APAKAH *GLOBAL VALUE CHAIN* (GVC) MEMENGARUHI PERMINTAAN TENAGA KERJA? STUDI EMPIRIS DARI INDUSTRI MANUFAKTUR INDONESIA TAHUN 2010-2015

Does Global Value Chain (GVC) Influence Labor Demand? Empirical Study of The Indonesian Manufacturing Industry 2010-2015

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Abstrak

Keterkaitan pada rantai nilai global atau GVC dapat mendorong perkembangan industri domestik, meningkatkan produktivitas, kemampuan ekspansi, yang akhirnya dapat menyerap tenaga kerja. Secara teoritis, partisipasi perusahaan pada GVC dapat meningkatkan permintaan tenaga kerja melalui efek skala dan juga dapat menurunkan permintaan tenaga kerja melalui efek substitusi. Isu ini relevan di Indonesia karena keterkaitan sektor manufaktur pada GVC ditengarai masih rendah. Studi ini secara empiris menguji korelasi partisipasi GVC pada subsektor industri manufaktur terhadap permintaan tenaga kerja. Penelitian ini menggunakan perhitungan ADB yang membagi partisipasi GVC subsektor manufaktur menjadi tiga jenis, yaitu Pure Forward Participation (PFP), Two-Sided Participation (TSP), dan Pure Backward Participation (PBP). Data yang digunakan merupakan data panel tahun 2010-2015 dari Survei Industri Besar dan Sedang yang dilakukan Badan Pusat Statitik (BPS) dan dianalisis dengan menggunakan model linear dinamik. Hasil analisis menemukan bahwa dalam jangka pendek, i) PFP berkorelasi positif; ii) TSP cenderung berkorelasi negatif, tapi tidak signifikan; dan iii) PBP berkorelasi positif, tapi tidak signifikan. Ketiga jenis partisipasi berpengaruh signifikan pada permintaan tenaga kerja dalam jangka panjang. Karena itu, keterkaitan industri manufaktur pada PFP dan PBP perlu ditingkatkan untuk meningkatkan penyerapan tenaga kerja sektor manufaktur.

Kata kunci: Permintaan Tenaga Kerja*, Global Value Chain* (GVC)*, Pure Forward Participation* (PFP), *Two-Sided Participation* (TSP), *Pure Backward Participation* (PBP)

Abstract

Participation in the Global Value Chain (GVC) encourages domestic industry development and increases productivity, expanding labour demand. However, theoretically, a firm's participation in GVC can increase the labour demand through the scale effect and reduce the labour demand due to the substitution effect. This issue is relevant in Indonesia because the extent of GVC participation among firms in the manufacturing sector is still low. This study examines the correlation of GVC participation in the manufacturing subsector to labour demand. This study uses Asian Development Bank (ADB) calculations that divide manufacturing subsector GVC participation into three types, namely Pure Forward Participation (PFP), Two-Sided Participation (TSP), and Pure Backward Participation (PBP). The data used is panel data from 2010-2015, the Large and Medium Industry Survey conducted by Statistics Indonesia (BPS) and analysed using a linear dynamic model. The analysis found that in the short term, (i) PFP is positively correlated, (ii) TSP tends to be negatively correlated but not significant, and (iii) PBP is positively correlated but not significant. All three types of participation significantly affect labour demand in the long run.

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Therefore, manufacturing industry linkages in PFP and PBP must be improved to increase labour absorption in the manufacturing sector.

Keywords:*Labor Demand, Global Value Chain (GVC), Pure Forward Participation, Two-Sided Participation, Pure Backward Participation*

JEL Classification: F12, F14, F66

INTRODUCTION

Global Value Chain (GVC) activities have significantly expanded since the 1990s and now play a predominant role in international trade. Approximately 50 percent of global trade is attributed to GVC activities (World Bank, 2020). International organizations like the World Bank and the Asian Development Bank (ADB) emphasize the importance of understanding the impact of GVC activities on national economies.

GVC participation offers potential benefits such as boosting investment, enhancing competitiveness, and fostering economic growth (Hing, Thangavelu, & Narjoko, 2020). Research by Jangam & Rath (2021) establishes a positive correlation between GVC participation and GDP per capita. However, the impact of GVC participation on labor demand remains uncertain. Theoretical frameworks suggest two distinct effects that collectively influence overall employment demand.

The first effect, known as the scale effect (Amiti & Wei, 2005; Banga, 2016; Pan, 2020), relates to the increasing scale of production due to lower average costs per unit of output. Participating in GVC can provide a firm with several advantages. These include access to lower-cost inputs from international markets, expanded market reach through exports, and increased productivity from knowledge spillovers and specialization reinforcement (Criscuolo & Timmis, 2017). Reduced input costs and enhanced productivity result in lower costs per unit of output, enabling firms to increase production and, consequently, increase their demand for labor.

