Agostino et al., 2015; Gereffi, Humphrey, and Sturgeon, 2005; Humphrey and Schmitz, 2002; Korwatanasakul and Paweenawat, 2021). The benefits of GVC participation – through interactions with foreign business partners – include product quality improvement, financial stability, market expansion, and productivity and competitiveness enhancement. These interactions force domestic firms to adjust their production to satisfy international standards while upgrading production processes and product quality through knowledge and technology absorption. However, these opportunities can present threats and challenges to domestic firms due to the extensive managerial and financial resources required to upgrade their technological capacity and to meet economies of scale and international standards (Korwatanasakul, 2019; Korwatanasakul and Intarakumnerd, 2020).

[1] The discussion of GVC participation refers to backward GVC participation and forward GVC participation. Although domestic participation in GVCs is crucial, especially in Viet Nam, the data do not allow the analysis of domestic linkages.

GVCs have been playing significant roles in Viet Nam's economic and social development. Viet Nam has shown increasing integration in GVCs since the Doi Moi reforms in 1986. Its GVC participation grew from 40.8% to 49.4% between 1990 and 2018, resulting in increased productivity and, in turn, rapid economic growth. Its GVC participation has also positively affected its labour market by increasing value creation, creating more and better jobs, and enhancing technology and management skills (Taglioni and Winkler, 2016).

As the country specialises in final assembly and finishing operations, Viet Nam has positioned itself as an 'Asian manufacturing powerhouse' (Nakamura, 2016). Apart from being active in signing bilateral and multilateral trade agreements, the government has offered various incentives to attract foreign direct investment (FDI) and to encourage domestic businesses to become part of GVCs. For instance, electronic components are exempted from import taxes, while high-tech projects and investments in industrial zones benefit from income tax incentives. Furthermore, the government provides other incentives through various labour and technology policies.

However, Viet Nam faces several issues, such as low domestic value added, weak domestic linkages and supplier base, lack of skilled labour, and low productivity growth, limiting its potential to deepen its GVC integration (MPI, 2019). Heavy dependence on foreign intermediates and technologies without domestic innovation leads to productivity deterioration and a slowdown in economic growth (Korwatanasakul, 2022).

For the past 2 decades, Viet Nam's economy has remained stable with an average growth rate of 6.5% (Korwatanasakul, 2022). In 2019, Viet Nam was 67 out of 141 countries in the Global Competitiveness Index 4.0, below half of the Association of Southeast Asian Nations (ASEAN) Member States – Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore, and Thailand (Schwab, 2019). Its performance and competitiveness were lacking in innovation capacity, product market, institutions, business dynamic, skills, and labour market, preventing the country from upgrading its value chains (Korwatanasakul, 2022).

Although GVCs have gained momentum in the emerging international trade literature, little is known about the link between GVCs and labour outcomes and firm productivity due to the lack of comprehensive GVC data at the firm level. A large

body of research, especially under models of final goods, has found that trade can generally lead to higher productivity through multiple channels (e.g. Aw and Hwang, 1995; Baldwin and Gu, 2003; Van Biesebroeck, 2005; Bustos, 2011; Fernandes and Isgut, 2015; Lileeva and Trefler, 2010; De Loecker, 2011). More recent GVC studies have moved towards micro-level analyses but have yielded heterogeneous findings varying by sector, firm type, and country (Farole, 2016). Thus, evidence of the impact of GVC participation in terms of the labour outcomes at the individual and firm levels – particularly in developing countries – remains unclear.

Against this backdrop, this study examines the roles of GVC participation and technology in enhancing labour productivity in manufacturing firms in Viet Nam. It utilises a panel fixed-effect regression with firm-level data from the Vietnam Technology and Competitiveness Survey (TCS) and Vietnam Enterprise Survey (VES), 2009–2018, by the General Statistics Office of Vietnam. The findings show the positive effect of backward GVC participation when considering firm GVC participation status (i.e. whether they engage with backward linkages). However, when accounting for the GVC participation degree (i.e. the GVC participation index), the results show a stark contrast, revealing the negative effect of backward GVC participation on labour productivity. The results, therefore, partly reject the learning-to-learn hypothesis. On the other hand, regardless of GVC indicators, forward GVC participation positively impacts labour productivity, confirming the views of learning-by-exporting and learning-by-supplying. The findings also suggest the significance of research and development (R&D), digital technology, and FDI in enhancing labour productivity. Therefore, policies promoting forward GVC participation should be the priority, while policies to promote backward GVC participation should be well designed and accompanied by policies that ensure technology transfer and local technology development to avoid the trap of a subordinate role.

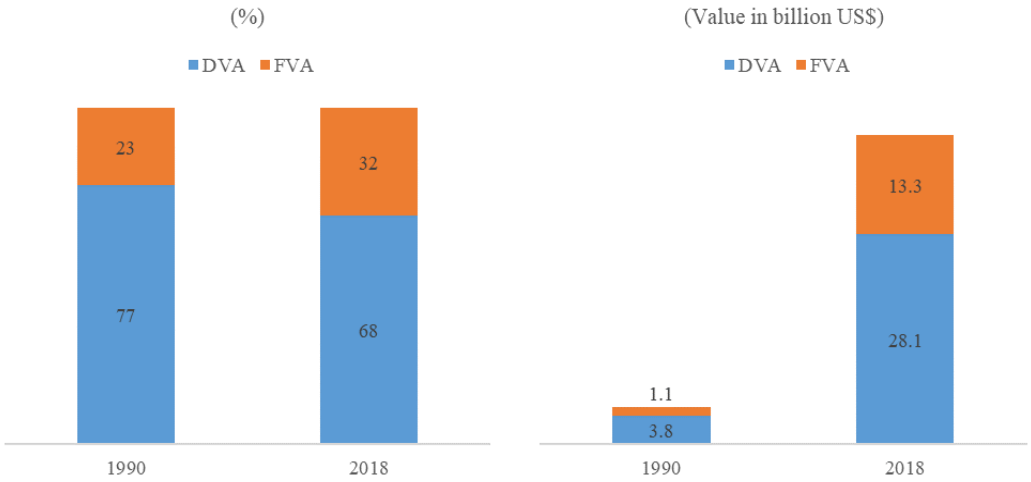
This study contributes to the existing research on the linkages between firm-level GVC participation and labour productivity. First, it provides new empirical evidence indicating the role of GVCs and technological development in firms (in Viet Nam) and, in turn, outlines the associated risks and opportunities. Second, while existing firm-level analyses resort to average industrial/sectoral GVC data or firm

GVC status (a dummy variable) due to data unavailability, this study utilises firm-level GVC panel data containing information on firm GVC participation degree/level. Finally, the study concludes with policy recommendations to help Vietnamese firms – and possibly firms in other developing countries – benefit from GVC integration.

2. Viet Nam and a Global Value Chain-Oriented Development Strategy

Under the Doi Moi economic reforms, Viet Nam promoted trade liberalisation and FDI, which facilitated the country in smoothly participating in regional and global production networks or value chains. Foreign input, such as intermediate goods and technologies, has allowed Viet Nam to achieve higher productivity, greater market access, and rapid economic development (Korwatanasakul, 2022). Indeed, Viet Nam's share of foreign value added (FVA) in gross exports has been expanding since 1990, accompanied by sharp rises in gross exports and domestic value-added (DVA) volume in exports, with annual growth of 11%–13% between 1990 and 2018 (Figure 1). The country entered GVCs by specialising in low value-added activities due to its competitiveness in cheap labour. Viet Nam's intensive backward GVC participation has helped the country become a hub for the electrical and electronics, textiles and clothing, and food processing industries, greatly benefiting domestic firms and the economy.

Figure 1: Viet Nam's Value-Added Content of Exports, 1990 and 2018



Notes: DVA = domestic value added, FVA = foreign value added.
Source: Korwatanasakul (2022).

There was a positive trend in Viet Nam's regional value chain (RVC) and GVC participation during the same period, as the levels of RVC and GVC participation increased substantially (Table 1). Moreover, the country deepened intra-industry trade with its regional trading partners in the food, beverages, and tobacco; electronics and motor vehicles; wood and wood products; chemicals and chemical products; and other manufacturing industries (Figure 2).

