HUMAN CAPITAL AND PARTICIPATION IN GLOBAL VALUE CHAINS: EVIDENCE FROM SMALL AND MEDIUM-SIZED ENTERPRISES IN INDONESIA

Vutha Hing, Shandre Thangavelu, and Dionisius A. Narjoko

Asian Development Bank Institute

Vutha Hing is a PhD student at the Institute for International Trade of the University of Adelaide. Shandre Thangavelu is a professor at the Jeffrey Cheah Institute for Southeast Asia, Sunway University, and the Institute for International Trade at the University of Adelaide. Dionisius A. Narjoko is senior economist at the Economic Research Institute for ASEAN and East Asia.

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

Abstract

This paper examines the effects of human capital on SMEs' participation in global value chains using Indonesian firm-level data. The paper adopts the discrete choice modeling of the probit framework to examine the behavior of firms in the export market. In particular, it examines SME behavior in the export market using firm-level data from the Indonesian Annual Manufacturing Survey in 1996 and 2006. The results indicate that SMEs' size, ownership structure, and financing capability drive their participation in global value chains. The results also suggest that SMEs with linkages to global value chain activities are more likely to have a higher level of human capital, higher productivity, more assets, and investment in research and development. We also find that "learning by exporting" and proximity to an export hub tend to play an important role in shaping SMEs' role in global value chains.

Contents

1. INTRODUCTION

The structure of world production now consists of highly integrated global and complex networks of firms involved in the production of intermediate parts and components, assembly, and distribution of the final outputs to consumers worldwide, commonly known as global value chains (GVCs)[1] (De Backer, De Lombaerde, and Iapadre 2018). As a consequence, the exchange of goods and services leads to a global production network. In the past decade, global supply chain trade has accounted for over 50% of goods trade and almost 70% of service trade (Gurría 2015).

The rise[2] of GVCs is transforming global trade and investment in several key dimensions. Baldwin (2012) asserted that GVCs are transforming developing countries in terms of creating linkages between global and domestic trade and industrial structure. The less developed countries are able to participate in the global production value chain based on their "comparative" and competitive advantages. Cadestin et al. (2018) also supported the new thinking of "bringing industrial policy into global value chains" based on the ground that GVCs provide a fast and easy path to industrialization and development. Despite having no consensus, there is growing evidence that participating in GVCs offers a wide range of economic benefits in terms of increasing trade and investment, enhancing competitiveness and growth (UNCTAD 2013; OECD 2013; Cattaneo et al. 2013; World Bank 2020). These have led to a popular trend whereby almost all countries aspire to join GVCs.

The prevalence of GVCs is also changing the role of firms, including small and medium-sized enterprises (SMEs), in international trade. Firms no longer strive to develop integrated industries but rather to link with value chain actors, specialize in a specific task or stage in the GVC, and move up value chains. Such a business strategy can in turn bring them substantial gains, including, among others, enhanced efficiency and productivity (Kang et al. 2010; Miroudot, Lanz, and Ragoussis 2009) and the potential transfer of technology and knowledge (De Backer, De Lombaerde, and Iapadre 2018; Cattaneo et al. 2013). GVCs offer SMEs a new platform to connect to foreign partners that could eventually help them to upgrade their products and boost their productivity and output growth (González et al. 2019). However, the critical challenge is that only a small proportion of SMEs manage to join production networks effectively. According to the WTO (2016), about 10% of manufacturing SMEs and 3.5% of services are involved in supply chain activities. The level of integration for large firms is significantly higher (26.7% for the manufacturing sector and 36% for services). This raises the fundamental question of which factors help SMEs to join GVCs.

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[1] Gereffi, Humphrey, and Sturgeon (2005) put forward the term "global value chains or GVC" to describe the new global production configuration in which countries source goods and services from several countries within an established network of firms that lead firms coordinate. Different disciplines use different terminologies for this phenomenon. For example, economists like Arndt and Kierzkowski (2001) and Grossman and Rossi-Hansberg (2008) defined such a production process as "production fragmentation," while economic geographers like Henderson et al. (2002) and Coe, Dicken, and Hess (2008) conceptualized it as a "global production network." This paper acknowledges the differences in the underlying concepts of value chains. Nevertheless, we use these terminologies interchangeably.

[2] Technological progress, advances in the transport and logistic sector that lead to a significant decline in trade costs, more liberal policies toward freer trade and investment flows, and the opening up of emerging economies, especially the People's Republic of China and India, drive the rapid proliferation of GVCs (Baldwin 2013; Humphrey and Schmitz 2002; De Backer, De Lombaerde, and Iapadre 2018; Amador and Cabral 2016; Baldwin 2012; Athukorala 2011).

This paper examines the performance of SMEs in terms of linkages with global value chains. In particular, we examine the factors that affect SMEs' participation in GVCs in the Indonesian manufacturing sector using firm-level data. Further, we look closely at human capital development and its impact on SMEs' participation in GVCs. The paper examines firm dynamics using firm-level data from Indonesia's Annual Manufacturing Survey in 1996 and 2006.

The empirical research examining the effects of SMEs on GVC activities in developing countries remains limited. Some recent studies, including Abe (2015); Harvie, Narjoko, and Oum (2010b); Wignaraja (2012) have examined the challenges and opportunities for SMEs in GVCs as well as empirically assessing the factors shaping SMEs' role in production networks. However, the major limitation of some prior studies rests on their research methods and sources of data. Some relied on perception from a survey of a limited number of firms to draw an argument that the low GVC participation of SMEs is mainly due to their lack of business networks, limited financial and human capital resources, lack of production and distribution competence, and difficulties in complying with complex trade procedures. The findings from studies of this sort provide insights into SMEs' challenges, yet they lack rigorous and econometric techniques to explain these relationships. Others, such as Harvie, Narjoko, and Oum (2010a) and Wignaraja (2012), applied an appropriate method to assess the determinants of SMEs' participation in GVCs. Nevertheless, these studies did not focus on Indonesian SMEs and on quantifying the impact of human capital on SMEs' participation in GVCs. This paper, therefore, aims to fill this gap by focusing on the effect of human capital and other firm-level characteristics on SMEs' participation in global value chains in Indonesia.

The remainder of this paper proceeds as follows. Section 2 briefly discusses the theoretical background and the literature review of SMEs and GVCs. Section 3 provides an overview of Indonesian SMEs with a strong emphasis on economic significance and participation in global value chains. Section 4 elaborates the empirical specification and data sources. Section 5 discusses the empirical results. Section 6 concludes.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

The literature on SMEs and global value chains can be grouped into two broad categories. The first strand of literature focuses on conceptualizing SMEs' engagement in production networks. Harvie (2010) framework of SMEs and production networks is one among a few that elaborate the possible roles of SMEs in production networks and the factors determining their business outcomes. SMEs can join the production process at various levels. They can be lower- or higher-tier suppliers according to their resources and psychological factors. Resource factors, which include, among others, financial resources, technology, market access, and skilled labor, essentially influence SMEs' capacities. Psychological factors relate to corporate norms, such as self-efficacy, business culture, desire, and commitment. The external environment, such as government policies and domestic and overseas market conditions, can also have an effect on SMEs' trajectory in production networks. Also highly relevant to the SME–GVC nexus is the WTO (2016) illustration of alternative trajectories for SMEs to engage in GVCs. According to this report, SMEs can participate in GVCs by either exporting goods or services directly to firms overseas or supplying inputs to local firms that produce for exporting. Studies refer to this mode of engagement as "forward GVC participation." Alternatively, SMEs can participate in value chain activities by sourcing inputs from foreign suppliers to produce goods and services for domestic consumption

and exports. Such a mode of integration reflects upstream linkages with foreign partners and is known as "backward GVC participation."