The second effect, known as the substitution effect (Amiti & Wei, 2005; Banga, 2016; Pan, 2020), can be divided into two ways: the substitution effect due to cheaper imported input prices and the substitution effect due to increased productivity. Lower prices for imported inputs incentivize firms to engage in GVCs, granting them access to more affordable materials from overseas. This accessibility allows

firms to potentially outsource certain production stages to foreign counterparts, reducing the need for labor previously allocated to those stages. Moreover, enhanced productivity among firms participating in GVCs enables them to achieve the same output levels using fewer inputs, thereby decreasing their overall demand for labor.

GVC participation indicators can be categorized into Pure Forward Participation (PFP), Two-Sided Participation (TSP), and Pure Backward Participation (PBP) (Borin, Mancini, & Taglioni, 2021). PFP characterizes the initial stage of GVC where domestic production (without imports) serves as inputs for other countries' exports. TSP indicates midstream GVC activity, involving importing inputs and their subsequent export as components of other countries' export products. Meanwhile, PBP represents the final stage of GVC, where a country's export production that relies on imported inputs is used not as input in the destination country but instead is consumed as final goods. To gain a comprehensive understanding of the impact of GVC, it is essential to examine these activities separately because each type can influence labor demand in the manufacturing sector differently (Banga, 2016; Dine, 2019; Pan, 2020).

Indonesia presents an intriguing case to examine this effect. As one of the world's largest developing countries, Indonesia harbors a significant population of unskilled workers (Amiti & Cameron, 2012; Kis-Katos & Sparrow, 2015). Despite this demographic, Indonesia's involvement in GVC remains relatively limited. Over the past decade, Indonesia has consistently ranked among the countries with the lowest rates of GVC participation within ASEAN.

The theoretical framework on labor demand from Pan (2020) suggests that participating in GVC can have varied effects depending on whether there is an increase in demand for a firm's output. If there is no increase in output demand, GVC activities that improve productivity across all three types of participation may lead firms to downsize their workforce. Conversely, if the firm experiences an increased output demand due to its GVC involvement, it is likely to expand its workforce.

Meanwhile, the Heckscher–Ohlin (H-O) model predicts that in international trade, countries will export goods that use their relatively abundant production factors and import goods

that use their relatively scarce factors of production (Attanasio, Goldberg, & Pavcnik, 2004). Firms rely heavily on these abundant inputs in their production processes will likely possess a comparative advantage in those products. Moreover, when firms engage in GVC activities, the arrangement by the main firms allows supplier firms in Indonesia to enhance their production capabilities through innovations in product and process, enhanced operational functions, and improvement towards new chain points (Agostino et al., 2015). It expanded production capacity, enabling supplier firms to increase productivity and achieve greater certainty in output demand.

Based on the theoretical frameworks discussed above, this study hypothesizes that participating in pure forward participation (PFP) and pure backward participation (PBP) will have a positive effect on labor demand because both types of participation predominantly utilize abundant production factors such as natural resources and unskilled labor (Ahmad, 2021; Lewandowski et al., 2023). In contrast, the two-sided participation (TSP) is hypothesized to have a negative effect. This hypothesis stems from the assumption that two-sided participation tends to rely on skilled labor, which is not as abundant in Indonesia's production factors. Amiti & Cameron (2012) noted that intermediate inputs in Indonesia are typically produced by a higher-skilled workforce compared to final goods.

Previous studies in Indonesia have focused on strategies to enhance the country's participation in GVC (Hing, Thangavelu, & Narjoko, 2020; Ingot & Verico, 2021). However, research exploring the relationship between GVC participation and employment in Indonesia still needs to be completed despite the critical importance of addressing employment issues in a country with a substantial population. Therefore, there is a need for empirical evidence to determine whether GVC activities can effectively contribute to increasing employment opportunities in Indonesia. This study aims to investigate the impact of three types of GVC participation —Pure Forward Participation (PFP), Two-Sided Participation (TSP), and Pure Backward Participation (PBP)—on labor demand within large and medium manufacturing firms in Indonesia from 2010 to 2015.

METHOD

Data and Variables

This study utilizes data from BPS-Statistics Indonesia, specifically from the Large and Medium Manufacturing Firms Survey (IBS), an annual survey covering almost all firms with at least 20 employees across Indonesia. The dataset includes information on employee numbers, firm value-added, total salary expenditures, sectoral classification based on ISIC Rev.4, and whether the firm engages in exporting and/or importing activities. However, the data does not provide direct information on whether firms are involved in Pure Forward Participation (PFP), Two-Sided Participation (TSP), or Pure Backward Participation (PBP) activities due to missing details on whether partner countries re-export the products. Future enhancements in firm-level data related to GVC analysis need to be awaited.

