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**TRADE, GLOBAL VALUE CHAINS,
AND SMALL AND MEDIUM-SIZED
ENTERPRISES IN THAILAND: A
FIRM-LEVEL PANEL ANALYSIS**

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In this report, "$" refers to United States dollars.

Abstract

This study assesses the determinants of global value chain (GVC) participation and the relationship between the degree of GVC participation and firms' performance. The main estimation method for both analyses is a panel fixed-effect regression employing unique panel firm-level data from the Office of Industrial Economics, Ministry of Industry, Thailand for the period 2004–2014. Our results show that small and medium-sized enterprises (SMEs) have a lower degree of engagement in both backward and forward GVC participation when compared with larger firms (non-SMEs). This study also finds that GVC participation, both backward and forward participation, is positively associated with firms' performance. Our results imply that being an SME is associated with a lower degree of GVC participation, but GVC participation can help firms (both SMEs and large firms) increase their revenues. Hence, policies to help local SMEs to enter GVCs smoothly would be the priority.

Keywords: global value chain, GVC, small and medium-sized enterprises, SMEs, Thailand, firm level, panel analysis

JEL Classification: F13, F14, L11, L25, L26, O24

Contents

1. INTRODUCTION

Small and medium-sized enterprises (SMEs) are significant contributors to economic activity and employment worldwide and Thailand is no exception. SMEs represent the vast majority of firms and employ the bulk of the domestic workforce. According to the Office of SMEs Promotion (OSMEP) (2019), there were approximately 3 million companies considered SMEs, which accounted for 99.8% of the total number of companies, in 2018. Moreover, SMEs generate 14 million jobs, equal to 86% of the total employment. Over the last year, the number of SMEs and their consequent employment grew by 1% and 4.7%, respectively. SMEs also contributed enormously to Thailand's gross domestic product (GDP) as they accounted for 45% of the national GDP, or around $215 billion. Despite SMEs' important economic contributions, their participation in international trade and global value chains (GVCs) remains limited. In 2018, the export volume of SMEs made up only 29% of the total export or $76 billion, while showing small growth at 0.5% (OSMEP 2019). In contrast, large domestic firms and multinational enterprises (MNEs) dominate GVCs and therefore benefit largely from new opportunities emerging from their participation.

The spread of GVCs coupled with the rapid development of new technologies present opportunities and challenges to SMEs. On the one hand, participation in GVCs can benefit SMEs in terms of: 1) capabilities and competitiveness enhancement; 2) product quality improvement; 3) financial stability; and 4) market expansion. By being involved in GVCs, SMEs can be exposed to new business partners, especially leading global firms. Through this interaction, SMEs can increase their productivity by meeting international standards and requirements, while continuously improving product quality through knowledge and technology transfer. On the other hand, SMEs' involvement in GVCs can be hindered by several requirements, including: 1) the ability to meet international standards; 2) greater managerial and financial resources; and 3) the protection of in-house intellectual property (UNCTAD 2010). These requirements are difficult to satisfy as SMEs face constraints in terms of economies of scale, access to finance and information, and technological capacity (Korwatanasakul 2019; Korwatanasakul and Intarakumnerd 2020).

Against this backdrop, this study aims to address two research questions that disentangle the relationship between GVC participation and SMEs. Firstly, what are firms' characteristics that determine GVC participation? Secondly, does GVC participation enhance SMEs' performance (e.g., total revenues) and competitiveness? This study tries to identify the determinants of GVC participation based on firm characteristics and also examines the relationship between GVC participation and firms' performance at the firm level based on the augmented production function. The main estimation method for both analyses is a panel fixed-effect regression using panel data from the Office of Industrial Economics (OIE), Ministry of Industry, Thailand for the period 2004–2014. Our results show that SMEs are involved less in both backward and forward GVC participation than larger firms (non-SMEs). This study also finds that GVC participation, both backward and forward, is positively associated with firms' performance. Our results imply that SMEs found difficulties in participating in GVCs, but GVC participation can help firms (both SMEs and large firms) increase their revenues. Therefore, policies aimed at helping local SMEs to smoothly enter GVCs would be the priority.

2. SMES IN THAILAND

2.1 SMEs and Thai Economy

SMEs[1] contributed to the Thai economy about 45% of the total GDP or seven trillion baht ($215 billion) in 2018, which was even larger than the economic contribution of large-sized enterprises (LEs) (Figure 1). In addition, Figure 1 shows that small enterprises (SEs) accounted for a higher share of GDP (31%) than medium-sized enterprises (MEs) (12%). Therefore, SMEs, especially SEs, are one of the main driving forces of the Thai economy. Table 1 compares the breakdowns of national GDP and SME-generated GDP by economic sector in 2018. The share of each sector was similar between the two breakdowns, except that of the wholesale and retail sector. The wholesale and retail sector contributed to a larger share of GDP when considering the breakdown of SME-generated GDP (31.4%), while the share of this sector in the national GDP was 15.9%. Hence, SMEs are more economically active in the wholesale and retail sector. The services sector manifested the largest economic contribution both in terms of national GDP and SME-generated GDP. In contrast, the role of the manufacturing sector was larger at the national level. The pattern of economic contributions of SMEs is clearer when further breaking down GDP by economic sector and enterprise size (Table 2). First, the role of LEs was more prominent than that of SMEs in the manufacturing sector as LEs contributed 64% of the GDP generated in the sector. Second, in terms of the wholesale and retail sector, SEs' economic contributions (1.88 trillion baht ($55 billion) or 72%) were significantly greater than the combined contributions of MEs and LEs (0.72 trillion baht or $22 billion). Last, a similar level of contributions between SMEs and LEs toward the sectoral GDP indicated that both SMEs and LEs were equally important in the services sector.

Figure 1: Composition of Thailand's GDP by Enterprise Size, 2018
(Unit: trillions of Thai baht)
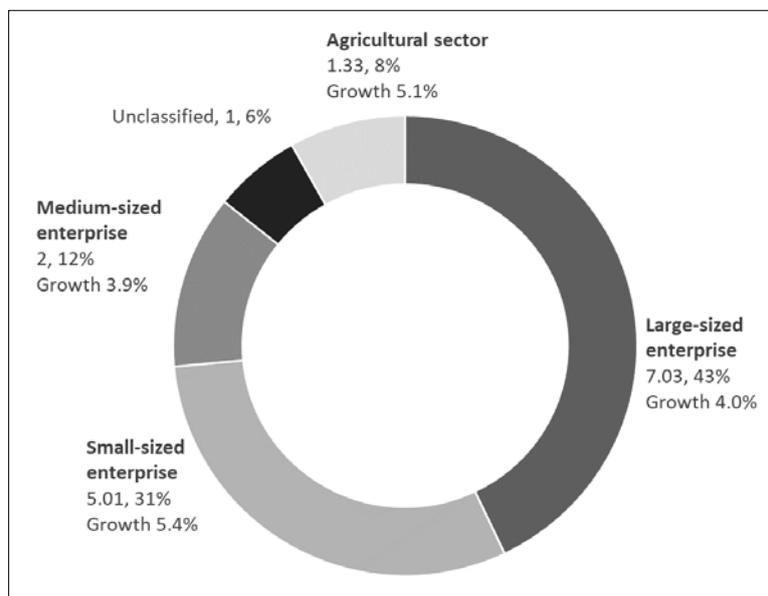
GDP = gross domestic product.
Source: Authors, adjusted from the Office of SMEs Promotion (2019).