It is worth noting that these two concepts have different focuses. Harvie's framework, on the one hand, articulates how firm capacities, the corporal culture, and the national business environment influence SMEs' behavior in value chain activities. The WTO (2016) definitional concept, on the other hand, specifically focuses on measuring firms' participation in GVCs. Notwithstanding, several empirical studies have used these concepts as the basis for designing empirical specifications. For example, Harvie, Narjoko, and Oum (2010a) applied Harvie's framework to draw an econometric specification for assessing the determinant factors of SMEs' participation in production networks. Thanh, Narjoko, and Oum (2009) also used the framework as a guideline for designing a country-specific case study on SME integration. The production networks in Cadestin et al. (2018) study followed the definition of SME participation in GVCs from the WTO (2016) and merged the WTO–OECD's Trade in Value-Added (TiVA) with enterprise data to map the participation of multinational enterprises in GVCs. González (2017) followed the same procedure to map the GVC participation of SMEs in ASEAN.

The second strand of literature emphasizes the empirical investigation of the factors affecting SMEs' integration into GVCs. Some studies have used pooled firm-level data from various countries, while others have specifically examined a country case study. Harvie, Narjoko, and Oum (2010a); Wignaraja (2013); Duval and Utoktham (2014); Wignaraja (2013) and Arudchelvan and Wignaraja (2016) are a few examples of studies on SMEs' participation in GVCs using multi-country firm-level data. Despite using different datasets, these studies adopted similar econometric specifications and explanatory variables. Specifically, Wignaraja (2012) used the World Bank Enterprise Survey (WBES) to investigate the factors influencing SMEs' participation in supply chains for five ASEAN economies. The firm-specific factors included firm size, year of establishment, type of ownership, technological capabilities, access to finance, education and skills of employees, and education and experience of executives. He tested several hypotheses, one of which was that a higher level of human capital correlates positively with joining supply chain trade. The findings supported the hypothesis that human capital is vital in supply chains. Having workers with a high level of education increases the probability of a firm joining supply chain trade. Other firm-specific factors, such as size, technological capacities, and access to credit, were also important for SMEs to join GVCs.

Duval and Utoktham (2014) used the WBES from 122 countries to conduct a similar empirical assessment. They defined SMEs as participating in a production network if they engaged in direct exports or indirect exports (supplying goods and services to domestic firms that produce for exporting). Their empirical results suggested that technology, international quality certification, access to finance, and foreign ownership increase the probability of SMEs' participating in international production networks. They chose the proportion of unskilled workers as a proxy for human capital and generally found no significant effect on SMEs' participation in value chains.

Harvie, Narjoko, and Oum (2010b) constructed a dataset from an SME survey in seven ASEAN countries to identify the challenges facing SMEs and then to assess the determinants of SMEs' participation in production networks. They examined the direct and indirect effects of SMEs' activities in production networks. The study found that productivity, foreign ownership, and access to financial institutions significantly determines the participation of SMEs in production networks. SMEs that were active in the innovation process also increased their likelihood of engaging in production networks. Interestingly, proximity to SEZs and ports, size, and age appeared to have no effect on SMEs' participation in production networks. Skill intensity, which the study

measured using the ratio of non-production workers to production workers, denoted the human capital resources of firms. However, the results were quite unstable across specifications and in general human capital resources appeared to be insignificant. The findings highlighted the importance of technology and know-how, foreign connection through ownership, and the adoption of new business ideas for SMEs to be competitive and participate successfully in production networks.

The recent study by Chuc, Anh, and Thai (2019) quantified the factors that help Vietnamese SMEs to participate effectively in production networks based on a survey of 208 enterprises. The estimation also accounted for skill intensity, which the study defined as the share of workers with higher education in the total number of workers, and training expenditure. Like earlier studies, the coefficients of size, foreign ownership, and productivities were positive and statistically significant. The authors found that skills have a positive and significant association with the propensity to join production networks, but such an effect does not happen for investment in training. The findings also indicated that SMEs that have a better connection with foreign markets and more active industry and business associations are relatively more likely to join GVCs. Also using micro-level data from Vietnamese manufacturing firms is the work by Thangavelu (2014). Despite quantifying the productivity spillovers of horizontal and backward FDI linkages, this study highlighted the importance of investment in human capital in helping local firms to improve their efficiency and productivity, which consequently increases their probability of linking with foreign firms and production networks.

Empirical research on Indonesian SMEs in GVCs is scarce in the existing literature. Machmud and Siregar (2009) compared the characteristics of SMEs joining production networks based on data from a survey of 105 firms. They found that SMEs in production networks are generally bigger, use modern production methods, are more open to international business, and have a higher percentage of workers with a high level of education. Although most of these results are consistent with the theoretical prediction, it is hard to draw a conclusive statement due to the problem of sampling and the absence of empirical procedures to quantify the effects. Anas, Mangunsong, and Panjaitan (2017) used descriptive statistics from an SME survey to portray the nature of Indonesian SMEs in the ASEAN economic integration. They also applied the probit estimation approach to assess the impact of free-trade agreements (FTAs) on exports and imports. The results indicated that exporting and importing SMEs are more likely to understand ASEAN economic integration better and have business relationships with foreign partners. The study also found that FTAs have encouraged firms to export and import. The research by Thangavelu, Nuryartono, and Findlay (ND) differs from the other two studies in the sense that it used a large dataset from the Indonesian Annual Manufacturing Survey for its empirical estimation. Despite focusing primarily on the impact of service activities on the productivity of the manufacturing sector, the findings implied that the servicification of manufacturing activities helps to foster Indonesian firms' participation and moving up in value chains. Human capital is one of the fundamental factors that drive service activities, and therefore the development of skills for workers will be critical to support and develop new service linkages and the productive capacity of the Indonesian manufacturing sector in global and regional production value chains (Thangavelu, Nuryartono, and Findlay ND).

3. OVERVIEW OF INDONESIAN SMES

3.1 SMEs in the Indonesian Economy

The latest statistics on the contribution of SMEs [3] to business establishments, employment, GDP, and exports prove that these enterprises are critical for Indonesia's economy. The consistent provision for SME development in the Indonesian government's five-year development plans as well as considerable program support for SMEs have also magnified their significance in the economic trajectory and social inclusion. According to statistics from the Ministry of Co-operatives and SMEs, which Table 1 presents, Indonesia had 62.93 million enterprises in 2017, of which 99.99% were SMEs. Micro enterprises were predominant, accounting for 98.92% of the total establishments. In terms of economic activities, the wholesale and retail trade sector accounted for 46% of non-agricultural Indonesian SMEs in 2016, followed by the manufacturing sector and hospitality and catering services, each representing 17% of the total (OECD 2018). Undoubtedly, the dominance of establishments has made SMEs the biggest source of employment in Indonesia. About 97% of occupations in 2017 were in SMEs, and the remaining 2.7% were in large enterprises. Again, the largest proportion of employment was in micro enterprises.

Table 1: Key Characteristics of Indonesian Enterprises by Firm Size, 2017

	% of Total Enterprises	% of Employment	% of GDP	% of Exports	Labor Productivity*
A. MSMEs	99.99	97.3	57.08	14.17	USD 44,133
Micro enterprises	98.92	90.8	30.06	1.26	USD 8,400
Small enterprises	0.99	3.5	12.54	2.48	USD 41,460
Medium-sized enterprises	0.08	3	14.49	10.44	USD 82,540
B. Large enterprises	0.01	2.7	42.92	85.83	USD 266,328

* The figure refers to the average GDP per employee for 2013, cited from OECD (2018).

Note: Micro enterprises are those with assets below Rp50 million or sales below Rp300 million; small enterprises are firms with assets of Rp50 to Rp500 million or sales between Rp300 million and Rp2.5 billion; and medium enterprises are firms with assets between Rp500 million and Rp5 billion or sales between Rp2.5 and Rp50 billion.

