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**Working Paper**

## Global value chain participation and firms' innovations: Evidence from small and medium-sized enterprises in Viet Nam

ADB Working Paper Series, No. 1138

**Provided in Cooperation with:**

Asian Development Bank Institute (ADBI), Tokyo

*Suggested Citation:* Dang Duc Anh; Vuong Anh Dang (2020) : Global value chain participation and firms' innovations: Evidence from small and medium-sized enterprises in Viet Nam, ADB Working Paper Series, No. 1138, Asian Development Bank Institute (ADBI), Tokyo

This Version is available at:

<https://hdl.handle.net/10419/238495>

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## **ADB Working Paper Series**

### **GLOBAL VALUE CHAIN PARTICIPATION AND FIRMS' INNOVATIONS: EVIDENCE FROM SMALL AND MEDIUM-SIZED ENTERPRISES IN VIET NAM**

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No. 1138  
May 2020

**Asian Development Bank Institute**

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Suggested citation:

Dang, D. A. and V. A. Dang. 2020. Global Value Chain Participation and Firms' Innovations: Evidence from Small and Medium-Sized Enterprises in Viet Nam. ADBI Working Paper 1138. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/global-value-chain-participation-firms-innovations-evidence-sme-vietnam>

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This research was conducted as part of the project of the Asia Development Bank Institute (ADBI) on "Globalization and Small and Medium-Sized Enterprises in Asia." The authors would like to thank Shujiro Urata for his helpful comments. We are also deeply indebted to the participants in the ADBI workshop Trade, Global Value Chains, and Small and Medium-Sized Enterprise at ADBI, Tokyo for their invaluable suggestions. The opinions expressed in this paper are the sole responsibility of the authors and do not reflect the views of their affiliation.

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**Abstract**

Participation in the global value chain could lead to different impacts on small and medium firms' performances. In this paper, we examine the relationship between the participation of the Vietnamese economy in the global value chain and small and medium firms' innovation in Viet Nam over the period 2007–2015. Using data from the Viet Nam Small and Medium Enterprise survey, we test whether a higher share of foreign value added in exports is likely to make small and medium firms innovate. To address the problem of omitted variable biases, we use the Chinese domestic value added in gross exports to the world as an instrument for foreign value added in gross exports in Viet Nam. We find that foreign value added in gross exports negatively correlates with firms' decision to introduce new products but positively associates with firms' decision to improve existing products. These relationships are more profound for firms in industrial zones and nonexporting firms. We also find evidence that the foreign value added in gross exports increases firm sales and have more subcontracts, which may help small and medium firms have more resources to innovate. As small and medium firms tend to improve existing products when they are more involved in global value chains, the government could use policies to incentivize small and medium firms to demand better technology, thereby improving the innovation system and creating a favorable environment in which to transfer new technology. These policy packages may include access to finance for those who invest in learning and adopt better technologies.

**Keywords:** trade, small and medium-sized enterprises, global value chain, Viet Nam

**JEL Classification:** F16, O24

## Contents

1.	INTRODUCTION .....	1
2.	CONCEPTUAL FRAMEWORK .....	2
3.	VIETNAMESE SMES IN GLOBAL VALUE CHAINS.....	3
4.	EMPIRICAL METHODOLOGY .....	4
4.1	Data Description .....	4
4.2	Empirical Model .....	6
5.	EMPIRICAL RESULTS.....	7
6.	CONCLUSION .....	16
	REFERENCES .....	17

# 1. INTRODUCTION

For emerging and developing countries, small and medium-sized enterprises (SMEs)<sup>1</sup> account for a large part of employment (WTO 2016). The fragmentation of production has created opportunities for SMEs in developing countries to access global markets as components or service providers, without having to build the entire value chain of a product. Even if they cannot participate directly in global value chains (GVCs) they can benefit from subcontracting to larger firms or foreign companies (Dang 2019). Despite their importance for developing economies, the effects of an economy's engagement with GVCs on SME performances are understudied. Only recently, some studies quantitatively estimated the impacts of engagement with GVCs on employment (such as Banga 2016; Jakubik and Kummritz 2017; Shen and Silva 2018). However, the question of how the participation of an economy in GVCs impacts SMEs' innovation has not been explored.

Economic literature has not provided a clear prediction about the effects of the participation of an economy in GVCs through foreign investment on domestic SMEs' innovation. On the one hand, the economy's integration into GVCs may positively affect SMEs' innovation. First, SMEs may have to compete with imported substitution products produced by foreign firms. Second, foreign firms may also compete with SMEs in using inputs such as employees, pushing up market wages, and increasing the production costs of SMEs (Dang 2019). All of these may force SMEs to innovate and technologically upgrade to increase their competitiveness and reduce production costs. Third, SMEs can obtain both technology and management skills when they get involved in global value chains developed by foreign firms (Gyeke-Dako et al. 2017; MacGarvie 2006), which contribute to higher productivity and demand for innovation. On the other hand, because most SMEs may never access GVCs through trading activities or linkages with foreign firms, an increase in GVC participation by an economy may not affect SMEs' innovation decisions.

Viet Nam is an interesting case study for examining the relationship between GVCs and SMEs because of its economic structure, more than 96% of which comprises small and medium-sized enterprises (VCCI and USAID 2016). Moreover, Viet Nam has emerged as an Asian manufacturing powerhouse (Nakamura 2016). Participation in GVCs, especially through foreign investment, has enabled Viet Nam to grow and play an important role in the process of structural transformation, contributing to the moving up the ladder of value chains (Hollweg, Smith, and Taglioni 2017). All of these will affect significantly the development and innovation of SMEs.