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[1] For the definition of SMEs, see Table 4.

Table 1: National GDP and SME-Generated GDP by Economic Sector, 2018

	National GDP		SMEs GDP	
	Share	**Growth**	**Share**	**Growth**
Agriculture	8.1	5.1	na	na
Manufacturing	26.8	3.0	22.6	3.1
Wholesale and retail	15.9	7.3	31.4	7.6
Services	41.0	4.3	39.1	4.6
Other	8.2	1.8	6.9	2.5

GDP = gross domestic product, SMEs = small and medium-sized enterprises, na = not applicable.

Note: Other sectors include mining, construction, power generation, and water utilities.

Source: Authors, adjusted from the Office of SMEs Promotion (2019).

**Table 2: Thailand's GDP Breakdown by Key Economic Sector
and Enterprise Size, 2018**
(Unit: trillions of Thai baht)

	Manufacturing		Wholesale and Retail		Services	
	Value	**Share**	**Value**	**Share**	**Value**	**Share**
Small enterprise	0.64	15%	1.88	72%	2.21	39%
Medium-sized enterprise	0.94	22%	0.32	12%	0.53	9%
Large enterprise	2.78	64%	0.40	15%	2.99	52%
Total	4.37	100%	2.60	100%	5.74	100%

GDP = gross domestic product.

Source: Authors, based on the Office of SMEs Promotion (2019).

In terms of international trade and GVCs, SMEs seem to have very limited involvement. Figure 2 shows that, in 2018, SMEs' shares of exports and imports were only 29% and 37%, respectively. The export and import shares of SMEs have leveled off during the past five years. Even though there appears to have been a positive expansion trend or growth in imports in 2017, both imports and exports experienced growth contraction in 2018 (Figure 3). The contraction of trade is predicted to be prolonged due to the US–People's Republic of China (PRC) trade war and coronavirus outbreak.

Figure 2: Composition of Exports and Imports by Enterprise Size, 2018
(Unit: trillions of Thai baht)
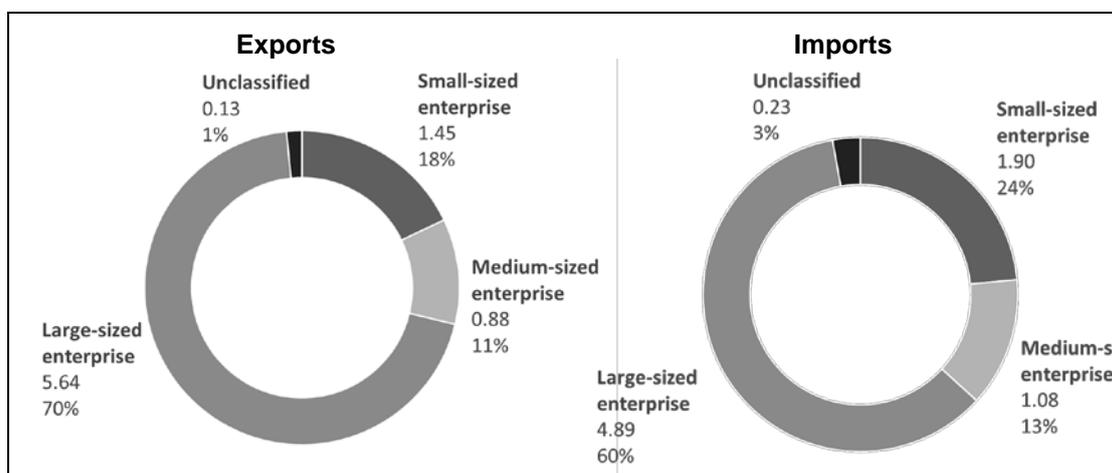
Source: Authors, adjusted from the Office of SMEs Promotion (2019).

Figure 3: Trends of SME Share in Exports and Imports and Expansion Rates, 2014–2018
(Unit: %)
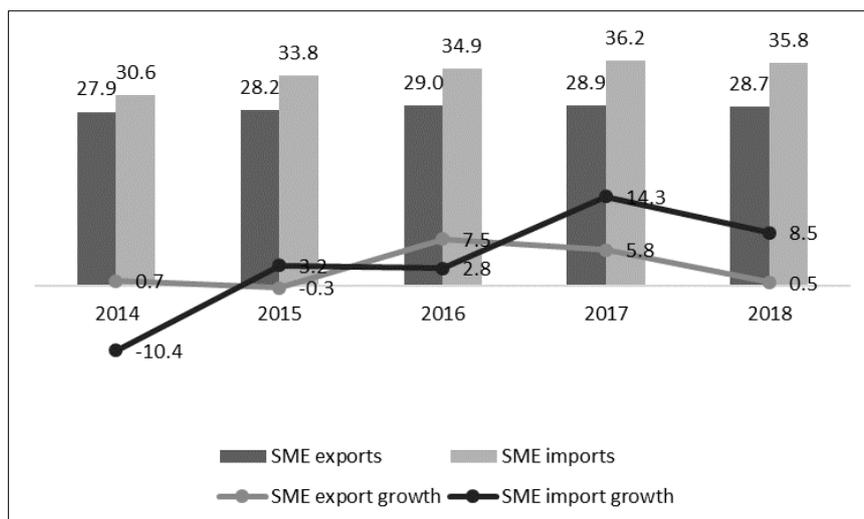
SMEs = small and medium-sized enterprises.
Source: Authors, adjusted from the Office of SMEs Promotion (2019).

In 2018, there were 3 million business enterprises in Thailand, of which 99.8% were SMEs (Table 3). SMEs were concentrated in either the trading business (wholesale and retail sector) or services sector (Figure 4). This is consistent with the SMEs' GDP contribution presented in Tables 1 and 2. As regards the breakdown of SME concentration by region, Figure 5 indicates that the northeast region accounted for the highest concentration of SMEs, while the east region showed the lowest concentration. As the east region is not highly populated and is promoted as an area of special economic zones, generally for foreign MEs and LEs, this may explain the low concentration of SMEs in this region. However, the share of SMEs in each region was not significantly different. In other words, SMEs were distributed evenly throughout the country.