To classify the firms into specific types of GVC, this study used the Information on GVC participation for several countries provided by World Integrated Trade Solution (WITS) which provides indicators for Pure Forward Participation (PFP), Two-Sided Participation (TSP), and Pure Backward Participation (PBP) for 14 industrial sectors. The details of those subsectors can be seen in the table below:

Table 1. ADB's 2-Digit Subsector Group of Manufacturing Industry

No.	Code	Subsector
1.	C3	*Food, beverages, and tobacco*
2.	C4	*Textiles and textile products*
3.	C5	*Leather, leather products, and footwear*
4.	C6	*Wood and products of wood and cork*
5.	C7	*Pulp, paper, printing, and publishing*
6.	C8	*Coke, refined petroleum, and nuclear fuel*
7.	C9	*Chemicals and chemical products*
8.	C10	*Rubber and plastics*
9.	C11	*Other non-metallic minerals*
10.	C12	*Basic metals and fabricated metals*
11.	C13	*Machinery, not elsewhere classified*
12.	C14	*Electrical and optical equipment*
13.	C15	*Transport equipment*
14.	C16	*Manufacturing, not elsewhere classified; recycling*

Source: ADB (2019).

This study assumes uniform GVC participation across firms within the same sector. Although the sectoral classification for GVC differs from ISIC-4 used in the IBS dataset, this study utilizes a concordance provided by the ADB to link GVC participation indicators at the sectoral-national level with firm-level employment data.

This study utilizes firm-level balanced panel data spanning from 2010 to 2015. This period is chosen because the trend in GVC participation has stabilized compared to the period before the global financial crisis of 2007-2009, especially in Indonesia, enabling a contemporary assessment of its effects. However, the firm-level panel data from the IBS is only available until 2015, limiting the study to analyze data from the post-crisis years available. The dependent variable in this study is the number of employees in large and medium manufacturing firms. GVC participation serves as the primary explanatory variable and is categorized into three types: Pure Forward Participation (PFP), Two-Sided Participation (TSP), and Pure

Backward Participation (PBP). Control variables align with the labor demand conceptual framework and include real wages and real output, obtained from the IBS survey data. To adjust for inflation and provide consistent comparisons, the study employs a value-added deflator as an implicit GDP index at the 2-digit level of manufacturing subsectors and subsequently uses this deflator to transform nominal values of wages and output into real terms. Table 2 presents the operational variables in this study.

Table 2. Operational Variables

Variables	Unit	Description
Labor	People	Number of employees
PFP	Percentage (%)	Share of pure forward participation's value added in total export
TSP	Percentage (%)	Share of two-sided participation's value added in total export
PBP	Percentage (%)	Share of pure backward participation's value added in total export
Wage	Million Rp.	Annual real wage per employee
Output	Trillion Rp.	Total real value-added

Note: This study employs a value-added deflator (implicit GDP index for 2-digit manufacturing subsector) to transform nominal values into real terms. How to measure or calculate PFP, TSP, and PBP as share of value added, you can see more details on Borin, Mancini, and Taglioni (2021).

Empirical Strategy

The model specifications in this study utilize the natural logarithm of the optimal labor demand function. It assumes that capital costs remain constant throughout the period from 2010 to 2015. Employing a dynamic labor demand model, the study includes a lagged dependent variable to account for the firm's decision-making process, where current employment levels are influenced by past levels of employment (Pan, 2020; Dine & Chalil, 2021). Previous research suggests the inclusion of two lagged terms of the number of employees in models using annual data (Nickell & Wadhwani, 1991).

A change in wages or output in the labor demand model is also responded to with a delay due to adjustment costs and forward-looking expectations (Nickell & Wadhwani,

1991). Therefore, the model specifications include lags of wages and output. The number of lags included is determined based on the behavior of the data. Given the six-year period of this study (2010-2015), the maximum feasible number of lags for each variable is two. Additionally, time dummies are incorporated to capture aggregate demand shocks (Arellano & Bond, 1991). Thus, the model specifications used in this study are as follows: Hence, the model specifications used in this study are as follows:

$$lnLabor_{i,t} = \beta_0 lnLabor_{i,t-1} + \beta_1 lnLabor_{i,t-2} + \beta_2 lnPFP_{i,t} + \sum_{j=3}^{5} \beta_j \, lnWage_{i,t-5+j} + \sum_{j=6}^{8} \beta_j \ln Output_{i,t-8+j} + c_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

$$lnLabor_{i,t} = \beta_0 ln\ Labor_{i,t-1} + \beta_1 lnLabor_{i,t-2} + \beta_2 lnTSP_{i,t} + \sum_{j=3}^{5} \beta_j \, lnWage_{i,t-5+j} + \sum_{j=6}^{8} \beta_j \ln Output_{i,t-8+j} + c_i + \gamma_t + \varepsilon_{i,t} \quad (2)$$

$$lnLabor_{i,t} = \beta_0 ln\ Labor_{i,t-1} + \beta_1 lnLabor_{i,t-2} + \beta_2 lnPBP_{i,t} + \sum_{j=3}^{5} \beta_j \, lnWage_{i,t-5+j} + \sum_{j=6}^{8} \beta_j \ln Output_{i,t-8+j} + c_i + \gamma_t + \varepsilon_{i,t} \quad (3)$$

$$lnLabor_{i,t} = \beta_0 ln\ Labor_{i,t-1} + \beta_1 lnLabor_{i,t-2} + \beta_2 lnTSP_{i,t} + \beta_3 lnPBP_{i,t} + \sum_{j=4}^{6} \beta_j \, lnWage_{i,t-5+j} + \sum_{j=7}^{9} \beta_j \ln Output_{i,t-8+j} + c_i + \gamma_t + \varepsilon_{i,t} \quad (4)$$

