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The Impact of Global Value Chain (GVC) Participation on the Productivity of Manufacturing Firms in Indonesia

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Abstract

Amidst the transformation of international trade through Global Value Chains (GVCs), Indonesia faces a pressing efficiency crisis characterized by significant productivity gaps relative to regional peers and a concerning contraction in Total Factor Productivity (TFP). While GVCs are theorized as catalysts for technological diffusion, the risk of structural stagnation in low-value assembly activities, often termed a "capability trap", remains a critical concern for the national manufacturing sector. This study systematically investigates the productivity premiums associated with functional GVC integration, proxied by exporting, importing, and two-way trading activities, among Indonesian manufacturing firms. Utilizing a refined sample of 13,371 establishments from the 2017 Industrial Survey (SI/IBS), the research employs the Ordinary Least Squares (OLS) method. The empirical results reveal that all forms of international trade engagement are positively and significantly associated with firm-level productivity. Most notably, the "Import Only" category exhibits the most substantial premium, estimated at approximately 142.6% over non-participating domestic firms. This finding provides strong evidence for "learning-by-importing," suggesting that bypassing domestic supply constraints through high-quality foreign intermediate inputs and machinery is the primary driver of technological catch-up in Indonesia. However, the disproportionate advantage of importing over exporting indicates a potential "capability trap," where efficiency gains remain heavily dependent on technology embodied in foreign inputs rather than internal innovation. Furthermore, the significant impact of firm size and technology use underscores the vital role of internal absorptive capacity. Consequently, this study recommends that industrial policies shift from traditional export-promotion paradigms toward facilitating deeper technological absorption and streamlining access to advanced global inputs to foster genuine functional upgrading.

1. INTRODUCTION

Global Value Chains (GVCs) have fundamentally transformed international trade, allowing countries to specialize in specific production stages rather than undertaking entire supply chains (Baldwin, 2016; Krugman et al., 2017). By integrating into these cross-border networks, firms gain access to broader markets and diverse intermediate inputs, optimizing their comparative advantages. For emerging economies like Indonesia, GVCs present a strategic avenue to supply raw materials and intermediate goods to more advanced industrial hubs (Torsekar & John, 2017; ADB & IsDB, 2019).

At the micro-level, GVC participation is theorized to enhance firm productivity through technology diffusion, efficiency gains, and imported input quality (Rigo, 2020; Andriansyah et al., 2021). However, recent empirical literature highlights that these benefits are not automatic or universally positive. Firms in developing nations may experience stagnant productivity or negative spillovers if they remain trapped in low-value-added assembly activities without significant technological upgrading (Autio et al., 2022; Chairul et al., 2025a). This structural risk is particularly alarming for Indonesia. As detailed in Table 1, Indonesia's output per worker (24.37) lags significantly behind regional peers like Malaysia (55.36) and Singapore (150.29). Furthermore, the country experienced a concerning Total Factor Productivity (TFP) contraction of -2.03% during the 2017-2018 period. This stark efficiency deficit threatens long-term competitiveness, highlighting an urgent need to systematically evaluate whether integration into global production networks actually translates into tangible productivity premiums for domestic industries.

Table 1. Productivity Indicators of Indonesia Compared to ASEAN and East Asian Countries

Country	Per Worker Labor Productivity*	Per Hour Labor Productivity**	TFP Growth***
Brunei	131.56	56.49	1.66
China	28.39	13.35	0.74
Philippines	19.53	9.83	-0.78
Hong Kong	117.75	55.26	-1.54
Indonesia	24.37	12.04	-2.03
Japan	76.89	45.19	0.62
Cambodia	6.97	2.89	2.45
Korea	77.25	40.01	0.85
Lao PDR	14.63	6.04	-1.63
Malaysia	55.36	26.49	-1.14
Myanmar	5.74	2.64	3.74
Singapore	150.29	68.47	-1.93
Taiwan	109.2	52.54	1.81
Thailand	30.75	14.78	0.79
Vietnam	14.11	6.58	1.33

* Output per worker, calculated as total output divided by the number of workers in 2020.
** Output per hour worked, calculated as total output divided by the average number of hours worked in 2020.
*** Total Factor Productivity (TFP) growth for the period 2017-2018.