Table 3: Breakdown of the Number of Enterprises by Business Sector, 2018
(Unit: firm)

	SE	ME	SMEs	LE	Total
Trading	1,275,470	4,087	1,279,557	2,493	1,282,050
Services	1,219,347	5,216	1,224,563	1,756	1,226,319
Manufacturing	522,886	4,599	527,485	2,152	529,637
Agribusiness	45,948	269	46,217	54	46,271
Total	3,063,651	14,171	3,077,822	6,455	3,084,277

SE = small enterprise, ME = medium-sized enterprise, SMEs = small and medium-sized enterprises, LE = large enterprise.
Source: Authors, based on the Office of SMEs Promotion (2019).

Figure 4: The Number of SMEs by Business Sector, 2018
(Unit: millions of enterprises)
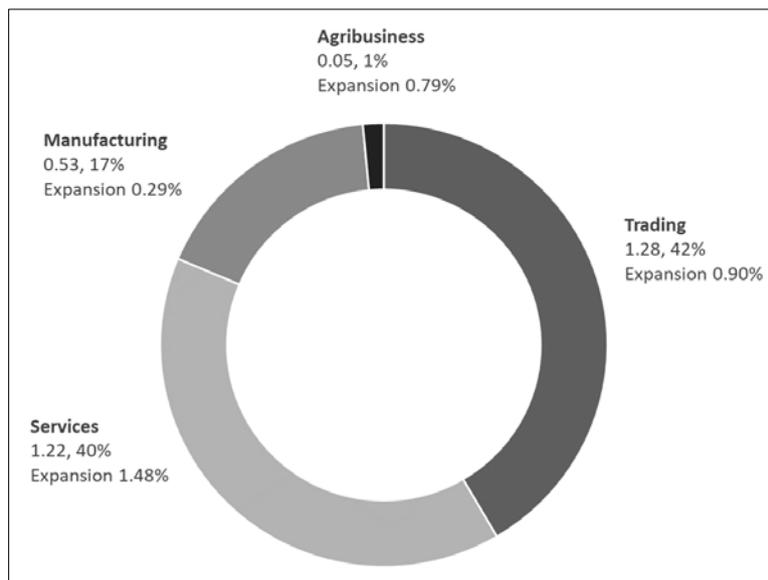
SMEs = small and medium-sized enterprises.
Source: Authors, adjusted from the Office of SMEs Promotion (2019).

In terms of the number of jobs, SMEs employed 14 million people in 2018, which accounted for 86% of the total employment. Over the last year, the SME employment grew by 4.7%. Figure 6 shows the SME employment by business sector in 2018. The employment was heavily concentrated in the services sector (43%), while the agribusiness sector had the lowest concentration of SME employment (1%). By comparing Figure 4 with Figure 6, we can see that the patterns of SME concentration (Figure 4) and SME employment concentration (Figure 6) by business sector are slightly different. According to Figure 4, the concentration of SMEs is similar between the trading business and the services sector, whereas the concentration of SME employment is larger in the services sector than the trading business sector. This may give some policy implications to the government when considering implementing any SME policies that may affect income distribution or employment across different business sectors. In terms of regional distribution, SME employment breakdown by region indicated that the largest concentration of SME employment was in the Bangkok metropolitan area (Figure 7). The distributions of SMEs (Figure 5) and SME employment (Figure 7) by region were quite similar, but the concentration of SME employment was biased toward the central region, including the Bangkok metropolitan area. Implementing any SME-related policies may have slightly different effects on income or other welfare distributions across different regions.

Figure 5: The Number of SMEs by Region, 2018
(Unit: millions of enterprises)

SMEs = small and medium-sized enterprises.
Source: Authors, based on the Office of SMEs Promotion (2019).

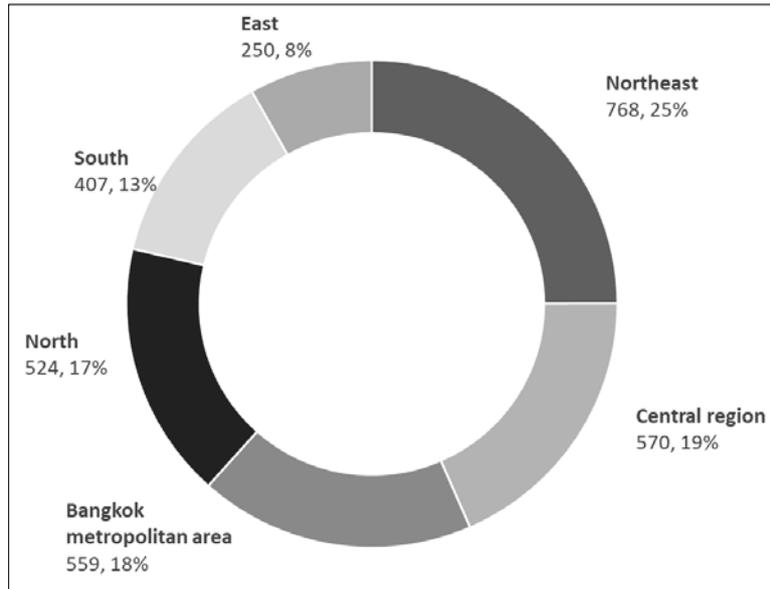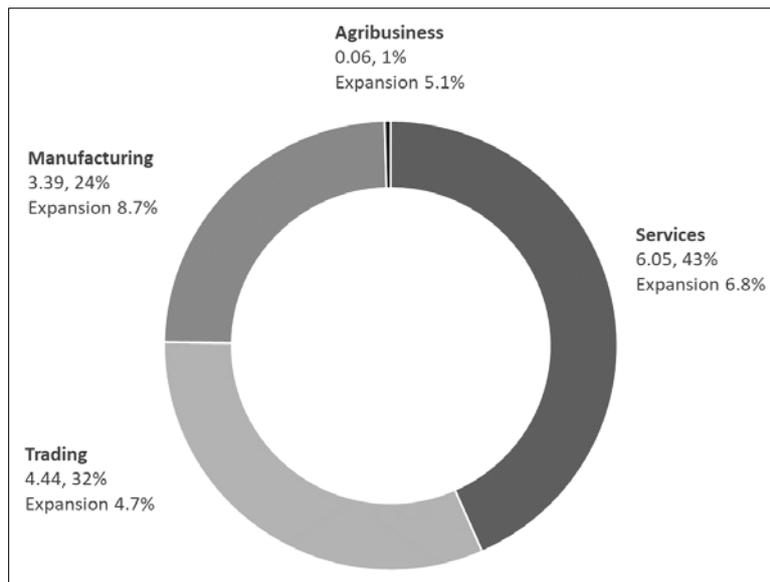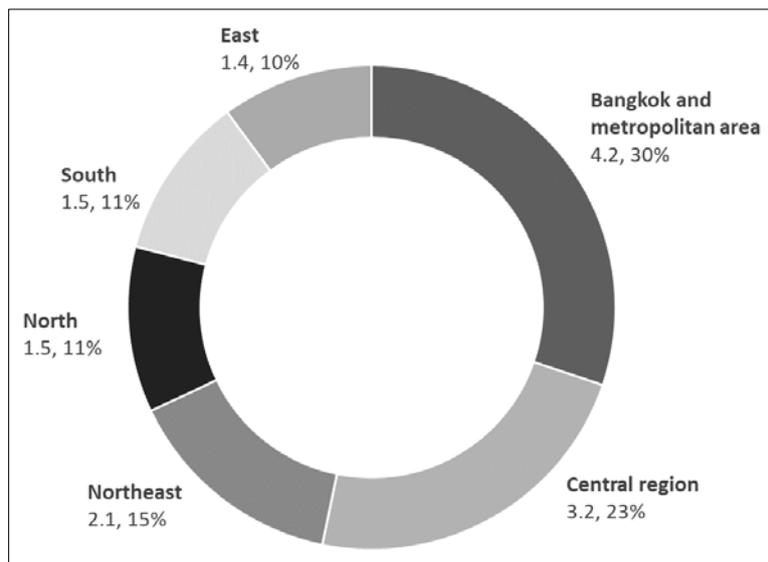**Figure 6: SME Employment by Business Sector, 2018**
(Unit: millions of persons)