Table 1: Viet Nam's Global Value Chain and Regional Value Chain Participation, 1990–2018

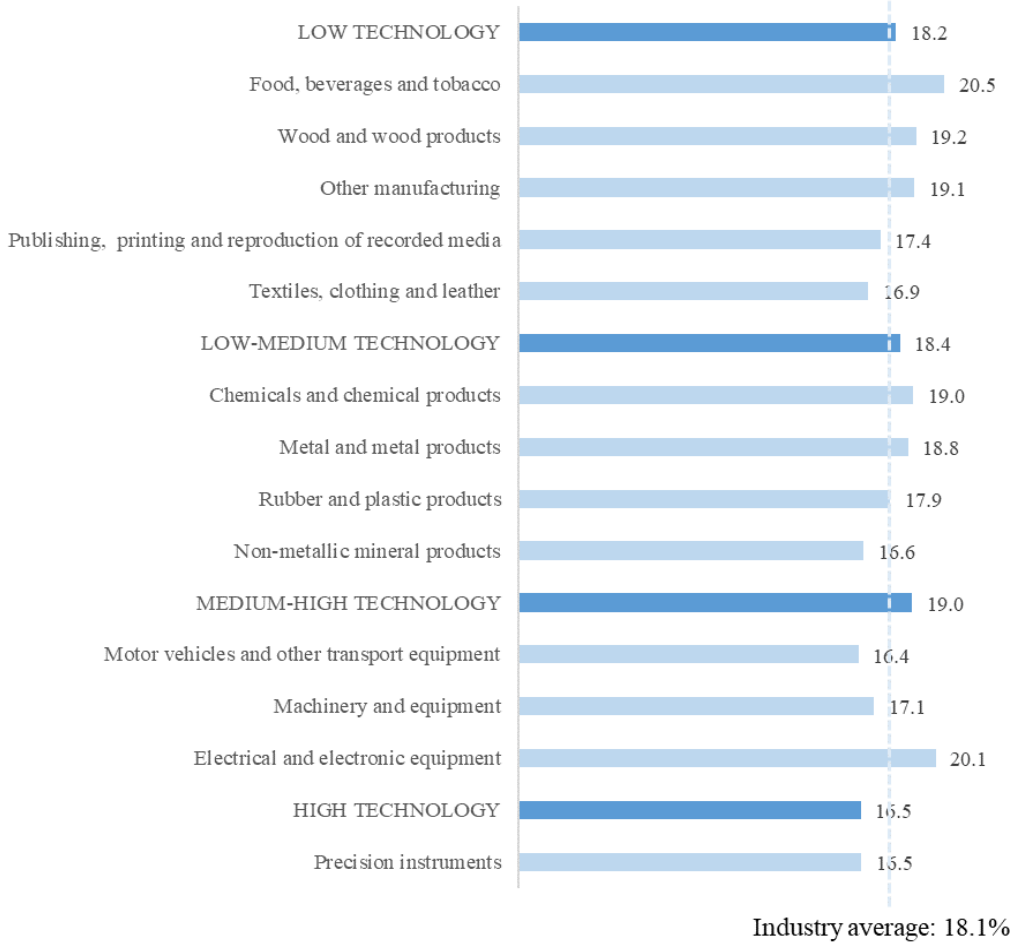
(%)

Year	FVA Share			DVX Share			GVC Participation	RVC Participation
	Non-ASEAN Countries	ASEAN Countries	Total	Non-ASEAN Countries	ASEAN Countries	Total		
1990	20.1	2.6	22.7	16.7	1.5	18.2	40.8	4.1
1995	23.4	4.2	27.6	14.2	3.3	17.4	45.0	7.5
2000	19.7	4.1	23.8	17.6	4.3	21.9	45.7	8.4
2005	24.3	5.4	29.7	18.9	4.4	23.4	53.1	9.9
2010	34.1	7.9	42.1	16.1	3.6	19.6	61.7	11.5
2015	26.7	6.7	33.3	16.7	3.5	20.2	53.5	10.1
2018	25.6	6.5	32.1	14.3	2.9	17.3	49.4	9.4

ASEAN = Association of Southeast Asian Nations, DVX share = share of Viet Nam's domestic value added incorporated into other countries' exports, FVA share = share of foreign value added in Viet Nam's exports, GVC = global value chain, GVC participation = FVA share + DVX share, RVC = regional value chain, RVC participation = FVA share by ASEAN countries + DVX share in ASEAN countries.

Source: Korwatanasakul (2022).

Figure 2: Viet Nam's Regional Value Chain Participation by Industry, 2015
(%)



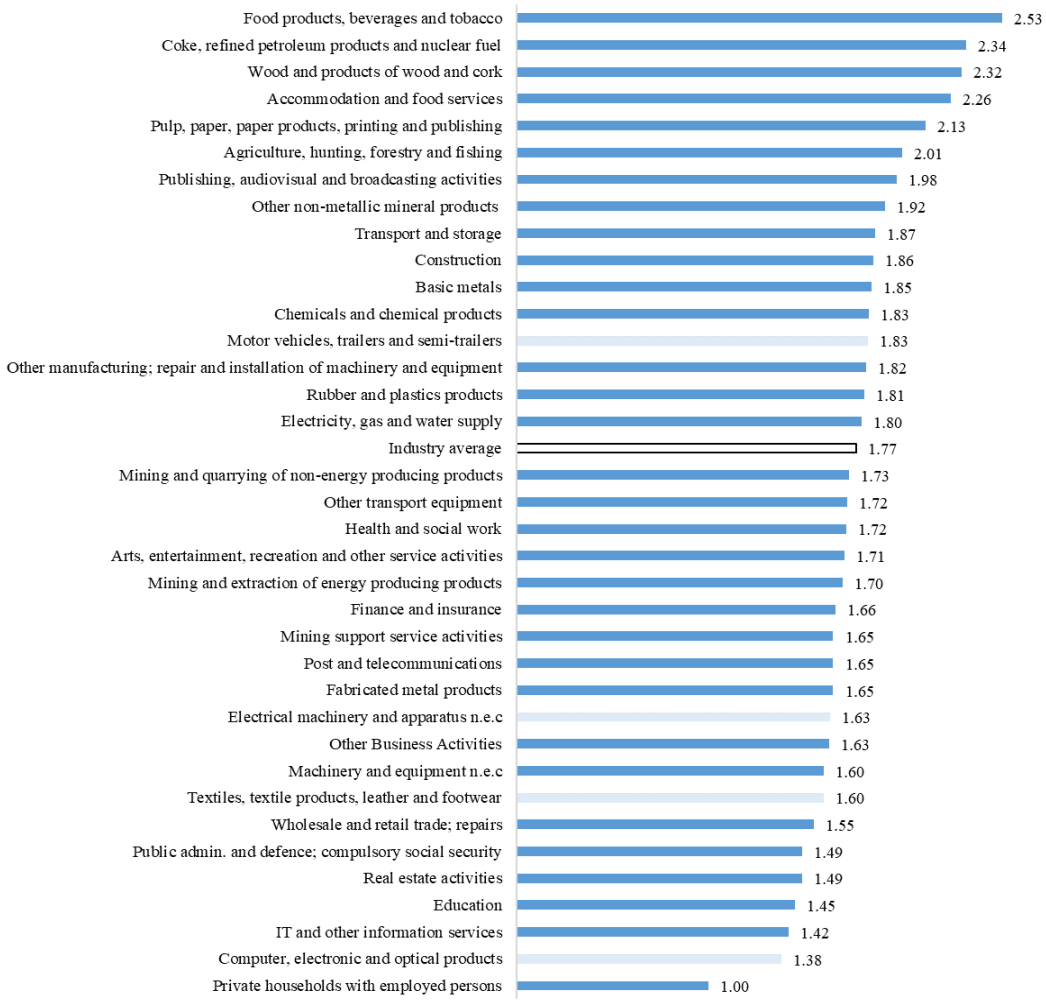
ASEAN = Association of Southeast Asian Nations.
Notes: Regional value chain participation is the sum of the share of foreign value added created by other ASEAN countries in Vietnamese exports and the share of Viet Nam's domestic value added incorporated into other ASEAN countries' exports.
Source: Korwatanasakul (2022).

Insufficient local technology development and recent rising wages have threatened Viet Nam's economic growth, primarily driven by low value-added and resource-related industries with limited technological transfer from foreign to domestic firms. As domestic suppliers have difficulty catching up with headquarters economies in terms of technology and innovation, they cannot move up value chains. For instance, in 2015, Samsung requested that Viet Nam provide 170 supporting products and services for its new electronics factory in Ho Chi Minh City – but only 12 out of 1,000 local firms met its requirements and standards (Korwatanasakul and

Intarakumnerd, 2020). An insufficient level of labour productivity was an issue. In addition to the readiness of domestic suppliers, the lack of foreign and domestic suppliers prevents Viet Nam from economic agglomeration and industrial clustering (Truong, 2008). Indeed, less than 250 supporting suppliers exist in Viet Nam's automotive industry, whereas 2,390 foreign and domestic suppliers coexist in Thailand (Korwatanasakul and Intarakumnerd 2020).

Heavy reliance on foreign inputs and technologies (i.e. a high share of FVA in gross exports or intensive backward GVC participation) without further upgrading – particularly in strategic industries such as the automotive, electrical and electronics, and textiles and clothing industries – poses challenges to the country to boost or even to maintain its current growth level (Korwatanasakul and Intarakumnerd, 2020, 2021). Industry-level GVC data reveal that strategic industries with a relatively higher share of FVA are not amongst the top industries in terms of multiplier-effect generation (Figure 3). In other words, these industries' production activities translate to a limited production level in other domestic industries and, in turn, only slightly raise the economy's overall output.

Figure 3: Multiplier Effects by Industry, Viet Nam, 2015



IT = information technology.