Source: Asian Productivity Organization (APO), Asian Economy and Productivity Map (processed by the authors).

To address this macroeconomic challenge, a granular focus on the manufacturing sector is essential, as it remains the backbone of the national economy by contributing over 20% to the GDP (BPS, 2021; Ministry of Home Affairs, 2023). While contemporary macroeconomic indicators highlight an ongoing reliance on resource-based and low-to-medium technology sectors, such as food processing and textiles (Ministry of Home Affairs, 2023), understanding the structural root of this productivity stagnation requires a deep firm-level analysis. Utilizing comprehensive micro-data from 2017, this study establishes a robust baseline for firm-level international engagement prior to recent global supply chain disruptions. This approach ensures structural consistency when analyzing how integration into global networks influences firm efficiency within a developing industrial landscape.

Despite the wealth of literature on global production networks, significant academic voids persist. Primarily, prior studies have largely concentrated on high-tech industries within advanced or distinct regional frameworks (e.g., Del Prete et al., 2017; Montalbano & Pietrobelli, 2018). This creates a notable empirical gap concerning the productivity dynamics of GVCs in resource-dependent, low-to-medium technology environments such as Indonesia (Korwatanasakul & Purbantina, 2021; Chairul et al., 2025b). Furthermore, although macro-level indicators like Trade in Value-Added (TiVA) offer valuable aggregate perspectives, they systematically obscure nuanced firm-level heterogeneities (Sturgeon, 2015). Consequently, this research adopts a firm's engagement in cross-border trade, encompassing exports, imports, and two-way trading, as a highly dependable and conceptually sound proxy for GVC integration. The validity of this methodological approach is strongly supported by recent empirical trade scholarship. For instance, Borin and Mancini (2019) establish that the movement of goods across multiple international boundaries, which inherently defines import and export operations, serves as a sufficient theoretical condition for confirming a firm's embeddedness in global production networks. Corroborating this at the micro-analytical level, Benkovskis et al. (2017) utilize export activities as a direct, interchangeable identifier for GVC participation. Additionally, Rigo (2017) provides compelling evidence that two-way traders function as an optimal GVC proxy, as these specific firms systematically exhibit characteristics of functional upgrading, including the adoption of foreign-licensed technologies and the implementation of rigorous quality standards. By deploying these robust, widely accepted trade proxies, the current study effectively maps a firm's operational integration into global input-output systems, entirely bypassing the aggregation limitations inherent in macroeconomic datasets, a methodological advantage that is particularly crucial when analyzing emerging economies like Indonesia, where granular input-output data remains scarce.

Building upon this methodological foundation, the primary objective of this study is to systematically investigate how integration into global value chains dictates the productivity trajectories of manufacturing firms in Indonesia. By executing this analysis, the current research delivers a tripartite contribution to the existing body of knowledge. Theoretically, it advances the GVC-productivity discourse by evaluating whether global integration in a resource-intensive developing economy fosters genuine technological spillovers or merely reinforces structural capability traps. Empirically, it provides a highly granular dissection of efficiency premiums across four mutually exclusive operational profiles: non-participating, export-only, import-only, and two-way trading establishments, thereby circumventing the pervasive aggregation bias of macro-level studies. Finally, from a practical standpoint, the empirical outcomes formulate precise, evidence-based policy prescriptions designed to stimulate domestic industrial upgrading and navigate the complexities of global production networks.