SMEs = small and medium-sized enterprises.
Source: Authors, adjusted from the Office of SMEs Promotion (2019).

Figure 7: SME Employment by Region, 2018
(Unit: millions of persons)

SMEs = small and medium-sized enterprises.
Source: Authors based on the Office of SMEs Promotion (2019).

2.2 SME Promotion Policies

Owing to the significant contributions of SMEs in terms of GDP and employment, the Thai government considered SME investment promotion as one of the main national strategies to solve structural economic and social problems and further boost the Thai economy after the 1997 financial crisis in Thailand. In 2000, the government pushed forward the idea of an SME investment promotion policy by enacting the SME Promotion Act BE2543. The Act, together with the ministerial regulation on SMEs' number of employees and the value of total fixed assets BE2545 issued by the Ministry of Industry (Thailand) (2002), established the official definition and classification of SMEs. The business sector, the number of employees, and the value of total fixed assets were the criteria of the classification (Table 4). To reflect the reality of the modern economy, in 2019, the government introduced a new definition and classification of SMEs (effective in January 2020). The modifications have been made in three areas, namely enterprise category, classification criteria, and sector grouping. First, a new enterprise category, "micro-sized enterprise," was created. Second, the classification criterion of total fixed assets was replaced by the new criterion of annual revenue, while the classification details of the number of employees were adjusted. Third, the services sector and the trading sector (wholesale and retail) were combined and subject to the same criteria. Details of the classification are presented in Table 5.

The product of the SME Promotion Act was the establishment of the Office of SMEs Promotion (OSMEP) in 2001. OSMEP is a governmental agency responsible for developing the SME promotion master plan and the promotion action plan by coordinating the work among different ministries and agencies. So far, OSMEP has delivered four five-year SME promotion master plans since 2002. Each master plan is tailored to reflect the current economic situation of each time period and prepare SMEs for current and future opportunities and challenges. The first plan (2002–2006) focused on economic recovery, infrastructure improvement, and enhancement of SMEs' competitiveness, especially SMEs in the export and services sectors, while the second

plan (2007–2011) emphasized preparing SMEs for knowledge-based and highly dynamic business opportunities (Turner et al. 2016). Balanced and sustainable growth with a strong emphasis on SMEs in the technology and innovation industry was the guiding concept for the third plan (2012–2016). The current SME promotion master plan is the fourth one and was implemented in 2017.

Table 4: 2002 Definition of SMEs

Sector	Small Enterprises		Medium-sized Enterprises	
	Fixed Asset[a]	Employee[b]	Fixed Asset[a]	Employee[b]
Manufacturing	≤ 50	≤ 50	> 50 and ≤ 200	51 – 200
Services	≤ 50	≤ 50	> 50 and ≤ 200	51 – 200
Wholesale	≤ 50	≤ 25	> 50 and ≤ 100	26 – 50
Retail	≤ 30	≤ 15	> 30 and ≤ 60	16 – 30

[a] million baht, [b] persons, "≤" = less than or equal to, ">" = greater than, SMEs = small and medium-sized enterprises.

Source: Authors, based on the ministerial regulation on SMEs' number of employees and the value of total fixed assets BE2545, Ministry of Industry (Thailand) (2002).

Table 5: 2019 Definition of SMEs

Sector	Micro-sized Enterprise		Small Enterprises		Medium-sized Enterprises	
	Annual Revenue[a]	Employee[b]	Annual Revenue[a]	Employee[b]	Annual Revenue[a]	Employee[b]
Manufacturing	≤ 1.8	≤ 5	≤ 100	≤ 50	> 100 and ≤ 500	> 50 and ≤ 200
Services, wholesale, and retail	≤ 1.8	≤ 5	≤ 50	≤ 30	> 50 and ≤ 300	> 30 and ≤ 100

Notes: [a]million baht, [b]persons, "≤" = less than or equal to, ">" = greater than, SMEs = small and medium-sized enterprises.

1. If the number of employees meets the criterion of one enterprise category, but annual revenue meets the criterion of another enterprise category, the criteria of annual revenue determine the enterprise category.

2. Micro-sized enterprises are part of small-sized enterprises.

Source: Authors, based on the ministerial regulation on SMEs' classification BE2562, Ministry of Industry (Thailand) (2019).

The fourth master plan (2017–2021) underlines the significance of SMEs as a competitive growth engine and an inclusive growth mechanism and aims to raise GDP created by SMEs to achieve at least 50% of the total GDP by 2021. The vision of this plan is to make doing easier for SMEs; increase the competitiveness of the existing SMEs (Smart SME); and help new SMEs (e.g., tech start-ups, creative start-ups, and cultural start-ups) to become high-value start-ups. Based on this vision, OSMEP developed three strategies, namely issue-based development and support programs for SMEs, business or industry-specific competitiveness enhancement, and the development of systematic growth-driven mechanisms for SMEs.

The first strategy, issue-based development and support programs for SMEs, puts emphasis on the creation of an ecosystem that helps increase overall SMEs' competitiveness and capability. Policy areas covered under this strategy include technology and innovation upgrading, ease of financial accessibility (e.g., a measure of exchange rate risk prevention, a revival fund for SMEs, low-interest loans for capital investment (transformation loans), among others), business-to-government and international market penetration, and entrepreneurship development programs.