$Labor_{i,t}$ is the number of employees in large and medium manufacturing for firm i in year t. $PFP_{i,t}$, $TSP_{i,t}$, and $PBP_{i,t}$ are continuous variables for pure forward participation, two-sided participation, and pure backward participation for firm i in year t. $Wage_{i,t}$ and $Output_{i,t}$ is the real wage and the real output for firm i in year t. c_i is the firm fixed effects, γ_t is time effect, and $\varepsilon_{i,t}$ is the error term. The research hypothesis will be tested by looking at the β_2 estimated coefficient of each GVC participation in equations (1), (2), and (3), and addition β_3 in equations (4).

In panel data, fixed effects estimation is often used because it can eliminate bias due to time-invariant unobserved heterogeneity. However, the use of fixed effects in this study will still be biased due to the dependent lag variable. This bias occurs because Strictly Exogenous Assumption (SEA) is violated and is known as Nickell Bias (Nickel, 1981). Therefore, this study uses internal instruments to address endogeneity using dynamic panel regression. Furthermore, the

inclusion of the lag dependent variable not only allows the estimate of short-term or contemporaneous effect of the GVC but also its long-term effects. The empirical model is then estimated by system GMM dynamic panel regression (SGMM).

The System GMM (SGMM) method employs the differences in the lagged dependent variable as instruments in the level equation and the lagged dependent variable as instruments in the first differences equation. This method is preferred over GMM difference due to its ability to mitigate the weak instrument problem (Blundell & Bond, 1998). The consistency of SGMM estimates hinges on two critical conditions: the presence of serial correlation in the error term, tested by AR (2), and the validity of internal instruments, assessed using the Sargan and Hansen tests. Rejection of the null hypothesis in these tests signifies the estimates' validity and consistency. Initially, the study utilized an AR (1) lag equation to estimate the impact of GVC activities on labor demand. However, this specification failed to satisfy both conditions. Consequently, the model was revised to incorporate an AR (2) lag structure, ensuring compliance with these conditions and enabling further analysis.

In this study, robustness checks are conducted using GVC participation data sourced from different providers. Specifically, data from the Organization for Economic Co-operation and Development – Trade in Value Added (OECD-TiVA) is utilized. To ensure consistency, the study aligns the ISIC Rev.4 subsector classification with OECD standards. By proxying these variables of interest, the study reassesses the impact of GVC participation across different activities in the manufacturing subsector, where the company operates, on firms' labor demand.

RESULTS AND DISCUSSION

Descriptive

This study initially examines the impact of the Pure Forward Participation (PFP) on labor demand among the exporting firms that do not utilize imported inputs. Due to data limitations, it is not feasible to precisely identify firms engaging in PFP. Instead, the study traces the firms that consistently exported throughout the period from 2010 to 2015, resulting in

1,373 firms. This continuity is expected to increase the likelihood of including firms engaged in PFP as observations. Table 3 presents the summary statistics of the exporter firms that do not utilize imported inputs.

Table 3. Summary Statistics of The Main Variables in Exporting Firm (Without Imported inputs), 2010-2015

Variables	Firm Obs.	Unit	Mean	Standard Deviation
Labor	1,373	People	295.38	953.16
PFP	1,373	Percentage (%)	15.37	8.86
Wage	1,373	Million Rp.	20.97	21.84
Output	1,373	Trillion Rp.	56,31	36,33

Note: This study employs a value-added deflator (implicit GDP index for 2-digit manufacturing subsector) to transform nominal values into real terms.

Next, this study investigates the impact of TSP and PBP in exporter firms that utilize imported inputs. Due to data limitations, it is not possible to precisely identify firms exclusively engaged in TSP or PBP. Consequently, both types of participation are considered within the same firm observations. The study traces the firms that consistently engaged in both exporting and importing activities from 2010 to 2015, resulting in 837 firms. Table 4 presents the summary statistics of the exporter firms that utilized imported inputs.

Table 4. Summary Statistics of The Main Variables in Exporter and Importer Firm, 2010-2015

Variables	Firm Obs.	Unit	Mean	Standard Deviation
Labor	837	People	919.05	2,199.25
PBP	837	Percentage (%)	16.65	8.47
TSP	837	Percentage (%)	3.76	2.71
Wage	837	Million Rp.	33.95	45.22
Output	837	Trillion Rp.	218.72	1,145.16

Note: This study employs a value-added deflator (implicit GDP index for 2-digit manufacturing subsector) to transform nominal values into real terms.

Tables 3 and 4 reveal notable distinctions in the characteristics of exporting firms without imported inputs and those with imported inputs, particularly in terms of employee numbers, wage levels, and output levels. This study further investigates these discrepancies between the two groups using statistical tests for mean differences. The results indicate significant variations in all three variables—employee numbers, wage levels, and output levels—between the two groups.