2. LITERATURE REVIEW

Theoretical Foundation of Firm Productivity in Global Value Chains

Industrial competitiveness fundamentally hinges on firm-level productivity, which captures the operational efficiency of converting resources into economic output (Krugman, 1994). To conceptualize how global integration actively shapes this efficiency, this research is anchored in the endogenous growth and knowledge spillover paradigms. As pioneered by Grossman and Helpman (1990), a domestic economy's "stock of knowledge capital" expands significantly through commercial exchange, which facilitates vital contact with international business communities and drives the cross-border transfer of intangible ideas. At the micro-economic level, empirical literature identifies that this continuous ex-post performance enhancement is primarily channeled through two functional conduits within GVC. First, the "learning-by-importing" mechanism empowers domestic manufacturers to bypass local supply constraints by acquiring advanced, high-caliber foreign intermediate components (Amiti & Konings, 2007; Kasahara & Rodrigue, 2008; Ar-Rafif & Revindo, 2025). Second, the "learning-by-exporting" hypothesis dictates that intense foreign competition and interactions with sophisticated global buyers compel producers to systematically innovate and optimize their processes (Clerides, Lach, & Tybout, 1998; De Loecker, 2007; Del Prete et al., 2017; Revindo et al., 2025). Together with broader cross-border investment spillovers (Griffith et al., 2004; Javorcik, 2004), executing these fragmented trade operations serves as the primary gateway to accessing vast external knowledge reservoirs.

Crucially, however, the successful translation of these global linkages into tangible productivity premiums is neither automatic nor universally guaranteed. Anchored in the Resource-Based View (Wernerfelt, 1984; Barney, 1991) and the principles of absorptive capacity (Cohen & Levinthal, 1990), an enterprise's ability to effectively internalize foreign spillovers is strictly contingent upon its preexisting human capital, organizational readiness, and technological infrastructure. Consequently, the dividends of GVC integration are highly heterogeneous and structurally conditional. Domestic firms in emerging economies lacking these robust internal capabilities face a pronounced risk of operational stagnation, potentially remaining perpetually locked in low-value assembly segments rather than capturing genuine efficiency upgrades. This inherent theoretical tension, between the immense endogenous learning opportunities provided by international commercial contacts and the restrictive internal constraints of developing industries, mandates a rigorous empirical investigation to disentangle how distinct functional trade profiles genuinely shape micro-level productivity trajectories.

Conceptualizing GVCs and the Empirical Proxy

Although theoretical frameworks conceptualize GVCs through the spatial dispersion of manufacturing stages (Baldwin, 2016), translating this concept into reliable empirical metrics remains highly contested in the literature. Conventional macro-level research frequently utilizes aggregate indices like Trade in Value-Added (TiVA) to track cross-border linkages (Riefky et al., 2025). Yet, microeconomic scholarship increasingly scrutinizes these macroeconomic measures for imposing rigid assumptions of firm homogeneity, thereby obscuring critical operational diversities and distinct integration behaviors within the same industry (Sturgeon, 2015). This structural limitation necessitates a shift toward micro-level proxies capable of capturing true organizational heterogeneity.

Addressing this empirical hurdle, especially within emerging economies lacking comprehensive micro-level input-output matrices, contemporary scholarship increasingly adopts distinct cross-border trading behaviors as a functional measure of GVC embeddedness. While recognizing that basic trade flows cannot perfectly map deep value-added chains, prominent trade literature affirms that traversing international customs borders is a robust, theoretically sound indicator of network integration (Borin & Mancini, 2019). Specifically, classifying enterprises into mutually exclusive operational profiles based on their directional trade flows, purely domestic, sole exporters, sole importers, and dual traders, enables researchers to effectively isolate varying channels of functional upgrading and technological exposure without the severe pitfalls of macroeconomic aggregation (Benkovskis et al., 2017; Rigo, 2017).

Empirical Evidence and Hypothesis Development

Extensive evidence in the empirical literature points to a beneficial link between Global Value Chain (GVC) involvement and firm performance. Establishments that navigate international networks, often by meeting rigorous global quality benchmarks, generally demonstrate higher efficiency levels compared to purely domestic operators (Del Prete et al., 2017; Montalbano & Pietrobelli, 2018). These productivity gains stem from several key factors: the diffusion of new technologies, the upgrading of labor skills, and the implementation of superior production processes (Constantinescu et al., 2017; Rigo, 2020). Additionally, participation in these networks drives innovation as firms must adapt to strict international requirements and evolving standardizations (Torres de Oliveira et al., 2026). This effect is further strengthened by trade liberalization, which allows firms to source more efficient and affordable foreign inputs to overcome local supply limitations (Amiti & Konings, 2007).