With regard to the second strategy, OSMEP tailors their policies to support different groups of SMEs based on the nature of their business and industry, e.g., high-value start-ups and traditional SMEs, among others. Policies to promote high-value start-ups entail the development of research and development (R&D), creative and design centres, start-up accelerator programs, ease of access to credits, relaxation of rules and regulations, and promotion of incentive programs. In contrast, policies to promote traditional SMEs focus on enhancing competitiveness, local market development, credit access improvement (e.g., local economy loans), and technology and product quality upgrading. The second strategy also supports the creation of SME clusters and networks, which help SMEs to smoothly participate in regional and global value chains. Last, the development of systematic growth-driven mechanisms for SMEs was proposed as the third strategy. This strategy aims to promote more efficient and effective SME support programs by developing tools to support SMEs' efficiency, revising rigid laws and regulations that may hinder the growth of SMEs, and devising more attractive incentive programs. Table 6 summarizes the visions, strategies, and policies described in the fourth SME promotion master plan.

Table 6: The Fourth SME Promotion Master Plan

Goal	
To raise GDP created by SMEs to achieve at least 50% of the total GDP by 2021	
Vision	
1. To improve the ease of doing SME business 2. To increase the competitiveness of the existing SMEs (Smart SME) 3. To support start-ups in becoming high-value start-ups	

Strategies	Policies
1. Issue-based development and support programs for SMEs	1. Technology and innovation upgrading 2. Ease of financial accessibility, e.g., a measure of exchange rate risk prevention, a revival fund for SMEs, low-interest loans for capital investment (transformation loans), among others. 3. Business-to-government and international market penetration 4. Entrepreneurship development programs
2. Business or industry-specific competitiveness enhancement	High-value start-ups 1. The development of research and development, creative and design centres 2. Start-up accelerator programs 3. Ease of access to credits 4. Relaxation of rules and regulations 5. Promotion of incentive programs Traditional SMEs 1. Competitiveness enhancement 2. Local market development 3. Credit access improvement, e.g., local economy loan 4. Technology and product quality upgrading
3. Development of systematic growth-driven mechanisms for SMEs	1. Development of tools to support SMEs' efficiency 2. Revision of rigid laws and regulations 3. Creation of more attractive incentive programs

SMEs = small and medium-sized enterprises, GDP = gross domestic product.
Source: Authors, based on the Office of SMEs Promotion (2017) and Wasi, Sa-ngimnet, and Monchaitrakul (2019).

Even though the current SME promotion plan did not have explicit strategies regarding GVC participation, the promotion plan proposed a few goals, objectives, and policy plans in terms of export enhancement under the first and second strategies. By 2021, OSMEP aims to accomplish two goals, namely achieving 30% of the national export volumes and raising the average annual export values of SMEs to 100 million baht ($3.1 million) per

enterprise. To this end, OSMEP, with the cooperation of three other government agencies, namely the Department of International Trade Promotion (Ministry of Commerce), the Board of Investment (Office of the Prime Minister), and the National Science and Technology Development Agency (Ministry of Science and Technology), set the objectives to raise SMEs' capabilities with regard to international market penetration, SME overseas investment, and involvement in large enterprises' supply chains. The corresponding policy plans were mainly in line with Thailand's industry 4.0 policy that heavily promoted the utilization of technology and innovation, such as E-commerce, market intelligence, product and services upgrading, among others. E-commerce was considered one of the channels to help SMEs penetrate the international market, while market intelligence was expected to help SMEs access comprehensive and necessary data and information regarding foreign markets and overseas investment, e.g., rules and regulations, trade statistics, foreign trading and business partners, etc. Moreover, incentive programs were put in place to directly and indirectly support SMEs. "Internationalization grants" helped SMEs to participate in overseas business promotion events such as business matching and product roadshows, among others. There was also an incentive program given to large enterprises that involved SMEs in their supply chains. This program indirectly helped SMEs to become part of GVCs.

3. LITERATURE REVIEW

GVCs have gained momentum in the emerging international trade and development literature. A large body of research has comprehensively examined the relationship between GVCs and productivity gains at country and industry level. However, little is known about the link between GVCs and firms' performance and competitiveness, especially in the context of SMEs and developing countries, due to the lack of comprehensive data and, in turn, limited empirical research.

Since the late 2000s, the awareness of the role of SMEs in GVCs and the concern over the uneven benefits generated from GVC participation have been raised among international organizations such as the United Nations Conference on Trade and Development (UNCTAD) and the Organisation for Economic Co-operation and Development (OECD). The first wave of studies was limited to case studies either by specific firms or by sector to explore the role of SMEs in the GVCs, the benefits of GVC participation, and the barriers preventing SMEs from joining GVCs. The studies cover a wide range of industries and countries, e.g., the automotive industry in Japan; the scientific and precision instrument industry in Australia; the software industry in Turkey; and the textile industry in Taipei,China, among others. In general, the studies (e.g., Chen 2019; OECD 2008) found that SMEs can get involved in GVCs through the following roles: as an original equipment manufacturer (OEM) or subcontractor, as an original brand manufacturer (OBM), or as an intermediate trader and supplier. The studies (e.g., APEC Study Center 2017; OECD 2008) also revealed some key benefits of GVC participation, including product upgrading, product specialization and niche market positioning, productivity and efficiency enhancement, market expansion, acquisition of knowledge, and innovation engagement. Nevertheless, SMEs may not be able to enjoy those benefits due to: 1) inadequate knowledge, technology, and innovation capacity; 2) the lack of managerial, financial, and human resources; 3) difficulties in complying with international standards and requirements; 4) limited economies of scale, productivity, and price competitiveness; and 5) manufacturing inflexibility and difficult bargaining position against a few large global firms (e.g., Hatsukano and Tanaka 2014; Korwatanasakul 2019; Korwatanasakul and Intarakumnerd 2020; Kotturu and Mahanty 2017; OECD 2007, 2008).

Among the limited amount of literature on SMEs and GVCs, current debates in the literature can be categorized into three areas, namely: 1) the quantification of SMEs' GVC participation; 2) the determinants of GVC participation in the context of SMEs; and 3) the relationship between GVC participation and SMEs' performance.

Quantification of SMEs' GVC participation: More recent studies (e.g., Cusolito, Safadi, and Taglioni 2016; Miao and Fortanier 2018; OECD 2019) have focused on how to measure domestic and foreign value-added components at firm level. By combining firm-level data with the Trade in Value Added (TiVA) database, the studies provide descriptive analysis of how firms of different sizes engage in GVCs. They found that GVC participation is heterogeneous between SMEs and larger firms in terms of trade patterns and their impact and that SMEs participate in GVCs largely through indirect exports supplied to larger exporting domestic or multinational firms. As the findings show that firms with different sizes or production functions engage differently in GVCs, this raises an interesting concern toward country-level and industry-level analyses of GVC participation.