Notes:

1. The total domestic backward linkage effects are calculated from the Leontief Inverse Matrix of the input–output table. For the full description of each sector, refer to the OECD Input–Output table (OECD, 2022).
2. Industries highlighted in light blue are Viet Nam's strategic industries.

Source: Korwatanasakul (2022).

3. Literature Review

3.1. Trade and Channels of Firm and Labour Productivity Enhancement

In the literature, a large volume of work that portrays the positive productivity spillovers of international trade through exports and imports (e.g. Damijan, De Sousa, and Lamotte, 2009; Kasahara and Lapham, 2013; Parteka and Wolszczak-Derlacz, 2013) suggests that simultaneously engaging in exports and imports yields greater benefits from positive interactions between both activities, such as sunk cost complementarity and joint R&D projects. Firm export status is also positively associated with the productivity of firms and labour due to the global competitive pressure that eliminates inefficiencies (e.g. Van Biesebroeck, 2005; Evenson and Westphal, 1995) and accumulation of external and foreign knowledge and intensive R&D investment, i.e. learning-by-exporting and learning-by-supplying (Alcacer and Oxley, 2014; Clerides, Lach, and Tybout, 1998; Gereffi, 1999; Giuliani, Pietrobelli, and Rabellotti, 2005; Pietrobelli and Saliola, 2008; Silva, Afonso, and Africano, 2012).

Similarly, firm import status also positively correlates with productivity – learning-to-learn – as domestic firms learn to imitate foreign technology and, in turn, potentially improve capacity for local innovation (e.g. Amiti and Konings, 2007; Coe and Helpman, 1995; Connolly, 2003; Eaton and Kortum, 1996b, 1996a; Halpern, Koren, and Szeidl, 2015; Keller, 1998; Topalova and Khandelwal, 2011). In addition, foreign intermediates and capital goods can improve firm and labour productivity owing to technological spillovers (e.g. Bas and Strauss-Kahn, 2014, 2015; Coe, Helpman, and Hoffmaister, 1997; Wagner, 2012; Xu and Wang, 2000) and access to foreign technology embodied within imports (e.g. Lee, 1995; Nishioka and Ripoll, 2012; Romer, 1993).

Although firm-level empirical studies have found a positive effect of being an exporter/importer on labour productivity (e.g. Aw and Hwang, 1995; Bernard and Jensen, 1999; Bernard, Jensen, and Lawrence, 1995; Van Biesebroeck, 2005; Clerides, Lach, and Tybout, 1998; Fafchamps, El Hamine, and Zeufack, 2008; Verhoogen, 2008), these studies suffer from technical issues, such as causality establishment (e.g. Balasubramanyam, Salisu, and Sapsford, 1996; Greenaway and Kneller, 2007; Salomon and Shaver, 2005), mixed empirical findings (e.g. Keller,

2004; Wagner, 2007), and conditional estimated results, depending on domestic firms' technological readiness (e.g. Alcacer and Oxley, 2014; Van Biesebroeck, 2005; Blalock and Gertler, 2004; Brancati, Brancati, and Maresca, 2017), export destination (e.g. De Loecker, 2007), buyer–seller interactions (e.g. Davies and Jeppesen, 2015; Gereffi, Humphrey, and Sturgeon, 2005; Love and Ganotakis, 2013), and types of goods and services (e.g. Masso and Vahter, 2015). In addition, other literature with anecdotal evidence (e.g. Papadogonas and Voulgaris, 2005) has argued that non-exporting/importing domestic firms are also subject to competitive pressure from the international market. Thus, similar reasoning regarding firm export status and global competitive pressure may apply to non-exporting firms.

3.2. Trade and Channels of Firm and Labour Productivity Enhancement

A large body of research has comprehensively examined the relationship between GVC participation and broad labour market outcomes, such as productivity gains, at the country and industry levels (e.g. Constantinescu, Mattoo, and Ruta, 2019; Kummritz, 2016; Taglioni and Winkler, 2016). However, the lack of availability of GVC data has led to restrictive levels of analysis and the problem of endogeneity (Agostino et al., 2015; Korwatanasakul, Baek, and Majoe, 2020). Although recent studies have moved towards a micro-level analysis, studies at the firm level – especially in developing countries – remain scarce, with highly case-/industry-specific and inconclusive results. Therefore, the current state of the literature highlights the need to analyse the effects of GVC participation on labour market outcomes, such as labour productivity, at the firm level to fill the gap in the literature.

Using industry-level data, Banga (2016) examined the employment impact of GVCs on the Indian labour market and found that GVC participation may enhance labour productivity. Likewise, Korwatanasakul, Baek, and Majoe (2020) showed that GVC participation induces higher monthly wages for individuals and increases labour productivity in the labour market through backward and forward linkages. Constantinescu, Mattoo, and Ruta (2019) also found a positive relationship between the industrial GVC participation level and labour productivity across countries. However, Kouton and Amonle (2021) found that backward GVC participation does

not affect labour productivity in the short run, while forward GVC participation does. In the long run, backward and forward participation positively affect labour productivity.

At the firm level, Agostino et al. (2015) and Montalbano, Nenci, and Pietrobelli (2018) employed cross-sectional data to examine the relationship between labour productivity and GVC participation. These studies proxied the GVC variables with firm export values and export statuses or positions (dummy variables) and found a positive relationship between the two variables. Banh, Wingender, and Gueye (2020) combined firm-level panel data with an industry-level GVC variable. They found that higher GVC participation at the industry level significantly raises productivity at the industry and the firm levels.

Another strand of the literature used firm-level panel data with dummy variables of GVC position or type to disentangle the linkage between labour productivity and GVC participation (Baldwin and Yan, 2014; Benkovskis et al., 2020; Cainelli, Ganau, and Giunta, 2018; Kılıçaslan, Aytun, and Meçik, 2021). They reported that, in general, productivity gains are greater for GVC firms with backward or forward participation, consistent with the learning-by-exporting and learning-to-learn hypotheses. Moreover, Benkovskis et al. (2020) posited that productivity benefits depend on specific types of exports or GVC participation that generate different levels of value added within GVCs, such as exports of knowledge-intensive services and intermediate goods.

However, the existing literature utilising industrial average values of GVC participation rather than firm-level values may have overgeneralised the impact of GVC participation on firm-level labour productivity. Moreover, the proxies of GVC participation, such as firm export value, export status (dummy variable), and export/value chain position (dummy variable), do not capture the level of GVC participation nor reflect different channels of GVC participation, potentially resulting in inaccurate estimates.

The studies of GVC participation and labour productivity in Viet Nam face the same issues. Jangam (2020) conducted a country-level analysis and concluded that there is a positive association of GVCs with labour productivity and employment in Asia-Pacific countries, including Viet Nam. Similar to Banh, Wingender, and Gueye

(2020), Duc (2019) combined firm-level panel data with an industry-level GVC variable to examine the impact of participation in GVCs on employment, using panel data of 1,230 SMEs. The study found that GVC participation may increase labour productivity, wages, and employment.

4. Data and Methodology

4.1. Data

This study utilises a firm-level panel dataset, combining 10 rounds of the Vietnam Technology and Competitiveness Survey (TCS), 2009–2018. The TCS is jointly conducted by the Central Institute for Economic Management (CIEM); General Statistics Office of Viet Nam (GSO); and Development Economics Research Group (DERG), University of Copenhagen. The survey is an additional part of the GSO's annual Vietnam Enterprise Survey (VES), covering 23 manufacturing sectors and 63 provinces, 5 of which are municipalities. While the VES provides general information about firm characteristics and financial accounts, the TCS collects detailed information on firm sourcing, production, and technology utilisation, such as the structure of inputs and outputs, import and export activities, workforce, R&D, and technology adoption. Matching the TCS and VES yields more comprehensive data to explore the links amongst labour productivity, GVC participation, and technology development.

Tax and permanent enterprise codes are used to create unique identifiers that permit matching the TCS and VES to construct a panel data set. Each firm receives a unique tax code from the provincial Department of Finance. Moreover, administrative information on the geographical location of firms, such as provincial and commune codes, is adopted to create a permanent enterprise code to prevent duplications in tax codes (Newman et al., 2015; Ngo and Nguyen, 2021). A price index, with 2010 as the base year, is utilised to convert data in nominal values to real, inflation-adjusted values. After retaining only the data of manufacturing firms, the TCS and VES pool data from 2009 to 2018 containing 62,824 observations with an average number of 6,282 firms per year. The sample size goes down to 60,926 after data cleaning (i.e. missing information and internal inconsistency). The balanced panel thus contains 23,460 observations or 2,346 firms per year.

Table 2 compares the sample used in this study (i.e. the matched TCS and VES sample) with the VES sample in terms of firm size, ownership type, and region.[2] Overall, the matched sample, balanced and unbalanced panels, and VES sample illustrate similar distributions. Regardless of sample type, most of the samples are SMEs (75%–83%), domestic private firms (63%–73%), and located in the South-East region (38%–42%). The distribution of data is consistent with that of CIEM, GSO, and DERG, combining TCS and VES data 2010–2014 (CIEM, GSO, and UoC 2015). The matched sample tends to contain a higher percentage of large and foreign firms than the VES sample.