This study examines the firm-level impacts of Vietnamese participation in GVCs on SMEs, spanning the period 2007–2015. Using the methodology of fixed-effects estimation, this study is the first to estimate the effects of engagement with GVCs, which is proxied by foreign value added in exports, on SMEs' innovation using firm-level data in developing countries. We find that foreign value added in gross exports correlates negatively with SMEs' decision to introduce new products but is positively associated with their decision to improve existing products. These relationships are more profound for firms in industrial zones and nonexporting firms. This implies that the production linkages with lead or foreign firms could be more important to the domestic SMEs' innovation than their direct trading activities. We also consider some potential mechanisms through which foreign value added in exports may affect domestic SMEs'

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<sup>1</sup> The definition of SMEs in this study is based on the World Bank classification. The World Bank divided firms into three groups: micro, small, and medium-scale. Microfirms have up to 10 employees, small firms have up to 50 employees, and medium firms have up to 300 employees.

innovation. We find that the foreign value added in exports leads to domestic SMEs achieving higher sales and having more subcontracts, which may help them have more resources to innovate.

However, these correlations may not be causal due to potential biases caused by measurement errors or omitted variables. To address these potential problems, we use the Chinese domestic value added in gross exports to the world as an instrument for foreign value added in gross exports in Viet Nam. To reaffirm the findings from the instrumental variable estimation, we implement some tests on the validity of the instrumental variable (IV). The results confirm that foreign value added in exports estimated by the IV approach does have effects on SMEs' innovation.

Our paper makes some contributions to the literature. First, we provide the first empirical evidence that an economy's connecting to the global value chain may affect SMEs' innovation in an emerging market economy, which can provide lessons for other developing countries with similar contexts. Second, we explore how it affects firms differently depending on the size distribution as small and medium firms are regarded as an important momentum for growth and job creation in developing countries.

The rest of the paper proceeds as follows. In Section 2, we provide a conceptual framework. An overview of the participation of Vietnamese SMEs in the global value chain is presented in Section 3. Section 4 describes the data and presents the empirical modeling strategy. Section 5 presents the results and discusses the tests of potential mechanisms. Section 6 concludes.

## 2. CONCEPTUAL FRAMEWORK

For developing countries, SME involvement in the global value chain could be either through trading activities or engaging with lead or multinational firms. As SMEs normally find it difficult to trade directly with the global market, their direct and/or indirect production linkages with lead or foreign firms play an important role in improving the domestic SMEs' productivity and demand for innovation.

We briefly discuss why an economy's connection to global value chains through foreign investment could affect SMEs' performance and innovation within an industry. This discussion guides the later empirical framework and analysis.

First, by supplying to local affiliates of foreign firms or lead firms, which in turn supply inputs to multinational enterprises (MNEs), domestic SMEs may have more incentive to improve the quality of their products and services to satisfy a higher requirement from MNEs (Newman et al. 2018). Also, they can innovate through adopting advanced technology or imitating better practices used by foreign firms. These benefits for SMEs depend on the degree to which MNEs transfer knowledge, sectors, and whether linkages are upstream or downstream (OECD and UNIDO 2019). Similarly, domestic SMEs may make use of the knowledge and expertise of workers previously working for MNEs for improving their productivity (ADBI 2015). Görg and Strobl (2005) found that domestic firms where their owners had worked in foreign firms before were more productive than their counterparts without that experience.

The second channel refers to the competition from foreign firms with domestic SMEs for using local resources. Foreign firms not only consume imported intermediate goods but also use local inputs, especially labor, to produce exports. As Sinani and Meyer (2004) indicate, foreign firms may offer higher wages and attract skilled labor from domestic firms. In such cases, foreign firms may exhaust human resources in local companies.

Domestic SMEs, therefore, are forced to replace lost workers through the use of more modern technology.

From another perspective, SMEs may have to compete with products produced by foreign firms that increase pressures on SMEs for innovation. Moreover, as Aitken and Harrison (1999) suggest, domestic firms' market share can decrease with the appearance of large foreign firms. Therefore, less efficient SMEs will exit the market and more efficient and innovative SMEs will survive.

The third channel is that the economy's engagement in the global value chain may be complementary to the production structure of SMEs in the sense that it supplements necessary inputs, which may lead to an increase in firms' productivity (and profitability), giving them more resources for their innovation. However, the extent to which SMEs can benefit depends on how they are involved in the global value chain. If they cannot access GVCs, the increased GVC participation of the economy may not affect SMEs' innovation decisions.

### **3. VIETNAMESE SMES IN GLOBAL VALUE CHAINS**

Viet Nam has been successful in attracting foreign direct investment (FDI). Recently, the share of the FDI sector in Vietnamese exports reached 70%. FDI has brought huge benefits to Viet Nam in terms of growth and jobs. Moreover, through foreign investments, Viet Nam is engaged in global and Asian supply chains (IMF 2016). However, participation in GVCs has been driven largely by foreign-owned firms. Vietnamese domestic firms have not been successful in gaining benefits from the participation of the economy in GVCs through developing linkages with foreign firms. Most local firms are small and only serve the domestic market. This is represented by low domestic value added and a weak supplier base in Viet Nam (MPI 2019).

One of the things that hinder SMEs from linking and securing business with foreign firms is the shortage of workforce skills. In addition, there are no formal information channels through which to obtain information on FDI sourcing strategies; therefore, potential domestic suppliers who lack business connections are disadvantaged in terms of linkage opportunities. Moreover, most domestic SMEs do not interact directly with global buyers but mainly through lead firms with their headquarters located outside Viet Nam. On the demand side, foreign firms are confronted with a lack of competitive local suppliers who can meet quality standards. There are also information asymmetry and coordination failures in connecting buyers and suppliers, even though there is motivation for both foreign firms and domestic SMEs to create their linkages (Asya et al. 2017).