Determinants of GVC participation in the context of SMEs: Arudchelvan and Wignaraja (2015) and Vidavong, Thipphavong, and Suvannaphakdy (2017) examined the firm characteristics that possibly determine SME participation in GVCs by utilizing a cross-sectional probit regression with firm-level survey data. The common finding was that firm size, measured by the number of employees, is positively associated with SMEs' likelihood of engaging in GVCs. Arudchelvan and Wignaraja (2015) also found that technology and research and development (R&D) are positively related to GVC participation, whereas Vidavong, Thipphavong, and Suvannaphakdy (2017) observed a contradictory result showing a negative relationship between R&D and participation. Other characteristics such as the number of trained employees and the value of a firm's export positively determine the likelihood of SMEs' participation in GVC (Vidavong, Thipphavong, and Suvannaphakdy 2017).

Relationship between GVC participation and SMEs' performance: Studies in this area estimated the impact of GVC participation on different indicators of SMEs' performance, including the competitiveness gap between SMEs and large firms, the propensity to export, labour productivity, and profits. Although GVC participation was measured differently, overall, the studies found a positive link between GVC participation and SMEs' performance.

On the one hand, Boffa, Jansen, and Solleder (2017) examined the relationship between GVC participation and the competitiveness of SMEs at country level. Their main estimation method is generalized two-stage least squares (G2SLS) estimation using a combination of firm-level and TiVA data. They found that GVC participation in terms of imports to export and domestic value added returning home is positively correlated with SMEs' competitiveness. On the other hand, López González (2017) and Vidavong, Thipphavong, and Suvannaphakdy (2017) conducted their analyses at firm level by utilizing cross-sectional regression and firm-level survey data. López González (2017) proxied GVC participation by share of foreign intermediates and share of foreign ownership, while using propensity to export and labor productivity as indicators of SMEs' performance. Both proxies were found to be positively related to both performance indicators. In the study of Vidavong, Thipphavong, and Suvannaphakdy (2017), GVC participation is a dummy variable, taking a value of one for an SME participating in GVCs, and zero for a nonparticipating SME. They found a positive relationship between GVC participation and SMEs' profits.

To summarize, what has been discovered so far is the following. (1) SMEs can be involved in GVCs as a contractor or supplier of indirect exports to gain benefits from

international production networks. However, GVCs also impose several challenges to SMEs. (2) Firms with different sizes heterogeneously participate in GVCs; therefore, the results of the analyses at country level and industry level may not reflect the reality and may produce wrong policy implications. (3) Among a limited number of previous studies, it is found that firm size plays a significant role in determining GVC participation and the participation is likely to positively contribute to aspects of SMEs' performance such as productivity and profit. Nevertheless, most findings were based on a cross-sectional analysis with a small number of observations and therefore may face the problem of endogeneity and biased estimation. Table 7 summarizes the different methodologies used in previous studies.

Table 7: Summary of Selected Previous Studies

Authors	Area of Study	Estimation Method	Data	Sample	Global Value Chain (GVC) Variables
Arudchelvan and Wignaraja (2015)	Determinants of GVC participation in the context of SMEs	Cross-sectional probit regression	2012 ADB and ADBI firm-level survey data (Malaysia)	207 firms	A dummy variable takes on the value of one if the firm responds positively to the question "is your firm part of a regional/global supply chain?" or zero otherwise.
Vidavong, Thipphavong, and Suvannaphakdy (2017)	Determinants of GVC participation in the context of SMEs	Cross-sectional probit regression	Firm-level survey data (Lao PDR)	135 firms	A dummy variable takes a value of one for an SME participating in GVC, and zero for a nonparticipating SME.
	Relationship between GVC participation and SMEs' performance	Cross-sectional regression	Firm-level survey data (Lao PDR)	135 firms	A dummy variable takes a value of one for an SME participating in GVC, and zero for a nonparticipating SME.
Boffa, Jansen, and Solleder (2017)	Relationship between GVC participation and SMEs' performance	Two-year panel regression: generalized two-stage least squares (G2SLS)	Firm-level and TiVA data	64 Countries	• Imports to export • Domestic value added returning home
López González (2017)	Relationship between GVC participation and SMEs' performance	Cross-sectional regression	Firm-level and TiVA data	22 601 firms	• Share of foreign intermediates • Share of foreign ownership

ADB = Asian Development Bank, ADBI = Asian Development Bank Institute, GVC = global value chain, Lao PDR = Lao People's Democratic Republic, SME = small and medium-sized enterprise, TiVA = Trade in Value-Added.
Source: Authors.

In addition, data availability is often lacking at firm level, even in advanced economies, and is considered a significant technical issue in the study of GVCs. Most studies have had no choice but to use the available aggregate data sources to examine the relationship between GVC participation and the broad market outcomes. The lack of availability of GVC data therefore led to analytical limitations, including restrictive levels of analysis.

To address the aforementioned gaps and limitations, our study focuses on the determinants of GVC participation and the relationship between the participation and firms' performance at firm level by utilizing firm-level panel data from 2004 to 2014. To the best of our knowledge, our study is the first to employ firm-level panel data in the analyses. This study contributes to more solid findings on the impact of GVC participation on firms' performance in terms of total revenues at firm level and provides relevant policy recommendations that can help support SMEs in smoothly integrating into GVCs.

4. DATA AND METHODOLOGY

4.1 Data

The firm-level panel data set used in this study combines 11 rounds of the annual survey on Thailand's industries conducted by the OIE, Ministry of Industry (Thailand). The main objective of this survey is to collect information on manufacturing establishments in Thailand covering all regions, including Bangkok and metropolitan areas (Samutprakarn, Pathum Thani, and Nonthaburi), the central region, the northern region, the northeastern region, and the southern region. This survey provides detailed information on production, sales, imports and exports, investment, human resources, technology and innovation, and a future production plan.

Our data set is a balanced panel that covers 1,259 firms (including SMEs and non-SMEs) for each year (2004–2014), spanning 21 industries in the manufacturing sector (based on the two-digit International Standard Industrial Classification level (15–37)). The firm information had been collected from the same set of firms and industries for 11 years and therefore we observe no data attrition. We classify SMEs according to the 2002 official definition of SMEs (Table 4), which better reflects our data than the 2019 definition. SMEs in the manufacturing sector are defined as firms with less than 201 employees or a value of total fixed assets equal to or less than THB 200 million (approximately $6.5 million). SMEs account for over 80% of all observations, which reflects the reality of SMEs in Thailand presented in Sections 1 and 2. Table 8 provides summary statistics.