Table 2: Comparison of the Matched TCS and VES Sample and VES Sample

Firm Characteristics	2009–2018					
	TCS and VES (balanced panel)		TCS and VES (unbalanced panel)		VES	
	n	%	n	%	n	%
Total	23,460		60,926		648,357	
Firm size						
SME	17,593	75.0	50,544	83.0	616,407	95.1
Large	5,867	25.0	10,382	17.0	31,950	4.9
Ownership						
SOE	52	0.2	628	1.0	14,295	2.2
Private	14,805	63.1	44,572	73.2	577,087	89.0
FDI	8,603	36.7	15,726	25.8	56,975	8.8
Region						
Red River Delta	5,910	25.2	17,704	29.1	197,382	30.4
North-East	1,070	4.6	3,129	5.1	25,748	4.0
North-West	350	1.5	987	1.6	7,911	1.2
North Central	1,130	4.8	3,172	5.2	27,598	4.3
South Central Coast	2,070	8.8	4,679	7.7	41,892	6.5
Central Highlands	360	1.5	1,104	1.8	11,159	1.7
South-East	9,860	42.0	23,244	38.2	282,886	43.6
Mekong River Delta	2,710	11.6	6,907	11.3	53,781	8.3

FDI = foreign ownership, including joint ventures; SME = small or medium-sized enterprise; TCS = Vietnam Technology and Competitiveness Survey; VES = Vietnam Enterprise Survey.
Source: Authors.

[2] The VES sample is used to compare with the matched TCS and VES sample, because the sample size of the VES is close to the number of manufacturing firms in Viet Nam. For instance, the 2018 VES contains 93,377 firms, accounting for 86% of the total number of manufacturing firms in Viet Nam, 108,587 firms in 2018 (GSO, 2021). For sample comparison by year, see Tables A1 and A2.

4.1.1. Description of Variables

Labour productivity serves as the dependent variable in the estimation, which is measured by total revenue divided by the number of employees. The independent variables of interest are the backward and forward GVC participation dummy and index. The backward GVC participation dummy indicates whether firms import foreign intermediate goods and export final products, whereas the forward GVC participation dummy identifies whether firms export intermediate goods. Furthermore, the backward GVC participation index results from multiplying the exports to total sales ratio and the ratio of foreign input to total input (Korwatanasakul, 2020; Urata and Baek, 2021). Meanwhile, the forward GVC participation index is calculated by multiplying the ratio of intermediate goods exports to total sales and the ratio of domestic input to total input.

Five additional variables serve as control variables in the estimation: capital–labour ratio, SME, R&D, modern technology, and foreign ownership. Since the data do not contain information on total capital, total assets per worker (K/L) and the total value of machinery and technology per worker (K/L 2) act as proxies of the capital–labour ratio. The SME dummy variable indicates whether a firm is an SME (SME = 1; otherwise, SME = 0).[3]

Foreign ownership is a dummy variable identifying firms with full or partial foreign ownership (i.e. a joint venture). The estimation model also considers the importance of technological upgrading on labour productivity and includes dummy variables of R&D (i.e. whether firms undertake R&D activities) and modern technology (i.e. whether firms utilise computer-operated machines, personal computers, or the internet). Except for the SME variable, all control variable coefficients on labour productivity are expected to be positive. Table 3 presents summary statistics and a definition of each variable.[4]

[3] According to the SME law, firms with the following conditions are classified as SMEs: (i) the number of employees is 200 persons or lower, (ii) total capital does not exceed D100 billion, and/or (iii) total revenue of a previous year does not exceed D300 billion (OECD, 2021).

[4] See Appendix Table A3 for more information about correlation coefficients amongst the variables.

Table 3: Summary Statistics

Variable	Description	Observation	Mean	Standard Deviation	Min	Max
Dependent variable						
Labour productivity	Logarithm of sales per worker	62,603	5.666	1.319	–5.966	12.635
Independent variables						
GVC participation						
Backward GVC participation dummy	Backward GVC participation dummy indicates whether firms import foreign intermediate goods and export final products. (Backward GVC participation = 1; otherwise = 0)	52,834	0.385	0.487	0	1
Backward GVC participation index	Backward GVC participation index results from multiplying the ratio of exports to total sales and ratio of foreign input to total input.	45,937	0.148	0.299	0	1
Forward GVC participation dummy	Forward GVC participation dummy indicates whether firms export intermediate goods. (Forward GVC participation = 1; otherwise = 0)	48,213	0.184	0.387	0	1
Forward GVC participation index	Forward GVC participation index results from multiplying the ratio of intermediate goods exports to total sales and ratio of domestic input to total input.	45,930	0.032	0.137	0	1
Control variable						
K/L	Capital per worker proxied by the logarithm of total assets per worker	62,781	5.713	1.234	–1.794	12.999
K/L 2	Capital per worker proxied by the logarithm of the total value of machinery and technology per worker	62,672	3.033	2.096	–7.462	12.398
SME	Small or medium-sized enterprise (SME = 1; otherwise SME = 0)	62,813	0.752	0.432	0	1
R&D	Undertaking R&D activities (R&D = 1; otherwise R&D = 0)	62,771	0.081	0.272	0	1

Modern technology	Adaption of computer-operated machines, personal computers, or the internet (Modern technology = 1; otherwise = 0)	62,824	0.601	0.490	0	1
Foreign ownership	Foreign-owned firms (including joint venture) (Foreign ownership = 1; otherwise = 0)	62,824	0.227	0.419	0	1

GVC = global value chain, R&D = research and development, SME = small or medium-sized enterprise.
Source: Authors.

4.1.2. Sample Firm Characteristics

Table 4 demonstrates the pattern of engagement in foreign trade by the sample firms from the perspective of backward GVC participation. Almost one-half of the sample (44%) does not engage in foreign trade (Panel C, Column 1), while one-quarter (24%) engages in foreign trade either through imports of input or exports of final products (Panel C, Columns 2-5). Approximately one-third of the sample (32%) imports foreign intermediate goods to produce final products to export (Panel C, Column 10), considered backward GVC firms. Within backward GVC firms (Panel B, Column 10), the distribution of firms by size skews slightly towards relatively larger firms (55%). When considering the distribution of firms by trade pattern within each firm size category, the data reveal that only 4%–22% of small firms (i.e. 1–200 employees) participate in GVCs, whereas 50%–68% of large firms (i.e. 201 employees and over) engage in GVCs (Panel C, Column 10). The distribution is consistent with the study of Urata and Baek (2021), which used combined enterprise survey data of 38,966 firms from 111 countries for 2009–2018. This implied that small firms may face higher barriers to participating in backward GVC participation.

Table 4: Pattern of Engagement in Foreign Trade by Sample Firms

			1	2	3	4	5	6	7	8	9	10	11	12
Sale	Domestic		O	O	O	X	O	X	X	O	O	**Backward**	**Non-backward**	**Total**
	Foreign (export)		X	X	X	O	O	O	O	O	O	**GVC firm**	**GVC firm**	
Input	Domestic		O	X	O	O	O	X	O	X	O	**(6-9)**	**(1-5)**	
	Foreign (import)		X	O	O	X	X	O	O	O	O			
Panel A	Firm size	1–10	2,833	47	117	99	148	41	26	14	63	144	3,244	**3,388**
	(number of	11–200	15,848	459	2,190	1,203	3,285	717	882	760	4,145	6,504	22,985	**29,489**
	employees)	200–300	670	55	300	236	526	165	308	217	1,083	1,773	1,787	**3,560**
		301 and over	849	62	454	586	1,128	1,060	1,687	542	3,118	6,407	3,079	**9,486**
	Total		**20,200**	**623**	**3,061**	**2,124**	**5,087**	**1,983**	**2,903**	**1,533**	**8,409**	**14,828**	**31,095**	**45,923**
Panel B	Firm size	1–10	14.0	7.5	3.8	4.7	2.9	2.1	0.9	0.9	0.7	1.0	10.4	**7.4**
	(number of	11–200	78.5	73.7	71.5	56.6	64.6	36.2	30.4	49.6	49.3	43.9	73.9	**64.2**
	employees)	200–300	3.3	8.8	9.8	11.1	10.3	8.3	10.6	14.2	12.9	12.0	5.7	**7.8**
		301 and over	4.2	10.0	14.8	27.6	22.2	53.5	58.1	35.4	37.1	43.2	9.9	**20.7**
	Total		**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Panel C	Firm size	1–10	83.6	1.4	3.5	2.9	4.4	1.2	0.8	0.4	1.9	4.3	95.7	**100**
	(number of	11–200	53.7	1.6	7.4	4.1	11.1	2.4	3.0	2.6	14.1	22.1	77.9	**100**
	employees)	200–300	18.8	1.5	8.4	6.6	14.8	4.6	8.7	6.1	30.4	49.8	50.2	**100**
		301 and over	9.0	0.7	4.8	6.2	11.9	11.2	17.8	5.7	32.9	67.5	32.5	**100**
	Total		**44.0**	**1.4**	**6.7**	**4.6**	**11.1**	**4.3**	**6.3**	**3.3**	**18.3**	**32.3**	**67.7**	**100**

GVC = global value chain.