Recognizing this challenge, the Vietnamese government has put their effort into setting up a policy framework for supporting industries that aim to upgrade the capabilities and technology of domestic firms to promote their relationships with FDIs and allow them to enter foreign markets (MPI 2019). The government has also revised and upgraded its SME policy, such as by issuing the Law on SME Support for strengthening the domestic private sector. At the same time, they have put in place many programs to encourage investment in improving SME competitiveness. They range from technological upgrading and innovation to market development, training, and skills as well as financial packages. However, while SME support programs are expected to address the constraints that firms face in Viet Nam, there is a lack of monitoring and evaluation systems to assess the outcomes and impacts of these programs (Asya et al. 2017).



## 4. EMPIRICAL METHODOLOGY

### 4.1 Data Description

In this section, we describe the main firm variables we use in our analysis and the global value chain data we match to the firm surveys.

#### SMEs' Innovation Data

The main SMEs' innovation data used in this study come from the 2007–2015 rounds of the Small and Medium Scale Manufacturing Enterprise survey. These surveys are implemented biannually to evaluate the characteristics of the Vietnamese business environment.<sup>2</sup> The surveys are carried out in 10 provinces, namely Ho Chi Minh City (HCMC), Ha Noi, Hai Phong, Long An, Ha Tay, Quang Nam, Phu Tho, Nghe An, Khanh Hoa, and Lam Dong. The random sample is stratified by ownership types, including household businesses, private firms, cooperatives, and limited liability and joint-stock enterprises. These surveys include only manufacturing firms with less than 300 employees. In total, the panel data cover the micro-information on about 2,500 businesses in 22 manufacturing industries, including food products, textiles, basic metals, other nonmetallic products, wearing apparel, and wood processing.

The surveys have a detailed section that includes information about SMEs' innovation. In our empirical work, we use several proxies to measure whether innovations are implemented by SMEs, such as the application of new technology, improvement of existing products, or the introduction of new products. The questions asked are as follows: "Has the firm introduced new product groups?"; "Has the firm introduced new production processes/new technology since the last survey?"; and "Has the firm made any improvements in existing products or changed specification since the last survey?" Firms could either answer "Yes" or "No." We construct binary variables that take a value of 0 or 1, where 0 corresponds to the response "No" and 1 to the response "Yes."

Table 1 shows a description of SMEs' innovation. We also provide a summary of the innovations by different types of firms. As indicated in the table, the share of firms introducing new products decreased from 4.8% in 2007 to 0.7% in 2013 and increased sharply to 29.4% in 2015. Such a sharp increase could be due to the establishment of the National Technology Innovation Fund in 2014 or the Viet Nam Inclusive Innovation Project in 2013 to improve the technological and innovative capacity of SMEs by helping them develop and acquire new technology and innovations (CIEM et al. 2016). During the same period, SMEs decreased their investment in technological improvement. The proportion of enterprises adopting new technologies declined by 10.7 percentage points between 2007 and 2015, from 15.7% in 2007 to 5% in 2015. The decrease in the adoption of new technology was mainly due to a decline in the adoption rates of small and medium firms. The proportion of firms investing in product improvement also fell in the same period, from 44.8% in 2007 to 13.3% in 2015, mainly because of a decline among small and medium firms.

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<sup>2</sup> The surveys have been carried out in collaboration between the Central Institute for Economic Management (CIEM) of the Ministry of Planning and Investment of Viet Nam (MPI), the Institute of Labor Science and Social Affairs (ILSSA) of the Ministry of Labor, Invalids and Social Affairs of Viet Nam (MOLISA), the Development Economics Research Group (DERG) of the University of Copenhagen, and the United Nations University World Institute for Development Economics Research (UNU-WIDER).

**Table 1: SMEs' Innovation Summary**

	2007	2009	2011	2013	2015	Average
Firms introduce new products (:=1)	0.048	0.029	0.044	0.007	0.294	0.080
Micro-firms	0.035	0.020	0.038	0.004	0.294	0.077
Small and medium firms	0.080	0.046	0.057	0.014	0.295	0.087
Firms introduce new technology (:=1)	0.157	0.136	0.132	0.066	0.050	0.108
Micro-firms	0.089	0.075	0.084	0.052	0.032	0.066
Small and medium firms	0.318	0.255	0.242	0.101	0.104	0.210
Firms have product improvement (:=1)	0.448	0.407	0.384	0.167	0.133	0.308
Micro-firms	0.375	0.317	0.338	0.131	0.109	0.250
Small and medium firms	0.618	0.582	0.492	0.262	0.206	0.448
Number of observations	2,091	2,508	2,386	2,445	2,134	11,564

Note: Mean values. Micro-firms have up to 10 employees.

Source: Authors' calculations from the Viet Nam Small and Medium Enterprise Survey 2007–2015.

## Global Value Chain Data

We use foreign value added in gross exports as proxies for Viet Nam's integration into global value chains. The Trade in Value Added (TiVA) database updated by the OECD and the WTO in 2018 provides the source for those data from 2005 to 2016.<sup>3</sup> In the TiVA database, the foreign value added in gross exports reflects the foreign value added content of intermediate imports embodied in gross exports (which is other countries' domestic value added in intermediates used in exports). This measure is suitable for studying countries whose manufacturing sectors are based on imported parts and components or active in downstream activities in the chain (Pahl and Timmer 2019).

Using concordance matrices, we match data collected from TiVA with the SME surveys in 2007–2015 for 16 manufacturing industries and then use them to analyze the effects of increasing global value chain participation of Viet Nam's economy on SMEs' innovation across all sectors.