Source: Ministry of Co-operatives and SMEs.

The contribution of SMEs to national outputs is not as dominant as that of employment. SMEs contributed about 57% to the GDP in 2017 compared with 42.9% from large enterprises. This outcome reflects a significant gap in labor productivity. The average value added per employee at the current price in 2013 for SMEs was $44,133, which was 6 times lower than that of large enterprises. The lowest productivity was in micro enterprises, with a productivity level that increased with the size of enterprises. SMEs' participation in export activities was significantly lower. The share of micro enterprises in the total exports was 1.26%; it was 2.48% for small and 10.44% for medium-sized

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[3] There is no single official definition of SMEs in Indonesia. Although the country has a legal SME definition in the Law No. 20/2008 that differentiates MSMEs by sales turnover and net assets, other public administrations, such as the Central Board of Statistics (BPS), use employment criteria to define SMEs. This paper adopted the SME definition in the Law No. 20/2008. Precisely, micro enterprises are those with assets below Rp50 million or sales below Rp300 million; small enterprises are firms with assets of Rp50 to Rp500 million or sales between Rp300 million and Rp2.5 billion; and medium enterprises are firms with assets between Rp500 million and Rp5 billion or sales between Rp2.5 and Rp50 billion. Although many official statistics disaggregate micro enterprises, the term "SMEs" in this paper often includes micro enterprises.

enterprises. Large enterprises accounted for the remaining 86% of exports. The under-representation of SMEs in export activities is actually a common pattern in most developing countries, since exporting requires significant initial investment in foreign market research, business networks with foreign partners, and product standards and compliance. These require financial resources and technical capabilities, which are often the major constraints facing SMEs.

3.2 SME Development Policies

The Indonesian government has adopted a number of strategic directions for SME development. The key directive is the Law on Micro, Small, and Medium Enterprises (MSMEs), which it enacted in 2008 and which formally sets the definition of SMEs and mandates the Ministry of Co-operatives and SMEs to lead policy co-ordination. The law also puts forward a series of policy measures, including, among other things, access to finance, business information, business support infrastructure, and business licensing, to enhance SMEs' contribution to economic growth. Apart from the Law, the National Mid-term Development Plan 2014–2019, the five-year policy direction for all ministries and government agencies to formulate their respective strategic plans, envisions the improvement of the productivity and competitiveness of SMEs. Relevant to SMEs are the strategies proposed to support SMEs' development objectives. They include (1) improving human resources quality, (2) enhancing access to finance, (3) increasing the value added of SMEs' products and their international presence, (4) strengthening partnerships and networks, and (5) improving rules and regulations.

The strategic programs and actions aiming to support the aforementioned strategies are diverse, and various ministries and public ministries manage them. For example, the Finance and Development Supervisory Agency, in cooperation with the Bank Indonesia, implemented the so-called "Kredit Usaha Rakyat" (KUR) program in 2007 and manages it. It is by far the largest micro credit program in Indonesia and provides business loans to SMEs at a lower interest rate, with a backing loan in 2014 reaching IDR 49.5 trillion (OECD 2018). The establishment of the SME Productivity Center under the supervision of the Ministry of Manpower and Transmigration also aimed to improve the productivity of SME workforces through the provision of technical training. Also relevant to human resources for SMEs are the entrepreneurship and management training programs that many other ministries and public institutions provide.

SME internationalization strategies primarily aim to promote SMEs' exports and participation in global value chains. The programs supporting SME internationalization are diverse in focus and management. For example, Indonesia Eximbank introduced export financing to help firms acquire export credit, export guarantees, and export insurance services. Besides, Indonesia Eximbank administers export-oriented training on export regulations, customs procedures, packaging, and online marketing as well as a coaching program for new exporters (OECD 2018). The Ministry of Trade, on the other hand, is in charge of non-financial aspects of internationalization. Key measures include the provision of export market information, product design and packaging for exporting, and export training. The Ministry also created the AEC Center in September 2015 as a venue to provide business counseling and market intelligence services for Indonesian firms that are striving to increase their exports to the ASEAN region.

Besides generic export support programs, the Indonesian government has introduced a number of specific measures to promote SMEs' integration into global production networks. The local content requirement that the Indonesia Investment Co-ordinating Board has imposed in certain sectors (i.e., machinery, motor vehicles, food, beverages, etc.) is among the policy directions aiming to promote the sourcing of domestic inputs in

the production for exports and hence enhancing the participation in value chains. Moreover, the Indonesia Investment Co-ordinating Board has recently introduced a matchmaking program through events and a website to enable local SMEs to be potential suppliers of multinational corporations.

3.3 SMEs' Participation in Global Value Chains

This section highlights the extent to which SMEs join global value chains. It then compares the characteristics of the SMEs that are effectively participating in GVCs (denoted as GVC SMEs) with those that are not participating in GVCs (denoted as non-GVC SMEs). As a later section will discuss in detail, the paper defines GVC SMEs as those that source raw material from abroad and produce outputs for exporting. Figure 1 suggests that not many Indonesian SMEs are effectively linked with global production networks, and this is manifest in a significantly low GVC participation ratio (4.1%). The level of integration in value chain activities for SMEs is comparable to the average for all manufacturing firms but significantly behind that for large firms (25.6%). Small enterprises have an even greater disadvantage when it comes to international transactions and are hardly able to connect to GVCs. Medium-sized firms, on the contrary, are better able to link with production networks, with a participation ratio that is about twice as high as that for all firms. The pattern appears to show that the GVC participation ratio increases when firms are bigger, which indicates the significance of the economy of scale to overcome the cost of entry into GVCs.

Figure 1: Share of Indonesia's Firms Participating in GVCs by Size
(%)
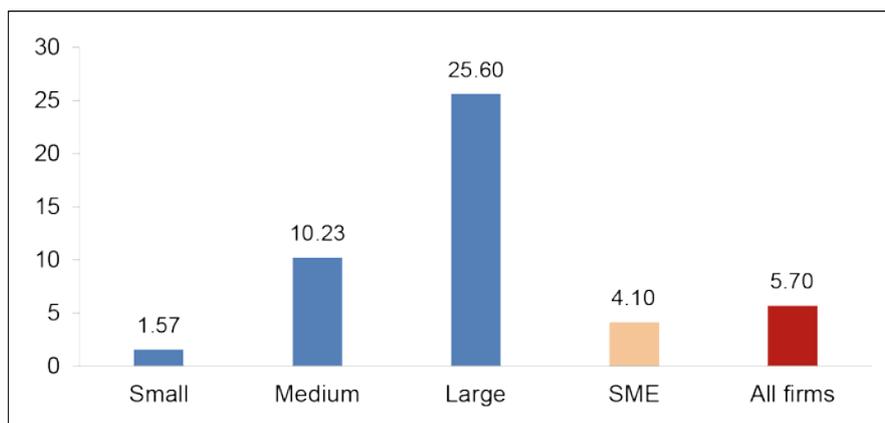
Note: The study calculated the share as the number of firms participating in GVCs divided by the total number of firms. It derived the share for SMEs from the ratio of SMEs participating in GVCs to the total number of SMEs.

Source: Author's calculation based on the IAMS in 1996 and 2006.

It should be noted that the extent of GVC participation varies notably across sectors. Figure 2 clearly shows that SMEs in the waste treatment and disposal sector are the most integrated into GVCs, with a participation rate of 12.7%. The sector with the second-highest percentage of SMEs in GVCs is transport equipment (7.1%), followed by other manufacturing (6.9%), chemicals (5.8%), and basic metals (5.7%). For the electric and electronic sector, despite having dynamic production networks linking various types of firms from different countries, only 5% of Indonesian SMEs could integrate into the networks. With even lower linkages with value chain activities are SMEs in the garment, apparel, and textile (3.1%), non-metallic mineral products (1.5%), and food, beverage, and tobacco (0.6%) industries.