Source: Authors.

This study utilises firms exporting intermediate goods as a proxy for firms engaging in forward GVC linkages (i.e. forward GVC firms) since the data contain insufficient information to trace the flow of exported intermediate goods and, therefore, the actual pattern of forward GVC participation. Using the data of intermediate goods exporters may overestimate a forward GVC participation situation. However, it is worth examining the pattern of engagement in foreign trade through exporting intermediate goods, as GVC firms are part of intermediate goods-exporting firms.

The number of forward GVC firms (proxied by the number of firms exporting intermediate goods), accounting for 16% of the sample, is lower than that of non-forward GVC firms (Table 5, Panel C, Column 7) and nearly two times less than that of GVC firms with backward linkages. In contrast to the backward GVC participation pattern, forward GVC firm distribution by size skews towards small firms (57%) (Panel B, Column 7). Moreover, less than one-third of the sample participates in value chains regardless of firm size. Approximately 3%–13% of small firms and 25%–27% of large firms engage in forward GVC participation (Panel C, Column 7). The distribution implies that firms in Viet Nam, especially micro firms, have difficulties engaging in forward GVC participation. In addition, as the data possibly overestimate the situation of forward GVC firms, fewer firms are likely to engage in forward GVC participation.

Table 5: Pattern of Engagement in Foreign Trade by Sample Firms

			1	2	3	4	5	6	7
Sale of intermediate goods	Domestic		X	O	X	O	**Forward GVC Firm (3–4)**	**Non-Forward GVC Firm (1–2)**	
	Foreign (export)		X	X	O	O			**Total**
Panel A	Firm size (number of employees)	1–10	3,721	983	0	139	139	4,704	**4,843**
		11–200	26,446	6,666	0	4,939	4,939	33,112	**38,051**
		200–300	2,669	383	0	988	988	3,052	**4,040**
		301 and over	7,002	405	0	2,780	2,780	7,407	**10,187**
	Total		**39,838**	**8,437**	**0**	**8,846**	**8,846**	**48,275**	**57,121**
Panel B	Firm size (number of employees)	1–10	9.3	11.7	0	1.6	1.6	9.7	**8.5**
		11–200	66.4	79.0	0	55.8	55.8	68.6	**66.6**
		200–300	6.7	4.5	0	11.2	11.2	6.3	**7.1**
		301 and over	17.6	4.8	0	31.4	31.4	15.3	**17.8**
	Total		**100**	**100**	**0**	**100**	**100**	**100**	**100**
Panel C	Firm size (number of employees)	1–10	76.8	20.3	0	2.9	2.9	97.1	**100**
		11–200	69.5	17.5	0	13.0	13.0	87.0	**100**
		200–300	66.1	9.5	0	24.5	24.5	75.5	**100**
		301 and over	68.7	4.0	0	27.3	27.3	72.7	**100**
	Total		**69.7**	**14.8**	**0**	**15.5**	**15.5**	**84.5**	**100**

GVC = global value chain.

Note: This study utilises firms exporting intermediate goods as a proxy for firms engaging in forward GVC linkage (i.e. forward GVC firms).

Source: Authors.

Table 6 illustrates the sample characteristics of GVC and non-GVC firms, reporting the mean values of each dependent and independent variable together with differences in mean and t-test. Overall, backward and forward GVC firms manifest higher mean values than non-GVC firms for all variables except the SME variable. In other words, GVC firms illustrate greater labour productivity, capital per worker, firm size, R&D activities, and adoption of modern technology. Moreover, GVC firms tend to engage with foreign investors through full or partial foreign ownership (i.e. a joint venture).

Table 6: Sample Firm Characteristics: Global Value Chain versus Non-Global Value Chain Firms

Mean	Backward GVC Participation				
	GVC Firm	Non-GVC Firm	Difference	t-statistics	
Labour productivity	6.046	5.530	0.517	45.043	***
K/L	5.948	5.664	0.284	25.915	***
K/L 2	2.987	3.228	–0.241	–12.617	***
SME	0.507	0.858	–0.351	–94.917	***
R&D	0.107	0.061	0.046	19.321	***
Modern technology	0.649	0.528	0.121	27.622	***
Foreign-owned firm	0.534	0.091	0.443	130.000	***
Mean	**Forward GVC Participation**				
	GVC Firm	**Non-GVC Firm**	**Difference**	**t-statistics**	
Labour productivity	6.161	5.674	0.487	27.404	***
K/L	6.063	5.714	0.349	20.388	***
K/L 2	3.461	2.977	0.483	15.997	***
SME	0.581	0.721	–0.140	–22.127	***
R&D	0.089	0.080	0.009	2.483	***
Modern technology	0.622	0.591	0.031	4.487	***
Foreign-owned firm	0.559	0.241	0.318	52.389	***

GVC = global value chain, K/L = capital per worker proxied by the logarithm of total assets per worker, K/L 2 = capital per worker proxied by the logarithm of the total value of machinery/technology per worker, R&D = research and development, SME = small or medium-sized enterprise, *** = statistical significance at 99% level.
Source: Authors.

4.2. Methodology

This study employs a panel fixed-effect regression to examine the link between GVC participation and labour productivity at the firm level. According to Constantinescu, Mattoo, and Ruta (2019), the estimation model is as follows:

$$(1)\ Y_{it} = A_{it}(\theta_1, \theta_2, \cdots, \theta_n) \times F(K_{it}, L_{it})$$

Equation 1 shows a simple production function in which Y_{it} indicates the output of firm i in year t. K_{it} and L_{it} are the capital and labour of firm i in year t. A is the technology spillover, and θ refers to the channels of technology spillover, such as traditional trade and FDI.

$$(2)\ lnLP_{it} = \alpha + \beta ln\left(\frac{K_{it}}{L_{it}}\right) + \sum_{j=1}^{n} \gamma_j ln(\theta_{jit-1}) + X_{it} + \delta + \mu + \varepsilon_{it}$$

Dividing Equation 1 by L_{it}, taking the log of both sides of the equation, and adding fixed effects yield Equation 2. $lnLP_{it}$ refers to the labour productivity of firm i in year t. X_{it} represents the matrix of control variables, such as firm size, R&D activities, and adoption of modern technology. In addition, δ and μ are dummy variables for industry and time, serving as fixed-effects variables to control unobservable factors, such as labour market reforms and technology shocks. Introducing fixed effects eliminates the potential for any time-invariant characteristics of firms to act as confounding factors in estimation. In other words, fixed effects prevent the estimation model from potential endogeneity issues from omitted time-invariant variables.

Labour productivity, LP_{it}, is calculated by dividing the total sales of a firm i by the total number of employees. The variable θ takes a lag of one period since it takes time for a firm to adopt new technology or to learn new knowledge through importing foreign intermediate goods. Therefore, the productivity of the importing firm may increase at least one period after the year in which the firm imported the intermediate goods. Using lagged independent variables can also help reduce potential endogeneity problems arising from reverse causal relationships and omitted time-varying variables. Following Constantinescu, Mattoo, and Ruta (2019), proxy variables for the participation of GVCs serve as a channel for the technology spillover, θ. Backward and forward GVC participation are included in the estimation model.

5. Estimation Results and Policy Discussion

Table 7 shows the estimation results of the effect of GVC participation, captured by dummy variables, on labour productivity. The results are robust across different specifications and indicate that GVC participation, both backward and forward, has a statistically significant positive relationship with labour productivity. To participate in GVCs, firms improve their efficiency by adjusting to international standards and acquiring new knowledge and technology through foreign R&D investment. These processes, in turn, enhance firm labour productivity and domestic innovation. Thus, the results support the hypotheses of learning-by-exporting, learning-by-supplying, and learning-to-learn.

Table 7: Effect of Global Value Chain Participation on Labour Productivity

	Dependent Variable: Labour Productivity					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Backward GVC participation	0.159***		0.147***	0.397***		0.367***
(dummy)	(0.0132)		(0.0136)	(0.0170)		(0.0176)
Forward GVC participation		0.0883***	0.0754***		0.175***	0.142***
(dummy)		(0.0139)	(0.0141)		(0.0195)	(0.0198)
K/L	0.700***	0.702***	0.694***			
	(0.00692)	(0.00697)	(0.00728)			
K/L 2				0.137***	0.141***	0.133***
				(0.00391)	(0.00401)	(0.00405)
Small or medium-sized	–0.345***	–0.363***	–0.337***	–0.406***	–0.458***	–0.380***
enterprise	(0.0112)	(0.0111)	(0.0115)	(0.0165)	(0.0164)	(0.0170)
Research and development	0.0360**	0.0326*	0.0304*	0.0646***	0.0929***	0.0719***
	(0.0166)	(0.0170)	(0.0173)	(0.0233)	(0.0243)	(0.0245)
Modern technology	0.0373***	0.0408***	0.0348***	0.0873***	0.0912***	0.0805***
	(0.0113)	(0.0116)	(0.0117)	(0.0148)	(0.0154)	(0.0154)
Foreign ownership	–0.00721	0.0299**	–0.0150	0.0311*	0.139***	0.00684
	(0.0122)	(0.0118)	(0.0126)	(0.0162)	(0.0160)	(0.0168)
Constant	1.811***	1.859***	1.839***	5.336***	5.475***	5.325***
	(0.0422)	(0.0435)	(0.0439)	(0.0293)	(0.0288)	(0.0297)
Observations	21,332	19,815	19,182	21,291	19,776	19,143
R-squared	0.596	0.601	0.605	0.307	0.303	0.317

K/L = capital per worker proxied by the logarithm of total assets per worker, K/L 2 = capital per worker proxied by the logarithm of the total value of machinery/technology per worker.