Table 2 shows the pattern of foreign value-added exports in the manufacturing sector. As can be seen, the share of foreign value-added exports is about 45% and remained almost unchanged in 2007–2015. The sectors with the largest source of foreign value-added exports are fabricated metal products and machinery and equipment. The figures show the highest growth in the share of foreign value-added exports in the machinery equipment sector, from 51% in 2007 to 59% in 2015; and a decline in the share of basic metal, from 54% in 2007 to 47% in 2015. The share of foreign value-added exports in the textiles, wearing apparel, and leather products sector increased from 42% in 2007 to 46% in 2013 and decreased to 45% in 2015. This shows the volatility in the domestic value content of Vietnamese exports in these sectors. However, in general, although the manufacturing sector accounts for a large share of exports, there is no improvement of domestic value-added contributions to the value added of exports over time.

<sup>3</sup> There are some limitations in TiVA data sets. As Silvia Nenci (2014) points out, because of the high level of sector aggregation, the results may be interpreted wrongly if not complemented by additional evidence (Sturgeon 2015). However, it is the best available data set that we have had so far.

**Table 2: Foreign Value Added in Exports by Sectors**

	2007	2009	2011	2013	2015	Average
All	0.45	0.47	0.45	0.44	0.45	0.45
Agriculture	0.30	0.34	0.31	0.29	0.31	0.32
Food products, beverages, and tobacco	0.36	0.39	0.37	0.33	0.37	0.36
Textiles, wearing apparel, and leather products	0.42	0.43	0.44	0.46	0.45	0.44
Wood and wood products	0.48	0.49	0.47	0.54	0.48	0.49
Paper products and printing	0.45	0.47	0.45	0.43	0.45	0.45
Chemicals	0.48	0.51	0.45	0.43	0.45	0.46
Rubber and plastics	0.51	0.54	0.53	0.50	0.53	0.52
Other nonmetallic mineral products	0.36	0.39	0.36	0.29	0.34	0.35
Basic metals	0.54	0.57	0.51	0.51	0.47	0.52
Fabricated metal products	0.58	0.63	0.58	0.56	0.58	0.59
Machinery and equipment	0.51	0.54	0.53	0.58	0.59	0.55
Motor vehicles	0.51	0.55	0.52	0.47	0.53	0.52
Other transport	0.53	0.59	0.55	0.47	0.55	0.53
Other manufacturing	0.48	0.51	0.49	0.43	0.48	0.48
Recycling	0.20	0.30	0.22	0.23	0.22	0.23
Services	0.28	0.30	0.27	0.26	0.27	0.28
Number of observations	2,091	2,508	2,386	2,445	2,134	11,564

Source: Authors' calculations from the Organisation for Economic Co-operation and Development–World Trade Organization, Trade in Value Added (TiVA) database. <https://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm> (accessed 1 December 2019) and Viet Nam Small and Medium Enterprise Survey 2007–2015.

## 4.2 Empirical Model

Our empirical model is represented by the following econometric specification:

$$y_{ijt} = \alpha + \beta FVA_{jt-1} + X'_{ijt}\Gamma + \lambda_i + \theta_t + \varepsilon_{ijt} \quad (1)$$

where  $y_{ijt}$  is the firm-level innovations of firm  $i$  in industry  $j$  at time  $t$ , and  $FVA_{jt-1}$  is the foreign value added in gross exports in industry  $j$  at time  $t - 1$ .  $\beta$  is the coefficient of our interest that shows the correlation between foreign value added in gross exports and SMEs' innovations. The main variable is lagged by one period to reduce potential simultaneity biases. Also, it reflects the possibility that SMEs' innovations may not respond instantly to global value chain participation. The term  $X$  is a vector of other firm characteristics, which include firm employment, firm ages, industrial zone dummy, and dummies for SME ownership (which are private firms, firms with state capital, and firms with foreign capital).  $\lambda_i$  and  $\theta_t$  are firm and year dummy fixed effects, where year dummies capture time-specific factors that are common to all firms, while firm dummies control for firm-specific characteristics. Standard errors are clustered by industry levels. Also, we use linear probability models to avoid the incidental parameter problem.

A challenge in estimating equation (1) comes from potential endogeneity between outcome variables and the foreign value added in exports variable. The first source of this endogeneity could be due to omitted variable biases. It is possible that unobserved characteristics of firms, which are correlated with the foreign value added in exports variable, affect a firm's innovation.

Using firm-level fixed effect estimation will get rid of the time-invariant characteristics of firms that act as confounding factors in our analysis. In addition, by incorporating a vector of other firm characteristic variables, we may reduce the possibility that our coefficient of interest is contaminated by the influence of other time-varying variables on firms' innovation. Of course, some omitted variable biases remain.

Another possible source of endogeneity is measurement error. Our main variable of interest is at the industrial level, and our dependent variable is at the firm level. From a firm's perspective, the foreign value added in exports measure is an aggregation of imports into sectors, including those without direct relevance to the firm. This all means that the main variable is measured with error, and this error will be embodied in the error term leading to a downward bias in the OLS estimates.

### Instrumental Variable (IV) Strategy

To address concerns of potential biases we instrument for the level of foreign value added in industrial exports using the Chinese domestic value added in gross exports. The People's Republic of China (PRC) is the main trading partner of Viet Nam and Viet Nam has imported a substantial amount of intermediate and capital goods from the PRC. At the same time, Viet Nam's exports also have to compete with exports from the PRC, especially with low-skilled products in the world market. This measure, therefore, is expected to be correlated with the level of imports into that sector in Viet Nam as it will pick up the general trend in the export of these goods to the world. Moreover, it is less likely to have direct impacts on Vietnamese firm innovation. Our first-stage specification is as follows:

$$FVA_{jt} = \omega + \delta DVA_{jt}^{China} + X'_{ijt}\pi + \mu_i + \sigma_t + \epsilon_{ijt} \quad (2)$$

where the variable  $DVA_{jt}^{China}$  is the Chinese domestic value added in gross exports of industry  $j$  and year  $t$ .  $X$  is a vector of the same variables in equation (1) such as firm employment, firm ages, an industrial zone dummy, and dummies for firm ownership (which are private firms, firms with state capital, and firms with foreign capital). We also control for firm and year fixed effects, so the specification captures firm characteristics and common global time trends that affect all countries in the region.