Figure 2: Share of Indonesia's Firms Participating in GVCs by Sector and Size
(%)
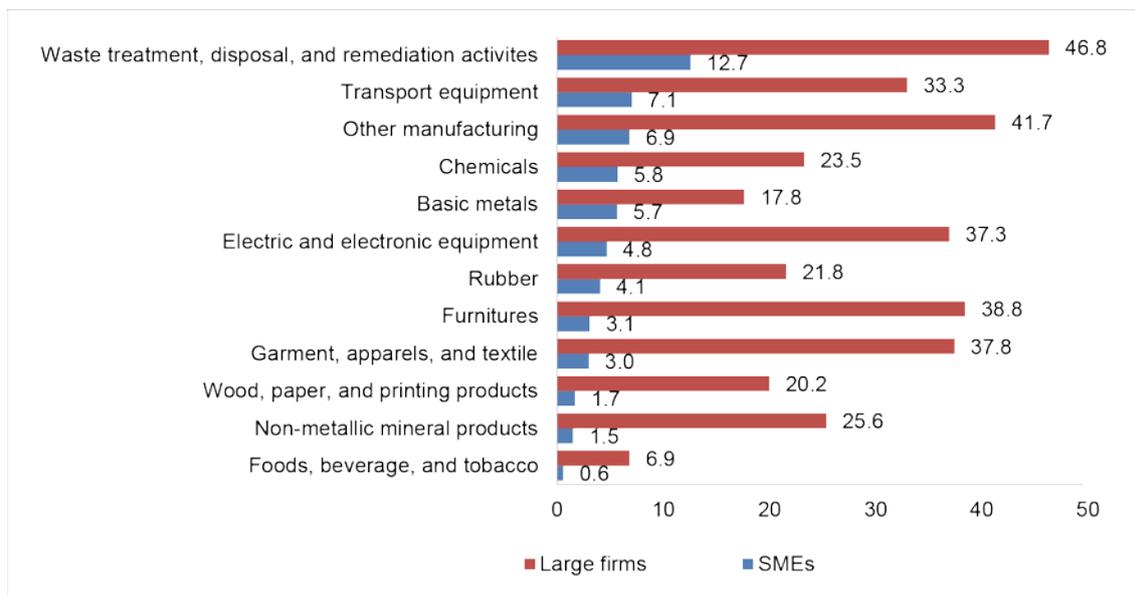
Note: The study calculated the share of SMEs in chemicals participating in GVCs as the number of SMEs participating in GVCs in that sector divided by the sector's total number of SMEs.

Source: Author's calculation based on the IAMS in 1996 and 2006.

Also interesting is the fact that, even within the same sector, GVC integration differs according to the size of enterprises. For example, 38% of large enterprises in the garment and textile sector had upstream and downstream linkages with foreign partners compared with only 3% of SMEs in this sector. In the electric and electronic sector, the GVC participation ratio is 37.3% for large firms versus 5% for SMEs.

Table 1 compares the average value of the firm characteristic variables of GVC SMEs with those of non-GVC SMEs and clearly indicates the significant existence of heterogeneity. The notable differences are not unique to Indonesia, as Antràs (2015); Bernard and Jensen (2004); Bernard et al. (2012); Harvie, Narjoko, and Oum (2010a); Wignaraja (2013); and Antras (2015) highlighted similar facts for other countries. Overall, GVC firms are larger, more productive, more capital intensive, and more innovative than non-GVC firms. On average, GVC SMEs have 191 employees compared with 65 for non-GVC SMEs, yet the former type of firm is younger, as the fewer years of operation show. About 38% of SMEs are foreign owned compared with just 2.6% of non-GVC SMEs. The average value of sales per employee for GVC firms is US$94,720 thousand, which is about twice as high as that for non-GVC firms. The gap in capital intensity between the two types of SMEs is smaller.

Moreover, GVC firms tend to have more formal training programs for staff and borrow more loans for investment than non-GVC firms. Table 1 also indicates that GVC SMEs employ significantly more skilled workers than non-GVC firms (49.7% versus 21.6%). The differences for all the variables are statistically significant. Although the t-test results provide some insights into the potential relationship of SME characteristics and participation in GVCs, they cannot explain the direction of causality. The econometric analysis in the following section remedies this methodological shortcoming.

Table 1: Comparison of SMEs' Characteristics

	GVC SMEs	Non-GVC SMEs	Statistically Different
Size	191	65	Yes ***
Age	10.5	12.5	Yes ***
Share of foreign ownership	37.9%	2.6%	Yes ***
Access to finance (%)	25.9%	13.9%	Yes ***
Skill intensity (% of skilled workers)	26.4%	21.9%	Yes ***
Share of firms providing a formal training program	49.7%	21.6%	Yes ***
Capital intensity (value of fixed assets per employee, thousand USD)	1,147.4	1,001.7	Yes ***
Labor productivity (sales per employee, thousand USD)	94,720.3	42,618.0	Yes ***
Expenditure on R&D (thousand USD)	3.8	1.2	Yes ***

Source: Author's calculation based on the IAMS in 1996 and 2006.

4. ECONOMETRIC SPECIFICATION AND DATA SOURCE

4.1 Econometric Specification

To estimate the effects of human capital and other SME characteristics on GVC participation, this paper adopts Roberts and Tybout (1997) theoretical model of the determinants of exporting, which stipulates that an SME participates in a GVC ($\Pr(gvc_{it} = 1)$) if its expected revenue (π_{it}) is greater than its current costs (c_{it}) plus its sunk cost of entry. Therefore, it is possible to express the GVC participation equation for SMEs as follows:

$$\Pr(gvc_{it}) = \begin{cases} 1 \ if \ \pi_{it} \ > \ c_{it} \ + \ N \ (1 - \ gvc_{it-1}) \\ 0 \ otherwise \end{cases} \tag{1}$$

where gvc_{it} is a dummy variable of firm *i* joining a GVC at time *t* and the term $N (1 - gvc_{it-1})$ denotes the sunk cost of GVC entry, which equals 0 if the firm had joined a GVC at time *t-1* and 1 otherwise. Since firm characteristics, such as size, age, ownership, capital, training and skills, productivity, and innovation, largely influence firm revenue and costs and because our firm-level data lack historical relevant information to capture the sunk cost, we can write our econometric specification to estimate the effects of human capital on SMEs' participation in GVCs as follows:

$$gvc_{isrt} = \alpha_0 + \beta_1 \ln size_{isrt} + \beta_2 sizesqr_{isrt} + \beta_3 \ln age_{isrt} + \beta_4 for\_own_{isrt} + \beta_5 acc\_fin_{isrt} + \beta_6 training_{isrt} + \beta_7 skill_{isrt} + \beta_8 \ln cap_{isrt} + \beta_9 \ln prod_{isrt} + \beta_{10} ln\_R\&D_{isrt} + \beta_{11} reg\_exp_{isrt} + time + region + industry + \varepsilon_{isrt} \tag{2}$$

where subscript *i* denotes the firm, *s* is the sector, *r* is the region, and *t* refers to time. We discuss the definition and measurement of the variables below.

- *GVC participation (gvc_{isrt})*: This is a dummy variable with the value 1 if firm *i* in sector *s* at time *t* from region *r* joins a GVC and 0 otherwise. Conceptually, SMEs can participate in GVCs in two different ways. They can engage in GVCs either by exporting intermediate goods or services directly to firms overseas or by supplying inputs to local firms that produce for exporting. The WTO (2016) calls this measure a "seller-related or supply-side" approach and labels this mode of

engagement "forward GVC participation." Alternatively, SMEs can participate in GVCs by sourcing inputs from foreign suppliers to produce goods and services for domestic consumption and exports. This mode of participation is known as "backward participation." It reflects the upstream linkages with foreign partners to source inputs for production (WTO 2016).