Notes:

1. Robust standard errors in parentheses.
2. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
3. All models control for industry and year fixed effects.

Source: Authors.

The coefficients of all control variables express the expected signs and are statistically significant and robust across different specifications. Both proxies of capital–labour ratio, the R&D dummy, and modern technology dummy positively affect labour productivity, as an investment in capital and technological upgrading enhances labour productivity. Moreover, the foreign ownership dummy coefficients are positively related to labour productivity. Foreign-owned and joint venture firms have greater financial resources and technological capacity that contribute to higher capital investment, technological development, and, in turn, labour productivity improvement.

On the contrary, being an SME negatively impacts labour productivity, since SMEs face constraints in terms of economies of scale, access to finance and information, and technological capacity (Korwatanasakul and Intarakumnerd, 2020; Korwatanasakul, 2019). These constraints hinder SMEs from boosting labour productivity.

Table 8: Effect of Global Value Chain Participation on Labour Productivity

	Dependent Variable: Labour Productivity					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
K/L = capital per worker proxied by the logarithm of total assets per worker						
Backward linkage (lag)	–0.0523***				–0.0436**	
	(0.0196)				(0.0197)	
Backward linkage		–0.0988***				–0.0907***
		(0.0199)				(0.0200)
Forward linkage (lag)			0.195***		0.188***	
			(0.0382)		(0.0384)	
Forward linkage				0.188***		0.173***
				(0.0377)		(0.0380)
K/L	0.704***	0.705***	0.704***	0.705***	0.703***	0.704***
	(0.00721)	(0.00709)	(0.00721)	(0.00709)	(0.00721)	(0.00709)
Small or medium-sized	–0.365***	–0.378***	–0.361***	–0.370***	–0.364***	–0.377***
enterprise	(0.0116)	(0.0114)	(0.0116)	(0.0113)	(0.0116)	(0.0114)
Research and	0.0308*	0.0398**	0.0297*	0.0402**	0.0296*	0.0396**
development	(0.0174)	(0.0173)	(0.0174)	(0.0173)	(0.0174)	(0.0173)
Modern technology	0.0416***	0.0405***	0.0416***	0.0390***	0.0421***	0.0403***

	(0.0119)	(0.0118)	(0.0118)	(0.0117)	(0.0119)	(0.0117)
Foreign ownership	0.0555***	0.0688***	0.0409***	0.0441***	0.0498***	0.0635***
	(0.0128)	(0.0127)	(0.0121)	(0.0119)	(0.0128)	(0.0127)
Constant	1.843***	1.865***	1.837***	1.848***	1.843***	1.865***
	(0.0454)	(0.0442)	(0.0455)	(0.0442)	(0.0454)	(0.0441)
Observations	18,771	19,184	18,769	19,182	18,769	19,182
R-squared	0.604	0.602	0.604	0.602	0.604	0.603

K/L 2 = capital per worker proxied by the logarithm of the total value of machinery/technology per worker

	(7)	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Backward linkage (lag)	–0.0978***				-0.0850***	
	(0.0266)				(0.0266)	
Backward linkage		–0.113***				–0.102***
		(0.0275)				(0.0276)
Forward linkage (lag)			0.290***		0.278***	
			(0.0528)		(0.0530)	
Forward linkage				0.252***		0.236***
				(0.0526)		(0.0529)
K/L 2	0.144***	0.142***	0.144***	0.143***	0.144***	0.142***
	(0.00412)	(0.00408)	(0.00411)	(0.00407)	(0.00411)	(0.00408)

Small and medium-sized	–0.468***	–0.478***	–0.462***	–0.469***	–0.467***	–0.476***
enterprise	(0.0171)	(0.0169)	(0.0170)	(0.0167)	(0.0172)	(0.0169)
Research and	0.0833***	0.0977***	0.0818***	0.0979***	0.0814***	0.0973***
development	(0.0248)	(0.0249)	(0.0248)	(0.0249)	(0.0248)	(0.0249)
Modern technology	0.0932***	0.0933***	0.0930***	0.0918***	0.0939***	0.0932***
	(0.0157)	(0.0156)	(0.0157)	(0.0156)	(0.0157)	(0.0156)
Foreign ownership	0.186***	0.185***	0.161***	0.156***	0.178***	0.178***
	(0.0170)	(0.0170)	(0.0163)	(0.0162)	(0.0170)	(0.0170)
Constant	5.490***	5.502***	5.476***	5.482***	5.484***	5.498***
	(0.0305)	(0.0293)	(0.0305)	(0.0290)	(0.0306)	(0.0294)
Observations	18,736	19,145	18,734	19,143	18,734	19,143
R-squared	0.301	0.301	0.301	0.301	0.302	0.301

Notes:
1. Robust standard errors in parentheses.
2. *** p < 0.01, ** p < 0.05, * p < 0.1.
3. All models control for industry and year fixed effects.
4. Lag = a lag of one period.
Source: Authors.

Table 8 shows the estimation results of the GVC participation index on labour productivity. The results reveal that the estimated coefficients of backward GVC participation are negative and statistically significant in all regressions, contrasting with the results in Table 7. Yet the estimation results of forward GVC participation index are similar to those estimated from the GVC participation dummy. The coefficients of forward GVC participation are positive, statistically significant, and robust across different specifications, supporting the hypotheses of learning-by-exporting and learning-by-supplying. Likewise, all control variables are statistically significant and robust; their coefficients show expected signs, as previously discussed.

The estimated results of the backward GVC participation (dummy variable) indicate that, on average, firms engaging with backward linkages have higher labour productivity than non-GVC firms (Table 7). Nevertheless, when considering the level of GVC participation, the backward GVC participation index reveals the importance and risk of the degree to which firms rely on foreign inputs and technologies (Table 8). The results suggest that a higher level of backward GVC participation deteriorates labour productivity. Indeed, Corredoira and McDermott (2014) argued that firms in host countries may fall into the trap of a subordinate role or a supporting supplier regardless of technological capabilities, reflecting the international division of labour. Although the division benefits Viet Nam in terms of static efficiency, the issue will likely worsen, as technology transfer and domestic technology development do not occur automatically (Korwatanasakul and Intarakumnerd, 2020, 2021; Pietrobelli and Rabellotti, 2011). Ultimately, the subordinate role trap adversely affects firm labour productivity (i.e. a negative dynamic effect).

The adverse effect of backward GVC participation reveals the risk of heavy reliance on backward linkages, particularly in terms of labour productivity. The problem does not only appear at the firm level but also at the macro level, as discussed in Section 2. Heavy reliance on foreign inputs and technologies (i.e. intensive backward GVC participation) without further upgrading can lead to structural stagnation, erosion of national competitiveness, and growth slowdown.

These results partly reject the learning-to-learn hypothesis predicting that firm import status positively correlates to labour productivity and highlights the risk of heavy reliance on foreign inputs and technology without domestic technology

upgrading (i.e. intensive backward GVC participation). In contrast, the results confirm the positive effect of forward GVC participation and, therefore, the hypotheses of learning-by-exporting and learning-by-supplying. In addition, the significance of R&D, digital technology, and foreign investment emerges from the results.

Thus, the findings suggest that policies to promote backward GVC participation should be well designed and accompanied by policies that ensure technology transfer and domestic technology development to avoid the trap of a subordinate role. For instance, strengthening the domestic linkage and industrial agglomeration and, in turn, improving domestic R&D and digital technologies help avoid the trap. Furthermore, policymakers should aim for forward GVC participation promotion, as it improves firm labour productivity and creates production efficiency due to global competitive pressure. Policies promoting R&D, digital technologies, and foreign investment complement both backward and forward GVC participation promotion policies, helping reduce the risk of backward GVC participation and facilitating domestic firms to upgrade their production, technologies, and value chains. Lastly, policies that can practically address the challenges faced by SMEs – such as a lack of the ability to meet international standards, lack of managerial and human resources, limited access to credit and loans, and limited access to information and innovation – will help them enhance their labour productivity.