Moreover, to reduce the possibility that estimates are influenced by the exit and entry of firms rather than within-firm variations, we restrict the sample to those firms that are present at least twice in this period.

## 5. EMPIRICAL RESULTS

We first present the ordinary least squares (OLS) results as a benchmark. In Table 3, we report an OLS regression with the different SMEs' innovation outcomes as the dependent variables. The main independent variable is foreign value added as a share of exports. All models include time dummies. To deal with potential contamination of the models by unobservable firm characteristics that may correlate with both foreign value-added variable and innovation outcomes, we use fixed effects estimation to account for potential time-invariant firm-specific omitted variables that may bias our results.

**Table 3: Foreign Value Added in Exports and SMEs' Innovation (OLS Estimates)**

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology
Foreign value added as a share of exports	-0.388*** (0.100)	0.584*** (0.099)	0.066 (0.079)	-0.403*** (0.101)	0.559*** (0.095)	0.037 (0.081)
Ln (employment)				0.009 (0.005)	0.060*** (0.009)	0.041*** (0.010)
Firm age				-0.000 (0.000)	-0.001 (0.001)	-0.001* (0.000)
Firms in industrial zones				0.044* (0.021)	-0.001 (0.029)	0.017 (0.024)
Firms with foreign capital				0.044 (0.046)	0.070 (0.206)	0.420 (0.365)
Firms with state capital				0.124 (0.110)	0.011 (0.166)	0.017 (0.110)
Observations	11,562	11,562	11,562	11,500	11,545	11,545
R-squared	0.183	0.108	0.026	0.174	0.184	0.112
Number of firms	3,259	3,259	3,259	3,259	3,258	3,258
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors that are robust to heteroskedasticity and clustered at the industry level are reported in parentheses. \*\*\* Significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level.

Source: Authors' calculations from Viet Nam Small and Medium Enterprise Survey 2007–2015.

The results in column (1) show that a higher foreign value added as a share of exports is associated with a lower probability of SMEs introducing new products. However, it increases the probability of firms improving existing products as shown in column (2). We find no evidence that a firm's introduction to new technology is associated with foreign value added in exports. We check the robustness of our results by including other firm characteristics such as firm employment, firm ages, industrial zone dummies, and dummies for firm ownerships that are likely to influence firm innovation. Our results are robust to the inclusion of these firm characteristics. Controlling for these variables in the regressions, we still find that our results for the relationship between foreign value added and firm innovation are almost the same. The magnitude of coefficient in column (4) shows that an additional one percentage point of foreign value added in exports lowers the probability of firms introducing new products by 0.4. At the same time, it increases the probability of firms improving current products by 0.56. One possible explanation is that SMEs may choose to concentrate on improving their existing products to satisfy increased requirements from MNEs rather than develop their new products. Large firms tend to improve existing products and introduce new technology more than small ones as indicated in columns (5) and (6). The result in column (4) also indicates that SMEs in industrial zones have a higher probability of introducing new products. SMEs with foreign and state capital tend to innovate more but the coefficients are not statistically significant.

## Heterogeneity

SMEs may have different incentives to innovate when they are engaged in GVCs, depending on their sizes. On the one hand, smaller firms may find it hard to innovate when they face the pressure of increasing imports. Larger SMEs are more likely to innovate because they generally have more resources with which to do so. On the other hand, small firms could be more flexible in allocating resources to the most innovative ideas to cope with more competitive pressures. By contrast, larger companies with many product lines may be more reluctant to innovate as they have to consider distributing their resources to change many of their products and services. To test these contradicting possibilities, we run separate regression for different firm sizes. The regressions exploring the relationship between foreign value added in exports and firm innovation with firm sizes, estimated using a linear probability model and the same specification as for the regressions presented in Table 3, are presented in Table 4.<sup>4</sup> The results in Table 4 confirm that the impacts of foreign value added in exports differ according to firm size. They indicate that the impacts of foreign value added in exports on firm innovation are more profound among micro-firms and support the hypothesis that smaller firms are more flexible and ready to innovate than larger ones. The findings in columns (1) and (2) also show that micro-firms may prioritize the improvement of existing products over the introduction of new products when they face an increasing level of foreign value-added imports.

**Table 4: Foreign Value Added in Exports and SMEs' Innovation by Firm Sizes (OLS Estimates)**

	(1)	(2)	(3)	(4)	(5)	(6)
	Micro-firms			Small and Medium Firms		
Variables	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology
Foreign value added as a share of exports	-0.405*** (0.127)	0.512*** (0.155)	0.107 (0.092)	-0.216 (0.129)	0.416** (0.146)	-0.127 (0.176)
Other variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,165	8,165	8,165	3,380	3,380	3,380
R-squared	0.213	0.095	0.012	0.137	0.152	0.077
Number of firms	2,602	2,602	2,602	1,309	1,309	1,309
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Micro-firms have up to 10 employees. Standard errors that are robust to heteroskedasticity and clustered at the industry level are reported in parentheses. Other variables include firm employment, firm ages, industrial zone dummy, and dummies for firm ownerships (which are private firms, firms with state capital, and firms with foreign capital). \*\*\* Significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level.

Source: Authors' calculations from Viet Nam Small and Medium Enterprise Survey 2007–2015.