This paper focuses on firms' productive capacity and their ability to link both upstream and downstream within production networks as a proxy for SMEs' participation in GVCs. Antràs (2019) argument stating that, when a firm both imports and exports, it is natural to conclude that this firm participates in a GVC inspired our selection of a conceptional definition. In the IAMS questionnaire, there are two questions capturing information on imports and exports. The first question asks about the source of raw material purchase in terms of quantity and value. It is possible to calculate the percentage of imported raw material simply as the ratio of the value of imported raw materials to the total value of raw materials. We can consider SMEs that source raw material from abroad to have upstream linkages with foreign partners. The second question enquires about the percentage of outputs that the company exports, which we interpret as the firm's linkage with foreign buyers. Therefore, we can classify SMEs that source raw material from abroad and produce outputs for exporting as participating in a GVC. This means that gvc_{isrt} equals 1 if a firm has both a ratio of imported raw material and a percentage of exports greater than 0 and 0 otherwise.

- *Size ($size_{isrt}$)*: Like most firm heterogeneity literature, for example Sjöholm (2003); Bernard and Jensen (2004); Sjöholm (2003); Jinjarak, Mutuc, and Wignaraja (2014); Harvie, Narjoko, and Oum (2010a) we measure firm size using the total number of employees.

- *Age (age_{isrt})*: This refers to the number of years in operation. In the Indonesian Annual Manufacturing Survey (IAMS), question 9 asks for the "starting year of commercial production," and the respondents provide the answer as a specified year. To obtain the age of a firm, we subtract the firm's operating year from the year of the survey and then add one.

- *Foreign ownership (for_own_{isrt})*: This is a dummy variable with the value 1 if the establishment is foreign owned and 0 otherwise. We define foreign-owned firms as those for which foreign individuals, companies, or organizations own 10% or more of their capital stake.

- *Access to finance (acc_fin_{isrt})*: This variable takes the value 1 if a firm has a credit line/loan from a financial institution and 0 otherwise.

- *Human capital ($hcap_{isrt}$)*: We use two separate measures to capture various aspects of human capital in enterprises.
  - The first variable is skill intensity within a firm ($skill_{isrt}$), which we measure as the share of skilled workers in the total number of employees. We follow Kasahara, Liang, and Rodrigue (2016) to measure skills based on educational attainment. Skilled production workers refer to production workers with at least senior high school education, while skilled non-production workers refer to this type of workers with a college degree. Thus, we calculate the share of skilled workers as the sum of skilled production and skilled non-production workers divided by the total number of employees.

- o The second variable reflects firms' training program for employees ($training_{isrt}$). It takes the value 1 if a firm provides formal training to its employees and 0 otherwise.

- o Since the quality and ability of workers within an enterprise is the fundamental resource for success, we hypothesize that SMEs with higher quality of human capital are more likely to engage effectively in GVCs.

- *Labor productivity ($prod_{istj}$)*: We use the ratio of the total annual sales to the total number of employees for this variable. Like most firm heterogeneity empirics, this paper hypothesizes that labor productivity is positively associated with GVC participation.

- *Capital intensity ($capint_{isrt}$)*: The measure of capital intensity varies slightly. Some studies, for example Farole and Winkler (2012) and Rodríguez-Pose et al. (2013), used the value of machinery, vehicles, and equipment as a proxy, while others, such as Aggarwal and Steglich (2018), measured capital intensity based on fixed assets. We observe considerable missing data for the value of building and machinery in our dataset and decide to use fixed assets instead. Precisely, we measure capital intensity as the value of fixed assets per employee.

- *Research and development ($R\&D_{isrt}$)*: We use the annual expenditure on research and development and production engineering as a proxy for this variable. Firms' ability to innovate and upgrade their production capability would help them to link rather easily with foreign partners. Thus, we hypothesize that SMEs with higher expenditure on research and development are more likely to participate in GVCs.

- *Regional knowledge (*reg_exp_{isrt}*)*: We follow Sjöholm (2003) to capture the export spillover effect on the propensity to join a GVC. We measure it as the average percentage of output that each region exports. We anticipate that regions that export a greater share of outputs are relatively likely to have more SMEs participating in GVCs.

- As previously mentioned, the level of SMEs' integration into GVCs varies across time, sector, and region. To account for time, industry, and region variation, we include time, industry, and sector dummy variables in our estimation.

4.2 Data

The data that we use for our empirical estimation come from the Indonesian Annual Manufacturing Survey (IAMS), which the Indonesian Central Bureau of Statistics manages. It has conducted the IAMS annually since 1975 with manufacturing establishments employing 20 staff members or more using a predefined questionnaire. The questions cover a broad range of business operation topics from general information, workers' wages and education attainment, and itemized incomes and expenditures to imports of raw materials and export share.

An important note on the IAMS dataset is that only the 1996 and 2006 rounds contained questions on employees' training and educational attainment, research and development, and business constraints and prospects. These allow us to construct human capital variables that align well with the human capital concept and empirics. On this ground, we choose the IAMS in 1996 and 2006 as a source of data. Altogether, there are a total of 52,456 enterprises, of which 22,997 are from the 1996 survey and 29,468 are from the 2006 survey. We define SMEs according to the Indonesian 2008 Law on Micro, Small, and Medium Enterprises (MSMEs), which classifies the sizes of enterprises

according to the net assets or annual revenues. Based on the revenue criteria, we define SMEs as those with annual revenues less than 50 billion Indonesian rupiah. This definition classifies 93% of enterprises as SMEs and the remaining 7% as large firms. Since we are interested in the factors that facilitate SMEs' joining of GVCs, we drop large firms from our sample. We also exclude observations with missing data for any variable. Such a data-cleaning procedure leaves us with 41,227 observations for estimation.

The final note on data processing is that we redefine the regional and sectoral coverages at a more aggregate level. Specifically, we group the provinces in which enterprises were located into seven geographic regions: Java, Kalimantan, the Maluku Islands, the Lesser Sunda Islands, Western New Guinea, Sulawesi, and Sumatra. We group manufacturing activities, which we originally coded at the five-digit level using the International Standard Industrial Classification (ISIC), into a two-digit classification before we categorize them further into a more aggregate sector based on the similarity of economic activities. This gives us 11 sectors: foods, beverages, and tobacco; garments, apparel, and textiles; wood, paper, and printing products; chemicals; rubber; non-metallic mineral products; basic metals; electric and electronic equipment; transport equipment; furniture; and other manufacturing.

4.3 Estimation Methods

We estimate equation (2) using two econometric methods. The first estimation applies the linear probability model (LPM), which assumes that all regressors are exogenous and coefficients are the marginal effects. The second estimator is the probit model, which is suitable for a binary choice. Several empirics on firm heterogeneity, for example Roberts and Tybout (1997); Sjöholm (2003); Roberts and Tybout (1997); Harvie, Narjoko, and Oum (2010a); Wignaraja (2012), have applied the probit model to quantify the decision to participate in exporting and global value chain activities. In all the estimations, we control sector, time, and region fixed effects.

To show that our baseline results are robust, we implement several robustness checks. First, we change the measure of GVC participation and distinguish backward GVC from forward GVC participation. Second, we adopt an employment-based definition of SMEs and re-estimate equation (2) using the LPM and probit model. Third, we introduce an instrumental variable as an alternative strategy to address the endogeneity concern. We suspect that skill intensity is endogenous and thus instrument it with two variables, namely the number of educational institutions in each region and the average ratio of skilled workers in each industry in a given year and region. We estimate the IV regression using the most commonly used estimator, two-stage least square (2SLS).