When applied to the Indonesian manufacturing sector, these theoretical insights suggest that GVC integration can significantly alter firm-level efficiency. Given the potential for technology catch-up and broader market access, integrated firms are expected to outperform their non-participating counterparts. While the specific magnitude of these benefits may vary across different trade profiles, the overall impact of bypassing domestic supply-side bottlenecks through global connectivity is likely to be positive. Therefore, based on these established mechanisms of technology transfer and innovation, this study argues that Indonesian manufacturing firms participating in Global Value Chains, as identified by their international trading profiles, will demonstrate notably higher productivity levels than non-integrated domestic establishments.

3. METHODOLOGY

Data Source and Sample Selection

This research utilizes micro-level data from the 2017 Large and Medium Manufacturing Survey (Survei Industri or SI/IBS) to empirically investigate the relationship between global integration and firm efficiency. Administered by Statistics Indonesia (BPS), this annual census comprehensively covers manufacturing establishments employing 20 or more workers. The classification of these firms strictly adheres to the *Klasifikasi Baku Lapangan Usaha Indonesia* (KBLI), which aligns seamlessly with the International Standard Industrial Classification (ISIC).

The raw dataset encapsulates detailed firm-level dynamics, encompassing total output, domestic and imported inputs, export values, capital stock, labor absorption, and innovation metrics. While the initial 2017 census recorded 33,577 establishments, a rigorous data cleaning process was executed to ensure econometric robustness. Specifically, observations lacking complete reporting on essential variables, most notably those required to accurately estimate Total Factor Productivity (TFP) and primary control variables like capital intensity, were systematically excluded to prevent estimation bias. Consequently, the final refined sample deployed for the regression analysis comprises 13,371 manufacturing firms.

Consistent with the conceptual framework established in the literature review, and acknowledging the absence of granular input-output macro-linkage data at the firm level, GVC participation is practically proxied through international trading statuses. Firms are categorized into four distinct functional groups: purely domestic entities (non-GVC participants), export-only firms, import-only firms, and highly integrated two-way traders (firms engaged simultaneously in exporting and importing).

Model Specification and Variable Operationalization

This study adopts a cross-sectional Ordinary Least Squares (OLS) estimation strategy to evaluate the relationship between international engagement and industrial efficiency. While the baseline model is inspired by Montalbano and Pietrobelli (2018), it is specifically tailored to accommodate cross-sectional micro-data, contrasting with their panel-based approach. The baseline econometric model to evaluate the productivity premium associated with GVC participation is specified as follows:

$$ln\_TFP_i = \beta_0 + \beta_1 Partgvc\_import_i + \beta_2 Partgvc\_export_i + \beta_3 Partgvc\_twoway_i$$
$$+\beta_4 ln\_capitalintensity_i + \beta_5 techuse_i + \beta_6 ln\_size_i + \epsilon_i$$

In this specification, the dependent variable is the natural logarithm of Total Factor Productivity (ln_TFP) for the firm i. The primary parameters of interest are the categorical GVC proxies: $Partgvc\_import_i$, $Partgvc\_export_i$, and $Partgvc\_twoway_i$, which are measured as binary dummy variables against the baseline of non-participating firms ($notgvc$). To isolate the specific impact of global connectivity, the model incorporates several structural control variables drawn from previous empirical studies that identify them as key determinants of manufacturing performance. These include capital intensity ($ln\_capitalintensity_i$), technological adoption ($techuse_i$), and the scale of operations or firm size (ln_size_i), represented by the natural logarithm of the total workforce.

Total Factor Productivity (TFP) Estimation

The dependent variable, TFP, serves as the ultimate metric for production efficiency, capturing the residual output growth unexplained by traditional inputs like labor and physical capital (Comin, 2010; Mankiw, 2022). To resolve potential endogeneity issues inherent in productivity estimations, TFP is derived using a Cobb-Douglas production function, conceptually aligned with the Levinsohn-Petrin methodological approach (Petrin et al., 2004; Rostiana et al., 2022). The base production function is defined as:

$$F(K, L) = AK^{\alpha}L^{\beta}$$

which can be transformed into its natural logarithmic form:

$$ln\, F(K, L) = ln\, Y = ln\, A + \alpha.\, ln\, K + \beta.\, ln\, L$$

Where Y represents total firm output, K denotes capital (proxied by the total estimated value of fixed assets, including machinery), and L stands for labor. The residual term, A, represents the firm-level TFP. The input elasticity parameters (α and β) are estimated via OLS without a constant term, from which the residuals are subsequently extracted to represent firm-specific productivity. The estimation results for these elasticities are detailed in Table 2, while the complete operational definitions and literature references for all variables are summarized in Table 3.