We examine whether exporting SMEs that have directly linked to the global value chain may innovate more. The results are shown in Table 5. The results in columns (1) to (3) indicate that foreign value added does not correlate with innovation by exporting SMEs. However, it significantly correlates with the improvement of existing products by nonexporting SMEs as indicated in column (5). This demonstrates that trade linkages may not be the main channel of SMEs' innovation.

<sup>4</sup> To save space, we do not report all estimated coefficients.

**Table 5: Foreign Value Added in Exports and Innovation by Exporting SMEs (OLS Estimates)**

	(1)	(2)	(3)	(4)	(5)	(6)
	Exporting firms			Nonexporting firms		
Variables	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology
Foreign value added as a share of exports	-0.302 (0.738)	0.453 (0.528)	0.075 (0.778)	-0.401*** (0.106)	0.553*** (0.100)	0.093 (0.083)
Other variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	709	709	709	10,836	10,836	10,836
R-squared	0.184	0.191	0.069	0.191	0.106	0.028
Number of firms	312	312	312	3,164	3,164	3,164
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors that are robust to heteroskedasticity and clustered at the industry level are reported in parentheses. Other variables include firm employment, firm ages, industrial zone dummy, and dummies for firm ownerships (which are private firms, firms with state capital, and firms with foreign capital). \*\*\* Significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level.

Source: Authors' calculations from Viet Nam Small and Medium Enterprise Survey 2007–2015.

**Table 6: Foreign Value Added in Exports and Innovation by SMEs in Industrial Zones (OLS Estimates)**

	(1)	(2)	(3)	(4)	(5)	(6)
	Firms in Industrial Zones			Firms Not in Industrial Zones		
Variables	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology
Foreign value added as a share of exports	-0.096 (0.372)	2.010*** (0.517)	-0.688 (0.683)	-0.428*** (0.100)	0.513*** (0.101)	0.092 (0.081)
Other variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	597	597	597	10,948	10,948	10,948
R-squared	0.150	0.152	0.108	0.191	0.111	0.029
Number of firms	343	343	343	3,187	3,187	3,187
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Standard errors that are robust to heteroskedasticity and clustered at the industry level are reported in parentheses. Other variables include firm employment, firm ages, and dummies for firm ownerships (which are private firms, firms with state capital, and firms with foreign capital). \*\*\* Significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level.

Source: Authors' calculations from Viet Nam Small and Medium Enterprise Survey 2007–2015.

SMEs in an industrial zone are more likely to receive knowledge transfers from MNEs. We also run a separate regression to SMEs located in industrial zones and those that are not. The results are reported in Table 6. In the regressions in columns (2) and (5), we find a positive and significant relationship between foreign value added and SMEs' improvement of existing products for both firms that are in industrial zones and those that are not. However, the magnitude of the main coefficient is much higher for the SMEs

in industrial zones than for those that are not. This confirms the above prediction that SME linkages to global value chains are through their connection to large and foreign firms.<sup>5</sup> At the same time, a higher share of foreign value added in exports results in a lower probability of introducing new products for SMEs that are not in industrial zones, as shown in column (4).

#### IV Estimates

The possible endogeneity bias that may arise from omitted time-varying variables and measurement errors leads us to carry out instrumental variable estimation, which takes into account unobserved time-varying factors that may simultaneously correlate with the foreign value-added variable and SMEs' innovation. We estimate equation (1) using fixed effects regression with an instrumental variable, which is the Chinese domestic value added in gross exports. All IV estimations include time dummies to account for changes over time in the economic environment. At the same time, we add firm characteristics to control for time-varying effects that may bias the results. Robust standard errors are clustered at the industry level.

We report the IV estimates in Table 7. As seen in the lower panel, the first-stage coefficient is negative and statistically significant. It shows that the higher value of the PRC's domestic value added in exports creates greater competitive pressure on Vietnamese exports in the world market so that Viet Nam will import less intermediate goods to produce exports. This leads to a decrease in the share of foreign value added in Vietnamese exports. The F-statistic of excluded instruments in all specifications is well above the critical values (10) identified by Staiger and Stock (1997). This indicates that the problem of weak instruments is not our concern.

**Table 7: Foreign Value Added in Exports and SMEs' Innovation (IV Estimates)**

	(1)	(2)	(3)
Variables	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology
Foreign value added as a share of exports	-0.633*** (0.237)	1.653*** (0.596)	0.176 (0.270)
First-stage estimation	Dependent variable: Foreign value added as a share of exports		
PRC's domestic value added as a share of exports	-0.78*** (0.13)	-0.78*** (0.13)	-0.78*** (0.13)
Other variables	Yes	Yes	Yes
Observations	11,538	11,538	11,538
R-squared	0.184	0.104	0.031
Number of firms	3,251	3,251	3,251
Firm fixed effects	Yes	Yes	Yes
Year dummy effects	Yes	Yes	Yes
F-statistics for an excluded instrument: 33.46			

Notes: Standard errors that are robust to heteroskedasticity and clustered at industry level are reported in parentheses. Other variables include firm employment, firm ages, industrial zone dummy, and dummies for firm ownerships (which are private firms, firms with state capital, and firms with foreign capital). In the first stage of the FE IV regression of foreign value added in exports: (a) the PRC's domestic value added in exports is used as an instrument for Viet Nam's foreign value added in exports; (b) the F-statistics for an excluded instrument in all regressions is larger than 10, implying that the instrument is strong (see Staiger and Stock 1997). \*\*\* Significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level.

<sup>5</sup> SMEs that could directly export may have less of a relationship with FDI firms than other SMEs in industrial zones. In our sample, only 17% of SMEs in industrial zones directly export.