5. EMPIRICAL RESULTS AND DISCUSSION

5.1 Baseline Results

Table 2 shows the baseline empirical results from the linear probability framework (column 1) and the probit method (column 2).[4] The table reports the standard errors in parentheses. With the exception of age, all the coefficients have the expected sign and

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[4] We examine the potential multicollinearity problem in our regression model. The correlation matrix is available from the author(s). The correlation suggests that the explanatory variables are weakly correlated. The highest correlation is between the skill and the size variable, with a value of 0.3179.

are statistically significant. Our results seem stable across different specifications, reflecting the robustness of the estimates.

The size coefficients are positive and strongly significant in both specifications. This means that larger SMEs are more likely to participate in value chain activities. The finding supports the prior hypothesis about the importance of the scale of economy to overcome the fixed cost of entry into GVCs. The coefficient of firm size square is positive and significant, implying that SMEs have to be very large to engage effectively in production networks.

Table 2: Estimation Results for SMEs' Decision to Participate in GVCs

Probability of Participating in GVCs	(1) LPM	(2) Probit
Firm size	0.0134***	0.470***
	(0.000241)	(0.0279)
Firm size squared	0.000000790***	0.000000556
	(0.0000000595)	(0.000000438)
Age	−0.00424	−0.0772***
	(0.00509)	(0.0170)
Foreign ownership	0.248***	0.925***
	(0.0284)	(0.0410)
Access to finance	0.0131*	0.140***
	(0.00559)	(0.0365)
Formal training	0.0159***	0.230***
	(0.00161)	(0.0312)
Skill intensity	0.0302***	0.414***
	(0.00404)	(0.0579)
Labor productivity	0.00632***	0.130***
	(0.000786)	(0.0141)
Capital intensity	0.000921	0.0114***
	(0.000470)	(0.00276)
Research and development	0.0105*	0.0158
	(0.00496)	(0.0210)
Export spillover	0.00129***	0.0563
	(0.000250)	(0.0452)
Constant	−0.122***	−6.918***
	(0.0151)	(0.900)
Year FE	Yes	Yes
Region FE	Yes	Yes
Sector FE	Yes	Yes
Observation	41,227	41,209
Adj. R-sq./pseudo R-sq.	0.1722	0.3231

Standard errors in parentheses; * p<0.05; ** p<0.01; *** p<0.001.

Source: Author's calculation based on the IAMS in 1996 and 2006.

The effect of enterprise age highlights that older SMEs tend not to join GVC activities, compared with younger SMEs, as the size coefficient is negative under the probit estimation. Our results are similar to those of Sjöholm (2003); Harvie, Narjoko, and Oum (2010a); Wignaraja (2012); Sjöholm (2003) and Aggarwal and Steglich (2018), who found negative and statistically significant coefficients. Wignaraja (2012) speculated that younger firms are more flexible and quicker to capture new technologies and understand new markets, which in turn help to facilitate their integration into production networks. Sjöholm (2003), on the other hand, attributed this finding to import substitution policies that encourage older enterprises to focus more on the domestic market than on export activities. We try to explore the reason behind the negative association between age and participation in GVCs by looking at expenditure on research and development and actual investment among firms with different years of operation from our database. The scatter plots suggest that younger SMEs tend to have more capital investment and greater expenditures on research and development, reflecting their superior capacity, which could lead them to relative success in GVC integration.

The ownership structure appears to have a positive and significant effect on SMEs' decision to join GVCs. More precisely, from column (1), foreign-owned SMEs are 25% more likely to engage in value chains than their domestic-owned counterparts. The results suggest that foreign ownership provides better networks with foreign partners, access to technology and management experiences, and learning from exporting from parent companies (Sjöholm 2003; Wignaraja 2015; Srinivasan and Archana 2011). The coefficients of access to loans are positive and statistically significant in both models, implying that SMEs that borrow money from financial institutions for capital investment are relatively more likely to be GVC firms.

The estimated coefficients for training and skills are positive and statistically significant in both estimations, leading us to conclude that SMEs that have better-quality human capital, which we measure as having a formal training program and a larger share of skilled workers, are more likely to engage effectively in global value chains. The importance of human capital in shaping firms' behavior in international trade is not uncommon in the empirical literature. For example, Wignaraja (2012) revealed that having a high school-educated workforce increases the potential for SMEs to join supply chains, while Aggarwal and Steglich (2018) found that skill intensity increases the probability of firms participating in value chains. Similarly, ADBI and ADB (2015) and Thangavelu, Nuryartono, and Findlay (ND) asserted that skills and training are among the critical factors that contribute significantly to firms' success in GVCs.

To establish the robustness of human capital effects, the new results allow us to check the sensitivity of the estimation. We follow Aggarwal and Steglich (2018) and measure skill intensity in terms of the ratio of wages and salaries to total sales. We then introduce another alternative proxy, which Thangavelu (2014) used, measuring the quality of labor via the average wage of a firm under the assumption that firms with higher average labor costs per worker employ more skilled labor. Table A.1 in the Annex provides the results of the estimation for alternative skill variables. The signs and magnitudes of all the variables are positive and statistically significant, indicating that human capital is critical for SMEs to join GVCs.

Other firm attributes also play an important role in shaping SMEs' outcome in GVCs. Specifically, more productive and capital-intensive firms appear to have a higher probability of GVC participation. The findings are in accordance with the theoretical prediction and support the well-known self-selection hypothesis in the firm heterogeneity literature. Since integration into production networks requires considerable initial investment, only SMEs with higher productivity and larger capital are able to offset the entry cost and self-select to enter into value chain activities. We observe a positive

coefficient for expenditure on research and development, implying that SMEs that spend more on research and development have a higher chance of linking to production networks. Finally, the sign of the export spillover variable is positive in the LPM model but not in the probit estimation, indicating that it is not robust.

5.2 Sensitivity Analysis

To check whether the baseline results are robust to several alternative measurements, this section introduces two sensitivity analyses. First, it alters the dependent variable proxy. We define GVC SMEs as those that engage in both importing and exporting activities. This definition is highly restrictive and fails to capture SMEs that link with either upstream supply chains or downstream supply chains. To capture firms involved in different modes of value chain activities, we construct separate GVC participation variables according to firms' commercial transactions. More precisely, we define SMEs that source intermediate inputs from foreign suppliers as "backward GVC participation." This variable takes the value 1 if SMEs import raw material from abroad and 0 otherwise. Another measure is called "forward GVC participation," which captures value chain involvement through exporting goods or services directly to firms overseas. Disaggregating by the mode of value chain participation, 15.2% of Indonesian SMEs deal with forward GVC and 18.3% engage in backward GVC. We estimate equation (2) separately for backward GVC participation and forward GVC participation and validate the results with the previous estimates.

Columns (1) and (2) in Table 3 report the results for backward GVC participation using the LMP and probit methods, respectively, while columns (3) and (4) contain the estimates for forward GVC participation. Similar to the baseline model, the goodness of fit for our alternative estimations is acceptable and the results are generally stable across different estimation methods for each dependent variable. The signs of the coefficients of size and foreign ownership are positive and statistically significant for all the specifications. Regardless of the mode of GVC engagement, size and ownership structure are important factors facilitating SMEs' participation in GVCs. The effect of age and access to finance varies according to the mode of GVC participation. For backward GVC participation, SMEs with more years of operation seem to have a higher GVC participation propensity; the sign is the opposite for forward GVC participation. Similarly, while access to finance does not matter for backward GVC participation, it is important for SMEs that engage in exporting activities. This is perhaps due to that fact that entry into export markets involves a significant cost, and therefore the ability to finance exports through bank loans or other sources of capital enables SMEs to join GVCs relatively easy.