Exporting firms that use imported inputs generally operate at a larger scale, characterized by higher levels of output and a greater number of employees compared to firms that do not import inputs. This trend can be attributed to the fixed costs associated with importing inputs, which smaller firms may struggle to cover (Antras & Chor, 2021).

Moreover, the higher wage levels observed in firms using imported inputs can be explained by their access to a broader range of higher-quality inputs and technology, which typically require skilled labor for effective utilization. Firms that import inputs can access more varied inputs, get better quality inputs, and learn the technology embedded in these imported inputs (Amiti & Konings, 2007). The use of a higher variety and quality of imports tends to encourage firms to use more skilled labor because of the tendency for high-quality inputs and skilled labor to be complementarity (Bas & Paunov, 2021; Shrestha & Winklers, 2021). Skilled labor tends to command higher wages, thereby contributing to the overall higher wage levels in these firms. Therefore, the wage level in exporting firms with imported inputs would tend to be higher than in the exporting firms without imported inputs.

Additionally, firms that utilized imported inputs can benefit in terms of enhanced productivity, which enables them to achieve greater output or added value per unit of input (Amiti & Konings, 2007; Antras & Chor, 2021). This productivity gain facilitates their expansion in export activities, as empirically evidenced by studies showing increased export volumes linked to greater use of imported inputs (Amiti & Davis, 2012; Feng, Li,

& Swenson, 2016). Furthermore, combining imported inputs with skilled labor can lead to improved product quality and variety, further boosting competitiveness and export capabilities (Antras & Chor, 2021; Bas & Paunov, 2021). Thus, exporting firms with imported inputs can have greater output or added value than exporting firms without imports.

The standard deviation values provided in Tables 1 and 2 indicate that exporting firms with imported inputs exhibit greater variability in employee numbers, wage levels, and output levels compared to their counterparts without imported inputs. This reflects a higher degree of heterogeneity in the characteristics of firms using imported input compared to the exporting firms without imported input.

Figure 1 illustrates Indonesia's participation in the three types of GVC activities from 2010 to 2015. The figure shows that Indonesia’s participation in GVC tends to decrease and stagnant around 38-41 percent as a share of exports. The figure indicates a predominant level of pure forward participation (PFP), suggesting that overall Indonesia has a higher degree of forward participation than backward participation.

This idea is in line with the view that Indonesia mainly exports products from the upstream activities producing a relatively low value-added (Ingot & Verico, 2021). The difference between upstream and downstream sectors is based on how the products they make are used (Antras & Chor, 2017). A sector is considered downstream if its main products are meant for final use rather than as inputs for other sectors. On the other hand, if the sector's output is mainly used as input for other sectors instead of being sold for final use, it is classified as an upstream sector.

Therefore, in the context of GVC, a high level of pure forward participation suggests that the country is mainly involved in upstream activities. This aligns with Indonesia's export profile, which heavily relies on natural resource-based products like coal, palm oil, and metals (Ahmad, 2021; Gupta, Choirinnida, Taufik, 2022). The high level of pure forward participation also shows that Indonesia mainly depends on exporting commodities (Shrestha & Winkler, 2021).