Source: Authors' calculations from Viet Nam Small and Medium Enterprise Survey 2007–2015.

In line with the results presented above, the findings, shown in the upper panel of Table 7, confirm the effect of foreign value added in exports on SMEs' innovation. The estimated effect in column (1) is statistically significant and indicates that a one percentage point increase in foreign value added in exports results in a decrease in the probability of SMEs introducing new products by 0.63, which is larger than the fixed effects estimate. In contrast, it increases the probability of SMEs improving existing products by 1.65 as indicated in column (2). The larger foreign value added in export coefficients indicates that not controlling for unobservables and measurement errors will lead to an underestimation of the true size of the effect of foreign value added in exports on SMEs' innovation.

In Table 8, we estimate the impacts of foreign value added in exports separately for different types of firm sizes using IV estimation. The results are different with what we found from OLS estimates in Table 4. Columns (1) and (4) indicate that the effects of foreign value added in exports are more pronounced for small and medium firms. In addition, small and medium firms tend to have more improvement in existing products than micro-firms as they face a higher level of foreign value added in exports, as presented in columns (2) and (5).

**Table 8: Foreign Value Added in Exports and SMEs' Innovation by Firm Sizes (IV Estimates)**

	(1)	(2)	(3)	(4)	(5)	(6)
	Micro-firms			Small and Medium Firms		
Variables	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology
Foreign value added as a share of exports	−0.733*** (0.268)	1.267 (0.803)	0.075 (0.159)	−0.857* (0.439)	1.392** (0.567)	−0.470 (0.388)
Other variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,866	7,866	7,866	3,057	3,057	3,057
R-squared	0.211	0.090	0.012	0.129	0.145	0.075
Number of firms	2,303	2,303	2,303	986	986	986
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy effects	Yes	Yes	Yes	Yes	Yes	Yes
F-statistics for an excluded instrument from (1) to (3): 24.60						
F-statistics for an excluded instrument from (4) to (6): 25.67						

Notes: Micro-firms have up to 10 employees. Standard errors that are robust to heteroskedasticity and clustered at the industry level are reported in parentheses. Other variables include firm employment, firm ages, industrial zone dummy, and dummies for firm ownerships (which are private firms, firms with state capital, and firms with foreign capital). In the first stage of the FE IV regression of foreign value added in exports: (a) the PRC's domestic value added in exports is used as an instrument for Viet Nam's foreign value added in exports; (b) the F-statistics for an excluded instruments in all regressions are larger than 10, implying that the instrument is strong (see Staiger and Stock 1997). \*\*\* Significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level.

Source: Authors' calculations from Viet Nam Small and Medium Enterprise Survey 2007–2015.

Table 9 presents the results of our analysis of the impacts of foreign value added in exports on innovation by SMEs in industrial zones. As F-statistics for an excluded instrument from (1) to (3) is 6.94, it shows that the instrument may be weak. Therefore, we may need to be more cautious to interpret the results in columns (1) to (3). The IV estimates in columns (1) and (4) indicate that a higher foreign value added in exports

leads to a lower probability of introducing new products for both firms in industrial zones and those that are not, although only the coefficient of the main variable in column (4) is statistically significant. However, the magnitudes of coefficients in columns (1) and (4) are quite similar. In addition, although the coefficient is not statistically significant<sup>6</sup>, the result in column (2) indicates that firms in industrial zones have about twice as big a probability of improving existing products as those not in industrial zones. This confirms the previous OLS estimates that the impacts of foreign value added in exports are more significant to the improvement of existing products by SMEs in industrial zones.

**Table 9: Foreign Value Added in Exports and Innovation by SMEs in Industrial Zones (IV Estimates)**

	(1)	(2)	(3)	(4)	(5)	(6)
	Firms in Industrial Zones			Firms Not in Industrial Zones		
Variables	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology
Foreign value added as a share of exports	-0.589 (1.226)	3.355 (2.077)	-0.751 (2.919)	-0.655** (0.255)	1.619** (0.629)	0.164 (0.255)
Other variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	396	396	396	10,859	10,859	10,859
R-squared	0.148	0.142	0.108	0.190	0.101	0.028
Number of firms	142	142	142	3,098	3,098	3,098
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy effects	Yes	Yes	Yes	Yes	Yes	Yes
F-statistics for an excluded instrument from (1) to (3): 6.94						
F-statistics for an excluded instrument from (4) to (6): 31.92						

Notes: Standard errors that are robust to heteroskedasticity and clustered at the industry level are reported in parentheses. Other variables include firm employment, firm ages, and dummies for firm ownerships (which are private firms, firms with state capital, and firms with foreign capital). In the first stage of the FE IV regression of foreign value added in exports: (a) the PRC's domestic value added in exports is used as an instrument for Viet Nam's foreign value added in exports; (b) the F-statistics for excluded instruments from (4) to (6) regressions are larger than 10, implying that the instrument is strong (see Staiger and Stock 1997). \*\*\* Significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level.

Source: Authors' calculations from Viet Nam Small and Medium Enterprise Survey 2007–2015.

Table 10 shows the IV estimates separately for exporting and nonexporting firms. In line with the OLS findings in Table 5, the results in columns (1) to (3) reveal that foreign value-added in exports does not impact the innovation of exporting SMEs. However, it results in a lower probability of introducing new products but a higher probability of improving existing products for nonexporting SMEs.