6. Conclusion

This study describes the status of GVCs in Viet Nam and examines the roles of GVC participation and technology in enhancing labour productivity in manufacturing firms. The estimation method is a panel fixed-effect regression employing firm-level data matching the TCS and VES, 2009–2018. The results show a negative impact of backward GVC participation on labour productivity when accounting for the degree/level of GVC participation and, therefore, partly reject the learning-to-learn hypothesis. The rejection indicates the risk of intensive backward GVC participation, consistent with the macro-level analysis showing the adverse effects of heavy reliance on foreign inputs and technologies without further

upgrading. On the other hand, the results support the hypotheses of learning-by-exporting and learning-by-supplying due to the positive effect of forward GVC participation on labour productivity. The analysis also shows the significance of R&D, digital technology, and foreign investment in promoting labour productivity. Thus, based on these findings, policymakers should set policies enhancing forward GVC participation as a priority, whereas policies to promote backward GVC participation should be well designed and accompanied by policies that ensure technology transfer and domestic technology development to avoid the trap of a subordinate role.

One possible caveat in the analysis may be that the estimation model does not explicitly control industry- and country-level factors, such as input tariff liberalisation. However, the estimation model controls for year and industry fixed effects, potentially mitigating this concern. Future research may consider employing a natural experiment to control for exogenous shocks to GVC participation. Moreover, due to data constraints, the analysis cannot account for the actual pattern of forward GVC participation and may overestimate the effect of forward GVC participation on labour productivity. The problem is common amongst GVC studies at the firm level and, therefore, urges rigorous GVC data collection. More comprehensive GVC data potentially benefit future research examining the role of forward GVC participation on labour productivity and other aspects.

Lastly, this study demonstrates the different estimated results between GVC participation indicators, status versus level/degree. This may be the result of the changes in sample firms. The sample with GVC participation dummies includes firms that switched between GVC and non-GVC status. In contrast, the sample with the GVC participation index involves firms that changed their degree of participation. A more detailed analysis considering the changes in firm GVC participation status, firm position in value chains, and the product level (i.e. what firms import and export) may help better understand the mechanism of GVC participation and labour productivity.

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Appendix

Table A1: Comparison of the Matched TCS and VES Sample and VES Sample, Unbalanced Panel

		Total				2009				2010			
		TCS and VES		VES		TCS and VES		VES		TCS and VES		VES	
Firm Characteristics		n	%	n	%	n	%	n	%	n	%	n	%
Total		60,926		648,357		7,672		45,766		7,881		51,560	
	of which:												
Firm size													
	SME	50,544	83.0	616,407	95.1	6,511	84.9	43,002	94.0	6,715	85.2	48,772	94.6
	Large	10,382	17.0	31,950	4.9	1,161	15.1	2,764	6.0	1,166	14.8	2,788	5.4
Ownership													
	SOE	628	1.0	14,295	2.2	20	0.3	648	1.4	9	0.1	639	1.2
	Private	44,572	73.2	577,087	89.0	5,938	77.4	40,638	88.8	6,198	78.6	45,857	88.9
	FDI	15,726	25.8	56,975	8.8	1,716	22.4	4,480	9.8	1,679	21.3	5,064	9.8
Region													
	Red River Delta	17,704	29.1	197,382	30.4	2,342	30.5	12,490	27.3	2,299	29.2	15,356	29.8
	North-East	3,129	5.1	25,748	4.0	332	4.3	1,669	3.7	390	5.0	2,068	4.0
	North-West	987	1.6	7,911	1.2	110	1.4	671	1.5	137	1.7	689	1.3
	North Central	3,172	5.2	27,598	4.3	383	4.99	1,946	4.3	452	5.7	2,120	4.1
	South Central Coast	4,679	7.7	41,892	6.5	565	7.4	2,976	6.5	619	7.9	3,349	6.5
	Central Highlands	1,104	1.8	11,159	1.7	131	1.7	818	1.8	146	1.9	950	1.8
	South-East	23,244	38.2	282,886	43.6	2,994	39.0	21,086	46.1	2,921	37.0	22,438	43.5
	Mekong River Delta	6,907	11.3	53,781	8.3	817	10.7	4,110	9.0	922	11.7	4,590	8.9
		2011				2012				2013			
		TCS and VES		VES		TCS and VES		VES		TCS and VES		VES	
Firm Characteristics		n	%	n	%	n	%	n	%	n	%	n	%
Total		8,290		54,657		7,657		55,787		7,134		59,019	
	of which:												
Firm size													

	SME	7,130	86.0	51,841	94.8	6,556	85.6	52,963	95.0	6,078	85.2	56,108	95.1
	Large	1,160	14.0	2,816	5.2	1,101	14.4	2,824	5.1	1,056	14.8	2,911	4.9
Ownership													
	SOE	43	0.5	1,634	3.0	216	2.8	1,654	3.0	201	2.82	1,706	2.9
	Private	6,460	77.9	52,572	96.2	5,739	74.9	49,080	88.0	5,306	74.4	51,734	87.7
	FDI	1,787	21.6	451	0.8	1,704	22.3	5,053	9.1	1,627	22.8	5,579	9.5
Region													
	Red River Delta	2,382	28.7	15,458	28.3	2,194	28.7	16,638	29.8	2,095	29.4	17,904	30.3
	North-East	441	5.3	2,095	3.8	413	5.4	2,036	3.7	393	5.51	2,314	3.9
	North-West	160	1.9	663	1.2	143	1.9	663	1.2	125	1.75	772	1.3
	North Central	434	5.2	2,309	4.2	417	5.4	2,311	4.1	398	5.58	2,526	4.3
	South Central Coast	639	7.7	3,681	6.7	613	8.0	3,680	6.6	573	8.03	3,848	6.5
	Central Highlands	161	1.9	1,000	1.8	143	1.9	1,002	1.8	146	2.05	1,055	1.8
	South-East	3,096	37.4	24,740	45.3	2,849	37.2	24,744	44.4	2,565	36	25,850	43.8
	Mekong River Delta	977	11.8	4,711	8.6	887	11.6	4,713	8.5	839	11.8	4,750	8.1

		2014				**2015**				**2016**			
		TCS and VES		**VES**		**TCS and VES**		**VES**		**TCS and VES**		**VES**	
Firm Characteristics		n	%	n	%	n	%	n	%	n	%	n	%
Total		4,733		63,701		4,770		64,064		4,484		76,178	
	of which:												
Firm size													
	SME	3,776	79.8	60,637	95.2	3,758	78.8	60,654	94.7	3,539	78.9	72,444	95.1
	Large	957	20.2	3,064	4.8	1,012	21.2	3,410	5.3	945	21.1	3,734	4.9
Ownership													
	SOE	29	0.6	1,762	2.8	29	0.6	1,534	2.4	29	0.7	1,589	2.1
	Private	3,240	68.5	55,964	87.9	3,227	67.6	56,061	87.5	3,035	67.7	67,187	88.2
	FDI	1,464	30.9	5,975	9.4	1,516	31.8	6,469	10.1	1,420	31.7	7,402	9.7
Region													
	Red River Delta	1,230	26.0	19,673	30.9	1,483	31.1	20,754	32.4	1,230	27.4	23,480	30.8
	North-East	259	5.5	2,433	3.8	245	5.1	2,393	3.7	230	5.1	3,015	4.0
	North-West	70	1.5	794	1.3	71	1.5	775	1.2	60	1.3	887	1.2
	North Central	228	4.8	2,670	4.2	235	4.9	2,668	4.2	223	5.0	3,230	4.2

	South Central Coast	368	7.8	4,076	6.4	357	7.5	4,033	6.3	343	7.7	4,910	6.5
	Central Highlands	81	1.7	1,066	1.7	79	1.7	986	1.5	83	1.9	1,250	1.6
	South-East	1,949	41.2	27,938	43.9	1,778	37.3	27,010	42.2	1,823	40.7	33,298	43.7
	Mekong River Delta	548	11.6	5,051	7.9	524	11.0	5,445	8.5	492	11.0	6,108	8.0

		2017				2018			
		TCS and VES		VES		TCS and VES		VES	
Firm Characteristics		n	%	n	%	n	%	n	%
Total		4,320		84,248		3,974		93,377	
	of which:								
Firm size									
	SME	3,375	78.1	80,458	95.5	3,106	78.2	89,528	95.9
	Large	945	21.9	3,790	4.5	868	21.8	3,849	4.1
Ownership									
	SOE	24	0.56	1,584	1.9	28	0.7	1,545	1.7
	Private	2,846	65.9	74,354	88.3	2,583	65.0	83,640	89.6
	FDI	1,450	33.6	8,310	9.9	1,363	34.3	8,192	8.8
Region									
	Red River Delta	1,291	29.9	26,970	32.0	1,158	29.1	28,659	30.7
	North-East	222	5.14	3,616	4.3	204	5.1	4,109	4.4
	North-West	59	1.37	954	1.1	52	1.3	1,043	1.1
	North Central	204	4.72	3,699	4.4	198	5.0	4,119	4.4
	South Central Coast	315	7.29	5,607	6.7	287	7.2	5,732	6.1
	Central Highlands	67	1.55	1,473	1.8	67	1.7	1,559	1.7
	South-East	1,711	39.6	34,966	41.5	1,558	39.2	40,816	43.7
	Mekong River Delta	451	10.4	6,963	8.3	450	11.3	7,340	7.9

FDI = foreign-owned firms and joint ventures, SME = small or medium-sized enterprise, SOE = state-owned enterprise, TCS = Vietnam Technology and Competitiveness Survey, VES = Vietnam Enterprise Survey.