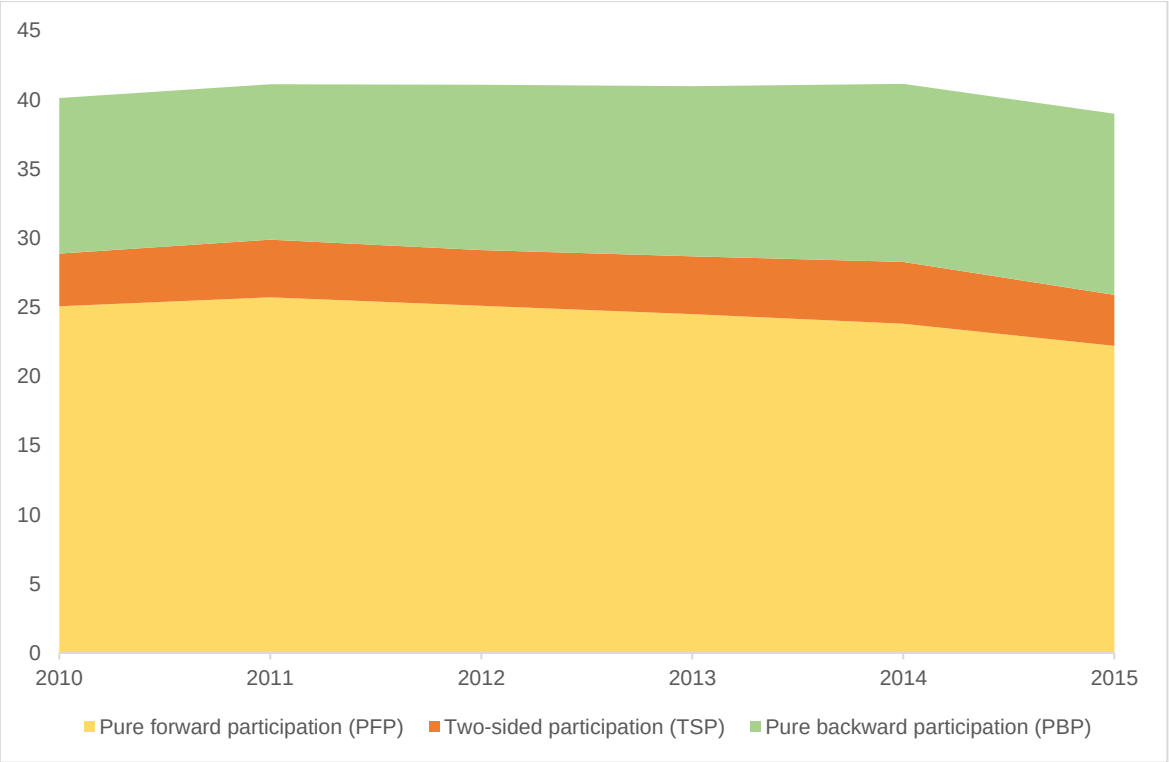

Figure 2. Indonesia's GVC Participation in Three Types of GVC Activities

Source: WITS (2023), processed.

Regression Results

Table 5 summarizes results from several specifications assessing the impact of pure forward participation, two-sided participation, and pure backward participation on labor demand using system GMM (SGMM) estimation methods. The table includes the estimated coefficients of models specified by equations (1) to (4) and estimates of the long-run effects associated with the three types of GVC participation.

The SGMM estimation results in distinct effects of pure forward participation, two-sided participation, and pure backward participation on labor demand. Specifically, in the short term, a 1 percentage point increase in pure forward participation correlates with a 0.016 percent increase in labor demand. However, it is only weakly statistically significant at a 10 percent level of significance. Despite this, the effect persists in the long run, as indicated by a statistically significant lag-dependent variable. Cumulatively, a 1 percentage point increase in pure forward participation is associated with a long-term increase in labor demand of approximately 0.12 percent.

Table 5. The Effect of Three Types of GVC Participation on Labor Demand

Variable	Specification			
	(1)	(2)	(3)	(4)
Lag 1 Labor	0.7562***	0.6692***	0.7013***	0.6864***
	(0.0256)	(0.0413)	(0.0452)	(0.0434)
Lag 2 Labor	0.1050***	0.1108***	0.0840**	0.0773*
	(0.0214)	(0.0373)	(0.0418)	(0.0395)
PFP	0.0166*	-	-	-
	(0.0100)			
TSP	-	-0.0142	-	-0.0134
		(0.0146)		(0.0148)
PBP	-	-	0.0284	0.0382
			(0.0236)	(0.0239)
Wage	-0.1193***	-0.1856***	-0.2137***	-0.1964***
	(0.0281)	(0.0426)	(0.0425)	(0.0430)
Output	0.1669***	0.2825***	0.2654***	0.2681***
	(0.0203)	(0.0272)	(0.0289)	(0.0275)
Lag 1 Output	-0.0598***	-0.0972***	-0.0872***	-0.0820***
	(0.0101)	(0.0191)	(0.0200)	(0.0195)
constant	-0.0648	-0.1138	-0.0615	-0.0948
	(0.1919)	(0.2560)	(0.2725)	(0.2656)
Firm dummy	Yes	Yes	Yes	Yes
Time dummy	Yes	Yes	Yes	Yes
N observations	5,492	3,348	3,348	3,348
N times *(*year)	4	4	4	4
N groups (firm)	1,373	837	837	837
N (instruments)	29	29	29	35
Variable	**Long Run Effect**			
	(1)	(2)	(3)	(4)
PFP	0.1196			
TSP		-0.0645		-0.0567
PBP			0.1323	0.1617

Notes: (1) Dependent variable is log natural of total workers (2) *** significance at level 1 percent, ** significance at level 5 percent, and * significance at level 10 percent, (3) parentheses is standard error.

The results can be interpreted as the dominance of the scale effect, where enhanced productivity attributed to GVC participation leads to increased output demands and, consequently, labor demand in both the short and long term, as hypothesized in this study. When firms engage in pure forward participation by exporting commodities relying mainly on natural resources, their association with leading firms typically boosts productivity. As suggested by Ahmad (2021), Indonesia's

participation in GVC heavily relies on natural resources. Furthermore, the abundant natural resources confer Indonesia a large comparative advantage in international markets, prompting firms to experience increased output demands and increased labor demand.

The finding of the effect of forward participation on workers in Indonesia is different from a study on GVC in India by Banga (2016), yet both studies highlight a common perspective: advancements in Global Value Chains (GVCs) can contribute to increased utilization of abundant inputs in their respective countries. In India, forward participation activities in India were found to have negligible effect on labor demand as the involved industries tend to be capital-intensive. Despite increased participation and output, there was no significant rise in labor demand. Conversely, industries engaged in pure forward participation in Indonesia lean towards being labor-intensive. Approximately 65 percent (893 out of 1373 firms) of observed pure forward participation units are categorized as labor-intensive sectors, including (1) the furniture industry, (2) the textile industry, (3) the apparel industry, (4) the wood industry, wood goods, and cork (excluding furniture) and woven articles from bamboo, rattan and the like, and (5) the rubber, rubber and plastic products, according to Verico (2021). This classification underscores their reliance on labor for production processes. Thus, the fundamental insight that GVCs can positively influence the utilization and exploitation of abundant inputs in a country remains pertinent in both countries.