### Testing for Potential Mechanisms

One of the channels through which foreign value added in exports may affect domestic SMEs' innovation is that SMEs have to compete with foreign firms in attracting employees, thereby pushing up market wages and increasing the production costs. That leads to a higher demand for innovation. We test for this transmission mechanism by examining the effect of foreign value added in exports on real wages. Another channel is that a higher level of foreign value added in exports leads to increases in total exports, possibly resulting in an increase in SME sales. Thus, domestic SMEs may have more

<sup>6</sup> The weak instruments in columns (1) to (3) may lead IV estimates to have larger standard errors and bias than OLS estimates (Staiger and Stock 1997)

resources for their innovation. We also test whether foreign value added in exports is associated with a higher probability of SMEs having subcontracts that help domestic SMEs acquire the knowledge and expertise required for improving their productivity and innovation.

**Table 10: Foreign Value Added in Exports and Innovation by Exporting SMEs (IV Estimates)**

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Exporting Firms			Nonexporting Firms		
	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology	Firms Introduce New Products	Firms Improve Existing Products	Firms Introduce New Technology
Foreign value added as a share of exports	-1.421 (1.678)	2.164 (1.326)	-0.378 (1.057)	-0.604** (0.236)	1.504** (0.626)	0.209 (0.275)
Other variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	585	585	585	10,737	10,737	10,737
R-squared	0.169	0.176	0.068	0.190	0.099	0.027
Number of firms	188	188	188	3,065	3,065	3,065
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy effects	Yes	Yes	Yes	Yes	Yes	Yes
F-statistics for an excluded instrument from (1) to (3): 17.98						
F-statistics for an excluded instrument from (4) to (6): 23.94						

Notes: Standard errors that are robust to heteroskedasticity and clustered at the industry level are reported in parentheses. Other variables include firm employment, firm ages, industrial zone dummy, and dummies for firm ownerships (which are private firms, firms with state capital, and firms with foreign capital). In the first stage of the FE IV regression of foreign value added in exports: (a) the PRC's domestic value added in exports is used as an instrument for Viet Nam's foreign value added in exports; (b) the F-statistics for excluded instruments in all regressions are larger than 10, implying that the instrument is strong (see Staiger and Stock 1997). \*\*\* Significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level.

Source: Authors' calculations from Viet Nam Small and Medium Enterprise Survey 2007–2015.

**Table 11: Potential Mechanisms**

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	OLS estimates			IV estimates		
	Ln(Real Wage)	Ln(Revenue)	Firms Have Subcontract	Ln(Real Wage)	Ln(Revenue)	Firms Have Subcontract
Foreign value added as a share of exports	0.363 (0.724)	7.742*** (1.388)	0.125 (0.109)	0.945 (2.290)	24.484*** (5.539)	0.221* (0.120)
Other variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,952	11,545	11,544	10,813	11,539	11,538
R-squared	0.071	0.195	0.015	0.025	0.065	0.014
Number of firms	3,245	3,258	3,258	3,106	3,251	3,251
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy effects	Yes	Yes	Yes	Yes	Yes	Yes
F-statistics for an excluded instrument (4) to (6): 33.75						

Notes: Standard errors that are robust to heteroskedasticity and clustered at the industry level are reported in parentheses. Other variables include firm employment, firm ages, industrial zone dummy, and dummies for firm ownerships (which are private firms, firms with state capital, and firms with foreign capital). In the first stage of the FE IV regression of foreign value added in exports: (a) the PRC's domestic value added in exports is used as an instrument for Viet Nam's foreign value added in exports; (b) the F-statistics for excluded instruments in all regressions are larger than 10, implying that the instrument is strong (see Staiger and Stock 1997). \*\*\* Significant at the 1% level, \*\* significant at the 5% level, \* significant at the 10% level.

Source: Authors' calculations from Viet Nam Small and Medium Enterprise Survey 2007–2015.



The results for both OLS and IV estimations are reported in Table 11. In columns (1) and (4), the estimated coefficients for foreign value added in exports are positive and show that foreign value added in exports increases wages. The effects of foreign value added in exports on wages may be either through higher demand for labor or more competition from larger firms in attracting labor, which increases wages. However, the coefficients are not statistically significant. As shown in columns (3) and (6), foreign value added in exports increases the probability of firms having subcontracts but the coefficients are only statistically significant in column (6).

The results in columns (2) and (5) indicate that foreign value added in exports has positive effects on SMEs' revenue and the coefficients are statistically significant. This shows that higher innovation may come from a higher level of resources as SMEs are involved directly or indirectly in global value chains. This is consistent with the hypothesis that foreign value added in exports complements the development of domestic SMEs.

## 6. CONCLUSION

The main objective of this study was to estimate the effect of the Vietnamese economy's linking to global value chains on the innovation of SMEs in the manufacturing sector in Viet Nam. In this paper, we explore the relationship between foreign value added in exports and SMEs' innovation in Viet Nam over the period 2007–2015. Using data from the Viet Nam Small and Medium Enterprise survey, we test whether a higher share of foreign value added in exports is more or less likely to make SMEs innovate. To address the potential biases from omitted variables, we use the Chinese domestic value added in gross exports to the world as an instrument for foreign value added in gross exports in Viet Nam.

We find that foreign value added in gross exports correlates negatively with SMEs' decision to introduce new products but is positively associated with their decision to improve existing products. These relationships are more profound for firms in industrial zones and nonexporting firms. These findings imply that the production linkages with lead or foreign firms may be more important to the domestic SMEs' innovation than direct trading activities. The paper also seeks to examine the channel through which the economy's participation in the global value chain may affect SMEs' innovation. We find evidence that the economy's participation in the global value chain leads to domestic SMEs achieving higher sales and have more subcontracts, which may help them have more resources to innovate.

As SMEs tend to improve existing products when the economy is more involved in global value chains, the government could use policies to incentivize SMEs to demand better technology, thereby improving the innovation system and creating a favorable environment in which to transfer new technology. These policy packages may include access to finance for those who invest in learning and adopting better technologies.

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