Source: Authors.

Table A2: Comparison of the Matched TCS and VES Sample and VES Sample, Balanced Panel

	Total				2009				2010			
	TCS and VES		VES		TCS and VES		VES		TCS and VES		VES	
Firm Characteristics	n	%	n	%	n	%	n	%	n	%	n	%
Total	23,458		648,357		2,346		45,766		2,346		51,560	
of which:												
Firm size												
SME	17,591	75.0	616,407	95.1	1,793	76.4	43,002	94.0	1,757	74.9	48,772	94.6
Large	5,867	25.0	31,950	4.9	553	23.6	2,764	6.0	589	25.1	2,788	5.4
Ownership												
SOE	52	0.2	14,295	2.2	5	0.2	648	1.4	6	0.3	639	1.2
Private	14,805	63.1	577,087	89.0	1,479	63.0	40,638	88.8	1,478	63.0	45,857	88.9
FDI	8,603	36.7	56,975	8.8	862	36.7	4,480	9.8	862	36.7	5,064	9.8
Region												
Red River Delta	5,910	25.2	197,382	30.4	591	25.2	12,490	27.3	591	25.2	15,356	29.8
North-East	1,070	4.6	25,748	4.0	107	4.6	1,669	3.7	107	4.6	2,068	4.0
North-West	350	1.5	7,911	1.2	35	1.5	671	1.5	35	1.5	689	1.3
North Central	1,130	4.8	27,598	4.3	113	4.8	1,946	4.3	113	4.8	2,120	4.1
South Central Coast	2,070	8.8	41,892	6.5	207	8.8	2,976	6.5	207	8.8	3,349	6.5
Central Highlands	360	1.5	11,159	1.7	36	1.5	818	1.8	36	1.5	950	1.8

South-East	9,860	42.0	282,886	43.6	986	42.0	21,086	46.1	986	42.0	22,438	43.5
Mekong River Delta	2,710	11.6	53,781	8.3	271	11.6	4,110	9.0	271	11.6	4,590	8.9

	2011				**2012**				**2013**			
	TCS and VES		**VES**		**TCS and VES**		**VES**		**TCS and VES**		**VES**	
Firm Characteristics	n	%	n	%	n	%	n	%	n	%	n	%
Total	2,346		54,657		2,346		55,787		2,346		59,019	
of which:												
Firm size												
SME	1,757	74.9	51,841	94.8	1,764	75.2	52,963	95.0	1,754	74.8	56,108	95.1
Large	589	25.1	2,816	5.2	582	24.8	2,824	5.1	592	25.2	2,911	4.9
Ownership												
SOE	7	0.3	1,634	3.0	8	0.3	1,654	3.0	7	0.3	1,706	2.9
Private	1,477	63.0	52,572	96.2	1,479	63.0	49,080	88.0	1,482	63.2	51,734	87.7
FDI	862	36.7	451	0.8	859	36.6	5,053	9.1	857	36.5	5,579	9.5
Region												
Red River Delta	591	25.2	15,458	28.3	591	25.2	16,638	29.8	591	25.2	17,904	30.3
North-East	107	4.6	2,095	3.8	107	4.6	2,036	3.7	107	4.6	2,314	3.9
North-West	35	1.5	663	1.2	35	1.5	663	1.2	35	1.5	772	1.3
North Central	113	4.8	2,309	4.2	113	4.8	2,311	4.1	113	4.8	2,526	4.3
South Central Coast	207	8.8	3,681	6.7	207	8.8	3,680	6.6	207	8.8	3,848	6.5
Central Highlands	36	1.5	1,000	1.8	36	1.5	1,002	1.8	36	1.5	1,055	1.8

South-East	986	42.0	24,740	45.3	986	42.0	24,744	44.4	986	42.0	25,850	43.8
Mekong River Delta	271	11.6	4,711	8.6	271	11.6	4,713	8.5	271	11.6	4,750	8.1

Firm characteristics	**2014**				**2015**				**2016**			
	TCS and VES		**VES**		**TCS and VES**		**VES**		**TCS and VES**		**VES**	
	n	%	n	%	n	%	n	%	n	%	n	%
Total	2,346		63,701		2,346		64,064		2,346		76,178	
of which:												
Firm size												
SME	1,731	73.8	60,637	95.2	1,737	74.1	60,654	94.7	1,751	74.6	72,444	95.1
Large	615	26.2	3,064	4.8	607	25.9	3,410	5.3	595	25.4	3,734	4.9
Ownership												
SOE	3	0.1	1,762	2.8	4	0.2	1,534	2.4	4	0.2	1,589	2.1
Private	1,482	63.2	55,964	87.9	1,479	63.0	56,061	87.5	1,481	63.1	67,187	88.2
FDI	861	36.7	5,975	9.4	863	36.8	6,469	10.1	861	36.7	7,402	9.7
Region												
Red River Delta	591	25.2	19,673	30.9	591	25.2	20,754	32.4	591	25.2	23,480	30.8
North-East	107	4.6	2,433	3.8	107	4.6	2,393	3.7	107	4.6	3,015	4.0
North-West	35	1.5	794	1.3	35	1.5	775	1.2	35	1.5	887	1.2
North Central	113	4.8	2,670	4.2	113	4.8	2,668	4.2	113	4.8	3,230	4.2
South Central Coast	207	8.8	4,076	6.4	207	8.8	4,033	6.3	207	8.8	4,910	6.5
Central Highlands	36	1.5	1,066	1.7	36	1.5	986	1.5	36	1.5	1,250	1.6

South-East	986	42.0	27,938	43.9	986	42.0	27,010	42.2	986	42.0	33,298	43.7
Mekong River Delta	271	11.6	5,051	7.9	271	11.6	5,445	8.5	271	11.6	6,108	8.0

	2017				2018			
	TCS and VES		VES		TCS and VES		VES	
Firm Characteristics	n	%	n	%	n	%	n	%
Total	2,346		84,248		2,346		93,377	
of which:								
Firm size								
SME	1,765	75.2	80,458	95.5	1,782	76.0	89,528	95.9
Large	581	24.8	3,790	4.5	564	24.0	3,849	4.1
Ownership								
SOE	3	0.1	1,584	1.9	5	0.2	1,545	1.7
Private	1,482	63.2	74,354	88.3	1,486	63.3	83,640	89.6
FDI	861	36.7	8,310	9.9	855	36.5	8,192	8.8
Region								
Red River Delta	591	25.2	26,970	32.0	591	25.2	28,659	30.7
North-East	107	4.6	3,616	4.3	107	4.6	4,109	4.4
North-West	35	1.5	954	1.1	35	1.5	1,043	1.1
North Central	113	4.8	3,699	4.4	113	4.8	4,119	4.4
South Central Coast	207	8.8	5,607	6.7	207	8.8	5,732	6.1
Central Highlands	36	1.5	1,473	1.8	36	1.5	1,559	1.7

South-East	986	42.0	34,966	41.5	986	42.0	40,816	43.7
Mekong River Delta	271	11.6	6,963	8.3	271	11.6	7,340	7.9

FDI = foreign-owned firms and joint ventures, SME = small or medium-sized enterprise, SOE = state-owned enterprise, TCS = Vietnam Technology and Competitiveness Survey, VES = Vietnam Enterprise Survey.
Source: Authors.

Table A3: Correlation Coefficients for Variables

	LP	BGVCI	BGVCD	FGVCI	FGVCD	
LP	1					
BGVCI	–0.0723	1				
BGVCD	0.1771	0.6037	1			
FGVCI	0.057	–0.0256	0.0016	1		
FGVCD	0.1255	0.1642	0.2309	0.6344	1	
K/L	0.6891	–0.1413	0.0932	0.0187	0.0964	
K/L 2	0.3202	–0.1988	–0.0504	0.0267	0.0755	
SME	–0.0851	–0.3502	–0.3855	–0.0355	–0.1070	
R&D	0.0469	–0.0045	0.0729	–0.0050	0.0111	
Modern technology	0.0323	0.0582	0.0933	0.0059	0.0204	
Foreign ownership	0.0928	0.4844	0.5179	0.0888	0.2506	
	K/L	**K/L 2**	**SME**	**R&D**	**Modern Technology**	**Foreign Ownership**
LP						
BGVCI						
BGVCD						
FGVCI						
FGVCD						
K/L	1					
K/L 2	0.4640	1				
SME	0.0929	0.2391	1			
R&D	0.0429	–0.0038	–0.0859	1		
Modern technology	0.0351	–0.0218	–0.0887	0.0850	1	
Foreign ownership	0.0272	–0.0439	–0.3070	–0.0349	0.0115	1

BGVCD = backward GVC participation dummy, BGVCI = backward GVC participation index, FGVCD = forward GVC participation dummy, FGVCI = forward GVC participation index, K/L = total assets per worker, K/L 2 = total value of machinery and technology per worker, LP = labour productivity, R&D = research and development (dummy), SME = small or medium-sized enterprise (dummy).
Source: Authors.

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