Two-sided participation exhibits a distinct impact on labor demand compared to pure forward participation. Activities involving two-sided participation often require skilled labor, which is not abundant in Indonesia. The result shows that firms with two-sided participation typically decrease their labor demand in the short term, and this reduction becomes notably significant over the long term. Specifically, a 1 percentage point increase in two-sided participation corresponds to a long-term reduction in labor demand by approximately 0.06 percent. This finding substantiates the hypothesis posited in this study.

The utilization of various high-quality imported intermediate inputs often prompts firms to employ skilled labor. This correlation arises because

high-quality imported inputs and skilled labor are complementary (Bas & Paunov, 2021; Shrestha & Winkler, 2021). Moreover, research by Amiti & Cameron (2012) indicates that the production of intermediate inputs in Indonesia involves workers with higher skill levels compared to those involved in producing final goods. The reliance on non-abundant production factors means that activities utilizing these inputs may not fully capitalize on the country's comparative advantage in output. Consequently, boosting output demand becomes challenging, making productivity-enhancing substitutions or the substitution effect more crucial in these operations.

The substitution effect driven by productivity enhancements within firms engaged in two-sided participation could be more pronounced than in firms solely participating in forward activities. In the two-sided participating firms, the substitution effect can amplify by imported inputs, resulting in a cumulative impact that exceeds that of pure forward participation activities. In addition, firms engaged in two-sided participation typically exhibit higher initial levels of productivity compared to those involved solely in forward participation. Such productivity disparity has been analyzed in the explanations provided by Table 3.2 and 3.3.

The findings from Table 4.1 reveal that pure backward participation has a positive impact on labor demand similar to pure forward participation. Like to two-sided participation, the short-term effect of pure backward participation on labor demand is not statistically significant but shows a significant positive effect over the long term. Specifically, an increase in pure forward participation of 1 percentage point correlates with a 0.13 percent increase in labor demand, aligning with the study’s hypothesis. Pure backward participation in Indonesia typically involves assembling final goods, which can be accomplished by the abundant unskilled labor force in the country (Lewandowski, Madon, and Winkler, 2023). When firms engage in GVCs, their collaboration with the lead firms often enhances productivity. Meanwhile, the use of abundant unskilled labor as a factor in production causes Indonesia to have a relatively high product comparative advantage in the international market, leading to higher demand for output and subsequently, demand for labor.

Furthermore, this study consolidates the estimation of two-sided participation and pure backward participation into a single equation. Initially estimated separately due to differing unit definitions, both activities now share the same group of firms due to data limitations. Column (4) of the estimation results indicates that simultaneous consideration of pure backward participation and two-sided participation confirms their consistent and significant effects on labor demand observed in columns (2) and (3). Pure backward participation tends to yield a positive effect, while two-sided participation exhibits a negative short-term impact. Both activities, however, demonstrate significant long-term effects.

The estimation results in column (4) show that pure backward participation and two-sided participation simultaneously have a consistent effect and level of significance on labor demand with the estimation results in columns (2) and (3). Pure backward participation tends to yield a positive effect, while two-sided participation exhibits a negative short-term impact. Both activities, however, demonstrate significant long-term effects. After being estimated together, the effect of pure backward participation was found to be more pronounced compared to separate equations, with a 1 percentage point increase correlating with a 0.16 percent rise in labor demand. Conversely, the effect of two-sided participation is somewhat diminished, showing a decrease in labor demand by 0.05 percent per 1 percentage point increase. This suggests that import and export firms in Indonesia tend to engage more prominently in pure backward participation activities than in two-sided participation, as illustrated in Figure 2 of this study.

Robustness Check

This study applies identical specifications from the main regression to conduct robustness checks by replacing the GVC variables with the OECD's GVC proxy. The estimation results demonstrate that these specifications effectively elucidate the relationship between the three types of GVC activities and labor demand. Indicators from AR (2), Sargan, and Hansen tests confirm that the internal instrument is valid enough

to minimize bias. Furthermore, there is no evidence indicating inconsistency or misspecification in the estimation results.