Table 2. Estimation Results of the TFP Model

Variables	Dependent: lnout
ln_capitalstock	0.3304*** (0.0054)
lnlab	0.7914*** (0. 00572)
_cons	(No Constant)
Number of observations	15,350
R2	0.9938

***p<0.01, **p<0.05, *p<0.1

Table 3. Definition and Operationalization of Variables

Variable	Operational Definition	Category	Source
Dependent Variable			
Firm Productivity (ln_TFP)	Total Factor Productivity (TFP) of a firm	Numerical (natural logarithm)	Del Prete et al. (2017)
Main Independent Variables			
Non-GVC Participation (notgvc)	Firms that do not participate in GVCs	Dummy: 1 = non-GVC firm; 0 = otherwise	Del Prete et al. (2017); Constantinescu et al. (2017); Montalbano & Pietrobelli (2018); Rigo (2020)
GVC Export Participation (Partgvc_export)	Firms that participate in GVCs through exporting only	Dummy: 1 = export-only firm; 0 = otherwise	
GVC Import Participation (Partgvc_import)	Firms that participate in GVCs through importing only	Dummy: 1 = import-only firm; 0 = otherwise	
GVC Two-way Participation (Partgvc_twoway)	Firms that participate in GVCs through both exporting and importing	Dummy: 1 = both export and import; 0 = otherwise	
Control Variables			
Capital Intensity (ln_capitalintensity)	Capital per worker, calculated as total estimated capital stock in 2017 divided by the number of employees	Numerical (natural logarithm)	Montalbano & Pietrobelli (2018)
Technology Use (techuse)	Use of technology in firm operations	Dummy: 1 = uses technology; 0 = does not use technology	Del Prete et al. (2017); Montalbano & Pietrobelli (2018)
Firm Size (ln_size)	Total number of employees in the firm	Numerical (natural logarithm)	Montalbano & Pietrobelli (2018)

4. RESULT AND DISCUSSION

Descriptive Statistics of GVC Participation, Industrial Sector Distribution, and Sample Characteristics

Before executing the formal empirical estimation, it is imperative to address the sample composition and the structural characteristics revealed by the 2017 manufacturing census. As shown in the "Total" row of Table 4, the initial raw dataset comprises 33,577 establishments. However, the analytical framework for the regression analysis utilizes a refined sample of 13,371 firms. This significant data reduction was strictly necessary to isolate observations with complete and non-zero reporting on capital assets, labor, and intermediate inputs, which are fundamental for computing Total Factor Productivity (TFP).

Utilizing this representative subset, the analysis first explores the sectoral landscape and the specific ways Indonesian firms integrate into global networks. Tables 4 and 5 delineate the sectoral distribution across functional participation profiles, revealing a profound structural asymmetry in Indonesia's manufacturing landscape. A critical observation from this data is the overwhelming dominance of import-driven participation; out of the firms integrated into global networks, approximately 86% (17,602 firms) are classified as "Import Only." This structural pattern implies that domestic firms primarily integrate into international networks as "downstream" processors that rely heavily on foreign intermediate inputs and machinery to sustain industrial production (Verico, 2021). This reliance further highlights a sharp dichotomy between sectors: traditional industries like Food Products (4,109 non-participants) and Wearing Apparel exhibit a significant domestic focus with limited international engagement, likely due to low technological intensity and the orientation toward the large local market (Verico, 2021). In contrast, technology-intensive sectors such as Chemicals and Fabricated Metals show a high concentration of import participation, driven by the necessity for technological catch-up and the procurement of high-quality components that are often locally unavailable (Amiti & Konings, 2007). Notably, the relatively low presence of Foreign Direct Investment (FDI) across these categories suggests that this import dependency is a systemic characteristic of domestic-owned enterprises rather than an exclusive phenomenon of multinational corporations.