Also differing according to the mode of GVC participation are the effects of labor productivity, capital intensity, and R&D. For example, we find that labor productivity has a negative effect on backward GVC participation but a positive and significant effect on forward GVC participation. The result still supports the self-selection hypothesis that high-productivity SMEs choose to focus more on export markets. Similarly, more capital-intensive SMEs have a higher probability of GVC participation, and the magnitude is much stronger for forward GVC participation. As expected, the training and skill variables turn out to be significant with the correct sign, indicating the important role of human capital in helping SMEs to join supply chains, through either upstream or downstream linkages. Thus, a higher level of human capital is important for SMEs to join supply chains successfully, and these results hold regardless of the different measures of GVC participation.

Table 3: Estimation Results for SMEs' Backward and Forward GVC Participation

	Backward GVC Participation		Forward GVC Participation	
	(1) LPM	(2) Probit	(3) LPM	(4) Probit
Firm size	0.0449***	0.237***	0.107***	0.570***
	(0.00316)	(0.0156)	(0.00822)	(0.0163)
Firm size squared	0.000000400***	0.000000151	0.000000561***	−0.000000630
	(7.18e-08)	(0.000000329)	(0.000000121)	(0.000000331)
Age	0.00518	0.0295**	−0.0301**	−0.167***
	(0.00298)	(0.00919)	(0.0104)	(0.00978)
Foreign ownership	0.294***	0.865***	0.267***	0.729***
	(0.0294)	(0.0361)	(0.00615)	(0.0369)
Access to finance	0.00172	−0.00935	0.0242***	0.103***
	(0.0176)	(0.0233)	(0.00372)	(0.0235)
Formal training	0.0316***	0.155***	0.0476***	0.218***
	(0.00466)	(0.0190)	(0.00767)	(0.0192)
Skill intensity	0.0909***	0.439***	0.0356*	0.138***
	(0.0257)	(0.0343)	(0.0182)	(0.0359)
Labor productivity	−0.0106	−0.0670***	0.0261***	0.151***
	(0.00736)	(0.00758)	(0.0000275)	(0.00820)
Capital intensity	0.000412	0.00150	0.00282**	0.0141***
	(0.000694)	(0.00160)	(0.000940)	(0.00168)
Research and development	0.0243	0.0801***	−0.00110	−0.0297
	(0.0140)	(0.0166)	(0.00488)	(0.0165)
Export spillover	0.00524***	0.0499*	0.0126***	0.0578***
	(0.000153)	(0.0204)	(0.000103)	(0.0170)
Constant	−0.162	−3.222***	−0.932***	−6.411***
	(0.0977)	(0.407)	(0.0858)	(0.393)
Year FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observation	41,227	41,209	41,222	41,222
Adj. R-sq./pseudo R-sq.	0.1270	0.1368	0.2246	0.2388

Standard errors in parentheses; * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Source: Author's calculation based on the IAMS in 1996 and 2006.

Next, our sensitivity check involves a new estimation using an alternative definition of SMEs based on employment, which classifies enterprises with fewer than 100 employees as SMEs. This classification gives us a somewhat different distribution of firms, with SMEs accounting for 79% of the total Indonesian manufacturing firms. Table A.2 in the Annex presents the results from the estimation using the LMP and probit methods. In general, the signs and magnitude of most coefficients are stable and consistent with the baseline results.

5.3 Addressing Endogeneity Concerns

In our econometric specification, we suspect that the skill intensity variable is endogenous due to reverse causality. The preceding analysis proves that having a workforce with a higher skill level helps SMEs to integrate into GVCs. However, the relationship would be the opposite in that GVC SMEs are inclined to hire higher-quality

and skilled workers. Another potential source of endogeneity in our model is omitted variables. SMEs connecting with value chains might possess an exceptional corporate culture and leadership. Our data could not capture these factors, and as a result the error terms incorporate them. Clearly, exceptional leadership and skill intensity are correlated in the sense that firms with such management tend to hire more skilled human resources.

In the presence of endogeneity, ordinary least-square estimation is biased. To address the endogeneity concerns, we apply the IV method to estimate equation (2) using the two-stage least-square (2SLS) estimator—the most common strategy that researchers use to address the endogeneity problem (Wooldridge 2016; Bascle 2008). Despite its superiority to the OLS estimator, the selection of IV proves to be very challenging. Weak and invalid instruments can cause less efficient estimations than OLS. Good instruments must satisfy two conditions: first, they must correlate strongly with the endogenous variables (relevance condition); and second, they must be unrelated to the error term (exogeneity condition). We opt for two variables to instrument skill intensity: 1) the number of high school and vocational training providers in each region; and 2) the average ratio of skilled workers for each sector in a given year and region. We select the instruments based on the widely recognized GVC framework in which higher skills of human capital are crucial for countries and firms to integrate into GVC. We believe that the quantity of educational institutions along with the availability of skills in a given region might indirectly affect firms' GVC strategy via their direct impact on firms' ability to hire a skilled workforce. We are not yet sure whether these IVs are valid and will conduct a series of tests after the estimation.

Table 4 presents the results of the IV estimation. To check whether the estimates are robust across different SME definitions, we estimate equation (2) twice: one for the default definition of SMEs based on the value of sales (column 1); and another for the employment-based definition (column 2). Before discussing the results, we adopt two standard tests to check whether our instruments are valid. The instrument relevance test aims to measure instruments' strength. Ideally, there must be a strong fit between the endogenous regressor and the instruments, which first-stage F-statistics greater than 9.08 prove (Stock and Yogo 2002; Bascle 2008). The value of the first-stage F-statistics of our 2SLS regression is 385.49, implying that our instruments are strong and thus satisfying the relevance condition. Next, we perform the instrument exogeneity test, in which the null hypothesis is that the instrumental variables are exogenous. Since the *p-value* is 0.1559, we cannot reject the exogeneity of our instruments and thus we can argue that the instruments satisfy the exogeneity condition.

The results from the 2SLS regression are not only similar to the baseline estimation but also stable across all the specifications using different definitions of SMEs. Except for the coefficient of size, which appears to be strongly positive for specification (1) and negative but insignificant for specification (2), other firm characteristics, including foreign ownership, access to finance, training and skill, labor productivity, capital intensity, and R&D, have positive and significant impacts on SMEs' propensity to participate in GVCs. Like the baseline results, younger SMEs are more likely to be involved in value chain activities. In summary, the results from the alternative method allow us to conclude that the positive relationship between human capital and GVC participation is robust.

**Table 4: Results for SMEs' Decision to Participate in GVCs
Using the 2SLS Estimator**

	Sale-Based Definition of SMEs	Employment-Based Definition of SMEs
	2SLS	2SLS
Firm size	0.00462*	-0.00558
	(0.00258)	(0.00372)
Firm size squared	0.000000838***	0.00000456***
	(4.01e-08)	(0.000000789)
Age	−0.00224*	−0.00148*
	(0.00106)	(0.000743)
Foreign ownership	0.231***	0.190***
	(0.00582)	(0.00568)
Access to finance	0.0156***	0.00758***
	(0.00238)	(0.00185)
Formal training	0.00719*	0.00829***
	(0.00292)	(0.00228)
Skill intensity	0.124***	0.0493*
	(0.0267)	(0.0198)
Labor productivity	0.00223[a)]	0.00284**
	(0.00138)	(0.000944)
Capital intensity	0.000932***	0.000251*
	(0.000165)	(0.000126)
Research and development	0.0110***	0.00652***
	(0.00190)	(0.00173)
Export spillover	0.00203	0.00163
	(0.00172)	(0.00127)
Instruments	2	2
Year FE	Yes	Yes
Region FE	Yes	Yes
Industry FE	Yes	Yes
Observation	39,726	32,677
Adj. R-sq.	0.149	0.085
First-stage F-statistic	385.49	334.901
Exogeneity test—p-value	0.1559	0.0875

Standard errors in parentheses; * p<0.05; ** p<0.01; *** p<0.001.