Table 8: Summary Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Share of imported inputs (%)	12,736	0.062	0.163	0	0.987
Share of revenue from exports (%)	9,113	0.216	0.340	0	1
ln(Total revenue)	9,113	18.95	2.143	5.044	26.90
SME (dummy)	12,794	0.827	0.378	0	1
Research and development (dummy)	12,794	0.061	0.239	0	1
Share of foreign ownership (%)	12,794	9.924	24.39	0	100
ln(Labor productivity)	11,870	0.452	1.560	−15.12	8.391
ln(Value of total capital)	12,579	17.11	2.756	0	25.30
ln(Labor input)	12,562	4.865	1.474	0	20.22
ln(Cost of intermediate goods)	8,338	18.3193	2.181	4.664	26.252

SMEs = small and medium-sized enterprises.
Source: Authors.

4.2 Methodology

4.2.1 Determinants of GVC Participation

First, this study investigates what factor determines the degree of GVC participation by following the equation of Arudchelvan and Wignaraja (2015)

$$GVC_{it} = \beta_0 + \beta_1 SME_{it} + \beta_2 X_{it} + \epsilon_{it}$$

where *GVC_{it}* represents the degree of GVC participation of firm *i* in year *t*. A firm can participate in GVCs through either backward or forward participation, which reflects the upstream or downstream link in the chain (Korwatanasakul, Baek, and Majoe forthcoming). Typical GVC participation refers to backward GVC participation, where an individual firm imports foreign input to produce its intermediate or final goods and services to be exported. On the other hand, forward GVC participation occurs when feeding intermediate goods or services to other firms for further processing. Share of imported input and share of revenues from exports are used as proxies for backward GVC participation and forward GVC participation, respectively. Share of imported input is calculated by dividing costs of imported input by total cost. Share of revenues from exports indicates the percentage of total revenue that comes from exports. *SME_{it}* is a dummy variable, taking a value of one for an SME, and zero otherwise. *X_{it}* includes a set of control variables, namely research and development (R&D), share of foreign ownership, and labor productivity. R&D is a dummy variable, taking a value of one if a company has a budget for R&D on either product or process development, and zero otherwise. Share of foreign ownership indicates the percentage of the ownership held by foreign investors or firms. Labor productivity is defined as the value added per worker and is calculated from a product value minus costs, including raw material costs, fuel and energy costs, and subcontracting costs (World Bank 2019). *e_{it}* is the disturbance term. Industry and year fixed effects are imposed in the estimation to control for unobserved heterogeneity across industrial groups and times. Variances among different industries and time periods (e.g., differences in production technologies, heterogeneous policy interventions in a specific industry and time period) may influence both variables *SME_{it}* and *GVC_{it}*. Applying fixed effects can help reduce endogeneity problems caused by measurement error and omitted variables.

4.2.2 GVC Participation and Firms' Performance

To estimate the impacts of GVC participation on firms' performance, the Cobb-Douglas production function is used and the GVC participation index is incorporated into the function. Our empirical model is specified as follows:

$$ln\, Y_{it} = \beta_0 + \beta_1 K_{it} + \beta_2 L_{it} + \beta_3 M_{it} + \beta_4 GVC_{it} + \beta_5 SME_{it} + \beta_6 X_{it} + e_{it}$$

where *lnY_{it}* is the firms' performance proxied by total sales of firm *i* in year *t*. *K_{it}* represents capital input captured by the value of total capital; *L_{it}* refers to labor input captured by the payment to employees; and *M_{it}* is the intermediate goods proxied by the cost of intermediate goods.[2] *GVC_{it}* represents the degree of GVC participation proxied by the share of imported inputs and share of revenue from exports. SME_{it} is a dummy variable, taking a value of one for an SME, and zero otherwise. *X_{it}* refers to a set of control variables related to a firm's characteristics, including R&D, share of foreign ownership,

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[2] The cost of intermediate goods is estimated from all the available cost information in our data set: The cost of intermediate goods is equal to the total cost minus other costs such as fuel and energy costs, subcontracting costs, and depreciation expenses for plant and equipment.

and labor productivity. Industry and year fixed effects are also imposed in the estimation. e_{it} is the disturbance term.

5. EMPIRICAL RESULTS AND POLICY DISCUSSION

5.1 Determinants of GVC Participation

The estimation results of Table 9 indicate the set of determinants of GVC participation. The SME variable shows a statistically significant negative effect on GVC participation, both backward (Columns 1–4) and forward (Columns 5–8) participation, and its coefficients are robust across different model specifications. As SMEs have limited knowledge, technology, and innovation capacity, it is difficult for them to participate in GVCs. SMEs, therefore, have a lower degree of GVC participation than larger firms (non-SMEs). Our results are fairly consistent with the findings of previous studies, e.g., Arudchelvan and Wignaraja (2015) and Vidavong, Thipphavong, and Suvannaphakdy (2017), which argued that firm size, measured by the number of employees, is positively associated with the possibility of participating in GVCs.

Table 9: Determinants of GVC Participation

Dependent Variables	Backward GVC Participation (Share of Imported Inputs)			
Independent Variables	1	2	3	4
SMEs	−0.0513***	−0.0496***	−0.0375***	−0.0342***
	(0.00428)	(0.00430)	(0.00435)	(0.00454)
Research and development		0.0299***	0.0217***	0.0197***
		(0.00695)	(0.00687)	(0.00703)
Share of foreign ownership			0.00127***	0.00116***
			(8.41e-05)	(8.70e-05)
ln(Labor productivity)				0.00644***
				(0.00102)
Constant	0.170***	0.166***	0.134***	0.131***
	(0.00737)	(0.00745)	(0.00732)	(0.00763)
Observations	12,736	12,736	12,736	11,818
R-squared	0.088	0.090	0.122	0.124
Dependent Variables	Forward GVC Participation (Share of Revenue from Exports)			
Independent Variables	5	6	7	8
SMEs	−0.122***	−0.116***	−0.0899***	−0.0922***
	(0.00901)	(0.00905)	(0.00913)	(0.00969)
Research and development		0.113***	0.0971***	0.107***
		(0.0146)	(0.0144)	(0.0152)
Share of foreign ownership			0.00272***	0.00274***
			(0.000150)	(0.000158)
ln(Labor productivity)				0.00419*
				(0.00253)
Constant	0.354***	0.337***	0.268***	0.274***
	(0.0131)	(0.0132)	(0.0132)	(0.0137)
Observations	9,113	9,113	9,113	8,463
R-squared	0.103	0.111	0.150	0.156

GVC = global value chain, SMEs = small and medium-sized enterprises.

Note: Robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All models control for industry and year fixed effects. Backward GVC participation and forward GVC participation are proxied by share of imported inputs and share of revenue from exports, respectively.

Source: Authors.