Table 6. The Effect of Three Types of GVC Participation on Labor Demand

Variable	Specification		
	PFP	**TSP**	**PBP**
Lag 1 Labor	0.7587***	0.6888***	0.6917***
	(0.0230)	(0.0383)	(0.0366)
Lag 2 Labor	0.0926***	0.0726**	0.0957***
	(0.0197)	(0.0332)	(0.0339)
OECD's GVC Proxy	**0.0219***	**-0.0032**	**0.0228**
	(0.0121)	(0.0126)	(0.0206)
Wage	-0.1224***	-0.1981***	-0.2033***
	(0.0275)	(0.0410)	(0.0406)
Output	0.1670***	0.2656***	0.2711***
	(0.0178)	(0.0249)	(0.0244)
Lag 1 Output	-0.0582***	-0.0827***	-0.0901***
	(0.0097)	(0.0179)	(0.0185)
constant	-0.0320	0.0549	-0.1278
	(0.1682)	(0.2345)	(0.2384)
Firm dummy	Yes	Yes	Yes
Time dummy	Yes	Yes	Yes
N observations	5.492	3.348	3,348
N times (year)	4	4	4
N groups (firm)	1373	837	837
N (instruments)	29	29	29
Upper bound PLS	0.7606	0.7273	0.7273
Lower bound FE	0.1281	0.1409	0.1411
AR (1) p-value	0.000	0.000	0.000
AR (2) p-value	0.606	0.385	0.531
Sargan p-value	0.109	0.224	0.642
Hansen p-value	0.151	0.053	0.344

Notes: (1) Dependent variable is log natural of total workers (2) *** significance at level 1 percent, ** significance at level 5 percent, and * significance at level 10 percent, (3) parentheses is standard error.

Table 6 confirms the robustness of the estimation results by showing consistent coefficients and levels of significance across variables compared to the main regressions in this study. Specifically, pure forward participation exhibits a positive and statistically significant correlation with labor demand, whereas two-sided participation and pure backward participation show no significant correlation. When employing the GVC participation proxy from the OECD, coefficients for pure forward participation are larger, whereas those for two-sided participation and pure

backward participation are smaller compared to the main regression results. Despite these variations, the overall estimation results consistently support the findings of the main regression's estimation regarding the effect of GVC participation on labor demand in the country.

CONCLUSION AND POLICY RECOMMENDATION

The impact of GVC participation on labor demand remains a topic requiring clarification, especially in developing countries. Theoretically, firms engaging in GVCs can increase labor demand through scale effects while potentially decreasing it via substitution effects. According to Rodrik (2018), developing countries might experience greater losses from reduced labor demand compared to the benefits gained from participating in GVCs. Therefore, empirical evidence is essential to thoroughly understand the net impact of GVC participation on labor demand in developing countries.

Research on GVC and labor demand in Indonesia remains underexplored. This study employs the dynamic linear panel model of labor demand and the GMM System estimation to investigate how GVC participation influences labor demand within Indonesia's large and medium manufacturing firms. Specifically, GVC participation is categorized into three types: pure forward participation, two-sided participation, and pure backward participation. Previous research suggests that each type of GVC activity exerts distinct effects on labor demand, motivating this study to differentiate between them for a comprehensive analysis.

This study employs a firm-level unit of analysis, grounded in the conceptual framework of labor demand and the Heckscher-Ohlin model. By focusing on the firm level, it can capture the diverse characteristics present within each firm. Due to the absence of firm-level GVC participation indicators, this study utilizes Indonesia’s GVC sectoral-national participation level as a proxy for GVC participation at the firm level.

This study faces two primary limitations. Firstly, there is a challenge in accurately identifying observation units for companies participating in GVCs. According to Borin, Mancini, and Taglioni (2021), an export company qualifies as a GVC

participant if it engages in Pure Forward Participation (PFP), Two-Sided Participation (TSP), or Pure Backward Participation (PBP) activities. The assessment of such participation relies on characteristic data sourced from the Large and Medium Manufacturing Firm Survey (IBS). However, the current data availability does not sufficiently indicate whether a company's output serves as an input for firms in destination countries. Consequently, this research can only categorize export companies without imported inputs as observation units for pure forward participation, and those with imported inputs as observation units for two-sided and pure backward participation during the period from 2010 to 2015.

Secondly, this study employs proxies for GVC participation, if all firms within a specific manufacturing sub-sector share the same level of GVC involvement as the national average for that sub-sector. Each company likely exhibits varying degrees of GVC participation. Nevertheless, using this proxy allows for observing variations in GVC participation intensity across firms within specific sub-sectors where they operate.

This study reveals that exporting firms observed for two-sided participation and pure backward participation, which involve imported inputs, generally exhibit greater scale and higher levels of productivity compared to exporting firms observed for pure forward participation, which do not involve imported inputs.

The estimation results highlight distinct effects of the three types of GVC participation on labor demand. Robustness checks reinforce these findings. Specifically, pure forward participation shows a consistently positive and significant correlation with labor demand in both the short and long term. In contrast, two-sided participation exhibits a negative correlation, with an insignificant effect in the short term but a significant impact in the long term. Similarly, pure backward participation tends to positively correlate with labor demand, initially insignificant in the short term but becoming significant over the long term.

These findings suggest that Indonesia's engagement in pure forward and pure backward participation activities enhances firm productivity, leading to increased output demand and subsequently higher labor demand. In contrast,

participation in two-sided activities boosts productivity without a proportional increase in output demand, resulting in a significant decrease in labor demand over the long term. Given these results, the study underscores the importance for government intervention to facilitate increased participation of Indonesian firms in GVC activities, particularly emphasizing pure forward and pure backward participation. This approach is seen as crucial for fostering employment opportunities in the country.

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