[a] Significant at the 10% level.

Source: Author's calculation based on the IAMS in 1996 and 2006.

6. CONCLUSION

In this paper, we examined the role of SMEs in GVC activities in the Indonesian economy using micro-level data. We carefully studied the effects of human capital and other firm attributes on Indonesian SMEs in GVC participation. The results suggest that integrating into upstream and downstream value chains is undoubtedly difficult for Indonesian SMEs, as the extremely low GVC participation ratio shows. Effective integration into global production networks requires SMEs to have superior capability and certain key fundamentals in addition to a locality that is conducive to peer learning. In particular, the size of an enterprise matters as it gains from economies of scale and helps to offset the cost of entry into production networks. We also found evidence that linkage with value

chain activities requires SMEs to have a higher level of human capital, better foreign networks (i.e., in terms of foreign ownership and location to an export hub) and superior production capacity, which we measured using higher productivity, more assets, and more investment in research and development.

We also assessed the effect of human capital and other firm attributes on different modes of GVC participation. Interestingly, several variables have robust and expected results. Most importantly, whether they involve backward or forward GVC linkages, firm resources, and capabilities, which their size, foreign networks, productivity, human capital, and location, are critical for SMEs to integrate into value chain activities. Further, we applied the IV method to address the endogeneity problem in our model and found that the results are robust. Fundamentally, a higher quality of human capital helps SMEs to integrate successfully into GVCs.

The paper highlights the importance of SMEs in GVC activities and in particular in creating employment as well as forward and backward linkages. The potential of the domestic capacity to absorb key technologies and knowledge is critically dependent on the competitiveness and efficiency of domestic SMEs. It seems to be very important for the Indonesian economy to create stronger linkages to GVC activities and move up the value chain activities. In particular, the study also highlights the importance of agglomerative effects, and SMEs in a cluster with MNCs tend to learn faster and are more efficient in participating in GVCs. Thus, policies are necessary to design industry strategies to create agglomerative effects either through cluster strategies or through a strategy for special economic zones, such as incubators and science parks.

In addition, the study highlights the importance of human capital as a critical factor in creating linkages for SMEs to participate in both manufacturing and service GVCs. This will be a critical factor for Indonesia to be regionally and globally competitive. The following might be important policy considerations for developing human capital for SME development:

a. The design of forward-looking educational institutions and improving the skills of workers will be critical for Indonesia to create competitive and sustainable economic growth in the long run. The formal education system could be a good backbone for building lifelong education and learning skills for SMEs and workers.

b. The government could set up SME training funds that SMEs could use to develop the skills of their workers. They could also use the funds to develop the skills and training of middle management, which is critical to absorb and implement best practices in human resources and international standards and practices.

c. The government could also set up incubators and innovation funds that will increase the research and knowledge collaborations between SMEs and universities. This will create linkages and spillovers in learning new innovation and technologies for SMEs. The innovation fund could also reduce the cost of research and development for SMEs.

d. The government could also consider MNC–SME mentorship schemes in which it can create a network between MNCs and SMEs for closer discussions and sharing of knowledge. In some cases, it could encourage MNCs to mentor SMEs on best practices in human resources, marketing, and networking that will create strong linkages between MNCs and SMEs.

e. Apart from building the quality of general education, which is a prerequisite condition for human capital development, the government might consider aggressively expanding technical and vocational training programs to sharpen the skills of the workforce that are of great use in value chain production. Our finding also suggests the importance of in-house formal training. The large-scale expansion of technical training services by the SME Productivity Centers that the Ministry of Manpower and Transmigration operates could be another policy option for the Indonesian government to enhance human resources quality.

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ANNEX

Table A.1: Estimation Results for SMEs' Decision to Participate in GVCs
Using Alternative Variables for Skill Intensity

Probability of Participating in GVCs	Skill (Wage/Sale)		Skill (Wage per Employee)	
	LPM	Probit	LPM	Probit
Firm size	0.0138***	0.501***	0.0155***	0.494***
	(0.000542)	(0.0297)	(0.00000365)	(0.0277)
Firm size squared	0.000000804**	0.000000533	0.000000779***	0.000000410
	(8.28e-08)	(0.000000460)	(5.65e-08)	(0.000000438)
Age	−0.00376	−0.0782***	−0.00480	−0.0960***
	(0.00509)	(0.0181)	(0.00521)	(0.0168)
Foreign ownership	0.251***	0.954***	0.252***	0.943***
	(0.0364)	(0.0426)	(0.0290)	(0.0409)
Access to finance	0.0148**	0.167***	0.0131*	0.143***
	(0.00539)	(0.0377)	(0.00545)	(0.0366)
Formal training	0.0167***	0.236***	0.0180***	0.253***
	(0.00348)	(0.0330)	(0.00162)	(0.0310)
Skill intensity	0.00185***	0.0837***	0.00442***	0.158***
	(0.000437)	(0.0197)	(0.000349)	(0.0265)
Labor productivity	0.0105***	0.265***	0.00617***	0.117***
	(0.0000284)	(0.0212)	(0.000747)	(0.0149)
Capital intensity	0.000916**	0.0114***	0.000934*	0.0111***
	(0.000323)	(0.00294)	(0.000442)	(0.00276)
Research and development	0.0111**	0.00774	0.0107*	0.0133
	(0.00429)	(0.0214)	(0.00512)	(0.0211)
Export spillover	0.000758***	0.0571	0.00135***	0.0587
	(0.000133)	(0.0479)	(0.000262)	(0.0436)
Constant	−0.151***	−8.173***	−0.157***	−8.088***
	(0.0225)	(0.958)	(0.0138)	(0.880)
Year FE	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
Observation	38,107	38,090	41,196	41,178
Adj. R-sq./pseudo R-sq.	0.1751	0.3355	0.1713	0.3216

Standard errors in parentheses, * p<0.05; ** p<0.01; *** p<0.001.

Source: Author's calculation based on the IAMS in 1996 and 2006.

Table A.2: Estimation Results for SMEs' Decision to Participate in GVCs Using an Alternative Employment-Based Definition of SMEs

Probability of Participating in GVCs	(1) LPM	(2) Probit
Firm size	−0.00329	0.501***
	(0.00314)	(0.117)
Firm size squared	0.00000490***	0.00000192
	(0.000000385)	(0.0000209)
Age	−0.00190	−0.0556*
	(0.00309)	(0.0237)
Foreign ownership	0.206***	1.013***
	(0.0307)	(0.0652)
Access to finance	0.00631***	0.139*
	(0.00167)	(0.0547)
Formal training	0.0116***	0.287***
	(0.000313)	(0.0469)
Skill intensity	0.0209***	0.487***
	(0.000895)	(0.0833)
Labor productivity	0.00452***	0.116***
	(0.000301)	(0.0200)
Capital intensity	0.000252***	0.00657
	(0.0000609)	(0.00414)
Research and development	0.00533	0.0114
	(0.00324)	(0.0430)
Export spillover	0.000910***	0.0290
	(0.000161)	(0.0398)
Constant	−0.0474***	−6.493***
Year FE	Yes	Yes
Region FE	Yes	Yes
Industry FE	Yes	Yes
Observation	41,227	41,209
Adj. R-sq./pseudo R-sq.	0.1033	0.2687

Standard errors in parentheses; * p<0.05; ** p<0.01; *** p<0.001.

Source: Author's calculation based on the IAMS in 1996 and 2006.