In terms of the control variables, R&D, share of foreign ownership, and labor productivity are statistically significant and positively affect GVC participation, both backward and forward participation. Their estimated coefficients are robust across different model specifications. Firms with a budget for R&D would have a higher quality of products and services and a more efficient production process. This translates into firms' higher competitiveness in getting involved in GVCs. This is similar to the finding of Arudchelvan and Wignaraja (2015) but contradicts that of Vidavong, Thipphavong, and Suvannaphakdy (2017). Furthermore, knowledge and technology transfer would take place in firms with a higher level of foreign ownership. The firms would have access to new technology and innovation, management know-how, and international networks and would therefore be quick to participate in GVCs. Lastly, firms with higher labor productivity can produce more efficiently and be more competitive in participating in such GVCs (e.g., Arudchelvan and Wignaraja 2015; Bernard and Bradford Jensen 1999; Clerides, Lach, and Tybout 1996).

5.2 GVC Participation and Firms' Performance

Table 10 shows the estimation results of the effect of GVC participation on firms' performance captured by total revenue. Our results indicate that GVC participation, both backward and forward participation, has a statistically significant positive relationship with firms' performance. By getting involved in GVCs, firms are required to adjust to international standards and requirements, while absorbing new knowledge and technology regarding product and production process development. Therefore, firms involved in GVCs would be more competitive in the domestic market and be able to expand their business to the international market. This, in turn, leads to higher revenue. Total capital, labor input, intermediate goods, and labor productivity are also statistically significant and robust across different specifications. All four factors contribute to higher total revenue among firms. Firms with more capital can invest more in new technology and production equipment to feed better products and services that can generate more revenues. Moreover, firms with greater intermediate goods, more labor, and higher labor productivity would be able to take advantage of economies of scale that reduce the cost of production and increase the revenue. On the other hand, SMEs have a statistically significant negative effect on firms' performance as SMEs are too small to enjoy the aforementioned benefits of economies of scale. Our results are consistent with previous studies such as Vidavong, Thipphavong, and Suvannaphakdy (2017) and Wignaraja (2014). Even though the share of foreign ownership is statistically significant in Column 2, its coefficients are very small and therefore negligible in both specifications (Columns 1 and 2). R&D is not statistically significant in either specification (Columns 1 and 2). These variables do not explain the variation in firms' revenue but the variation in firms' GVC participation (see Section 4.1).

5.3 Policy Discussion

Our results imply that being an SME is associated with a lower degree of GVC participation, but GVC participation can help firms (both SMEs and non-SMEs) increase their revenues. Moreover, a lower degree of GVC participation, especially in terms of backward GVC participation, implies that SMEs have a lower chance of upgrading their technology and products because of limited access to foreign quality input and technology. This becomes a vicious cycle since SMEs cannot participate in GVCs or move up a value chain without upgrading their technology and product. In terms of forward GVC participation, it may be difficult to draw any policy implications as our data cannot capture implicit forward GVC participation where local Thai firms feed their

intermediate goods to MNEs located in Thailand. Nevertheless, the more relevant question for SMEs that have already participated in GVCs should be where they are on the value chain and how they can upgrade to a higher one. Taking the example of the Thai automotive and electronics industries, these two large industries are not listed among the top industries in terms of multiplier effect generation or the impact on other domestic industries (Korwatanasakul 2019). Moreover, local suppliers (usually SMEs) are mostly located in lower tiers since they do not have sufficient technological capacities to meet the global standard level to design and manufacture modules for original equipment manufacturers. This is because industrial upgrading takes place mainly in MNEs, and technology transfer from these suppliers is hardly observed. Only a few local suppliers under licensing agreements with global automakers could achieve the required technological sophistication and upgrade to Tier 1. In other words, local suppliers find it difficult to upgrade to higher tiers or higher positions in the value chains and remain competitive without technological assistance from foreign companies (Korwatanasakul and Intarakumnerd 2020).

Table 10: The Effect of GVC Participation on Firms' Performance
(total revenue)

Dependent Variable	Firms' Performance (Total Revenue)	
Independent Variables	Backward GVC Participation	Forward GVC Participation
GVC participation	0.518***	0.0392**
	(0.0380)	(0.0171)
ln(Value of total capital)	0.0198***	0.0237***
	(0.00463)	(0.00464)
ln(Labor input)	0.770***	0.785***
	(0.0163)	(0.0156)
ln(Labor productivity)	0.746***	0.760***
	(0.0168)	(0.0162)
ln(Cost of intermediate goods)	0.188***	0.174***
	(0.0139)	(0.0131)
SMEs	−0.0572***	−0.0602***
	(0.0190)	(0.0193)
Share of foreign ownership	0.000281	0.000719***
	(0.000190)	(0.000207)
Research and development	0.0284	0.0304
	(0.0191)	(0.0194)
Constant	11.09***	11.24***
	(0.192)	(0.183)
Observations	5,583	5,583
R-squared	0.965	0.963

GVC = global value chain, SMEs = small and medium-sized enterprises.

Note: Robust standard errors are in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. All models control for industry and year fixed effects. Backward GVC participation and forward GVC participation are proxied by share of imported inputs and share of revenue from exports, respectively.

Source: Authors.

As discussed in Section 3, SMEs may find it difficult to enter GVCs for several reasons, e.g., a lack of ability to meet international standards, a lack of managerial and human capital resources, limited access to credit and loans, and limited access to information and innovation, among others. Therefore, any policies that can practically address these challenges faced by SMEs will help local SMEs to enter GVCs smoothly. For example, the government can empower SMEs through a mix of policy tools such as promoting SMEs' digital capabilities, easing access to commercial bank credit, giving corporate tax incentives, and providing high-quality business support services, among others. With these empowerment initiatives, Thai SMEs will be able to engage in the upgrading of GVCs.

6. CONCLUSION

This study addresses the gaps in the literature through empirical analysis of the determinants of GVC participation and the relationship between GVC participation and firms' performance for the case of a developing country, namely Thailand. First, this study investigates what factors determine the degree of GVC participation. Second, based on the Cobb-Douglas production function, this study examines the relationship between GVC participation and firms' revenues. Both analyses utilize a panel fixed-effect regression employing unique panel firm-level data for the period 2004–2014. The analyses also separately examine the effects of forward and backward GVC participation on firms' performance. Our results show that SMEs have a lower degree of engagement in both backward and forward GVC participation. Moreover, this study finds that GVC participation, both backward and forward participation, is positively associated with firms' performance. Hence, policies aimed at helping local SMEs to enter GVCs smoothly would be the priority. One possible caveat in our analysis may come from the problem of endogeneity due to the reverse causality between GVC participation and total revenue. Therefore, our empirical results must be interpreted with care. However, this study is an initial steppingstone for contributing to more solid findings on the impact of GVC participation on firms' performance at the firm level. Future research may improve on the methodology to deal with the endogeneity issue.

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