While these sectoral patterns provide a structural overview of global engagement, a more granular examination of the data is required to understand the underlying operational disparities within the sample. Table 6 presents the descriptive statistics for the variables, revealing the stark disparities in operational characteristics across the sampled firms. The productivity metric, ln_TFP, shows a mean of 16.410 with a substantial standard deviation (SD) of 2.202. The gap between the minimum (6.812) and maximum (24.759) values indicates an extreme productivity range, confirming that Indonesian manufacturers operate across a highly fragmented efficiency frontier. This high variance justifies our inquiry into global participation as a primary driver to bridge this efficiency gap. Similarly, the control variables exhibit significant heterogeneity; for instance, capital intensity ranges from -6.615 to 22.363 (SD: 1.884), reflecting a vast disparity in mechanization levels, from labor-intensive traditional shops to highly automated factories. Furthermore, the notably low mean of technology adoption (techuse) at approximately 1.6% indicates a critical bottleneck, as most firms operate at the lower end of the technological spectrum. Finally, the variance in firm size, ranging from a natural log of 2.996 (approximately 20 employees) to 10.920, underscores the diversity of operational scales that determines a firm's ability to overcome the high sunk costs of international engagement.

Table 4. Industrial Sectors, GVC Participation Status, and Foreign Direct Investment (FDI)

Industrial Sector	Not GVC	GVC						Total GVC	Total Firm
		Export Only		Import Only		Two-way			
		No FDI	FDI	No FDI	FDI	No FDI	FDI		
Manufacture of Food Products	4109	383	69	2724	149	44	30	3399	7508
Manufacture of Wearing Apparel	290	9	1	320	25	4	1	360	650
Manufacture of Textiles	427	20	3	243	3	5	5	279	706
Manufacture of Rubber and Plastics Products	970	59	3	1530	91	56	31	1770	2740
Manufacture of Other Non-Metallic Mineral Products	943	86	33	1683	130	40	57	2029	2972
Manufacture of Furniture	355	24	10	453	49	17	21	574	929
Manufacture of Fabricated Metal Products, Except Machinery and Equipment	537	276	27	595	35	16	19	968	1505
Manufacture of Chemicals and Chemical Products.	251	14	7	406	33	23	9	492	743
Manufacture of Wood and Products of Wood and Cork (Except Furniture) and Articles of Straw and Plating Materials	424	5	0	564	11	3	1	584	1008
Printing and Reproduction of Recorder Media	109	3	1	25	2	1	1	33	142
Manufacture of Leather and Related Products	412	57	14	831	151	24	30	1107	1519
Other Manufacture	94	3	1	250	18	7	6	285	379
Manufacture of Paper and Paper Products	791	78	35	1509	126	46	39	1833	2624
Manufacture of Machinery and Equipment n.e.c	1252	44	7	638	42	13	12	756	2008
Manufacture of Tobacco Products	121	16	3	351	54	13	10	447	568
Manufacture of Motor Vehicles, Trailers and Semi Trailers	481	17	7	888	100	20	29	1061	1542
Manufacture of Beverages	91	1	10	258	101	9	36	415	506
Manufacture of Basic Metals	92	4	9	350	73	7	17	460	552
Manufacture of Electrical Equipment	247	8	3	385	64	6	15	481	728
Manufacture of Other Transport Equipment.	117	3	9	434	93	11	20	570	687
Manufacture of Computer, Electronic and Optical Product	170	8	3	299	40	7	10	367	537
Manufacture of Basic Pharmaceutical Products and Pharmaceutical Preparations	457	307	83	860	49	16	22	1337	1794
Repair and installation of machinery and equipment	309	60	23	347	39	32	50	551	860
Manufacture of Coke and Refined Petroleum Products	187	1	0	177	4	0	1	183	370
Total	**13236**	**1486**	**361**	**16120**	**1482**	**420**	**472**	**20341**	**33577**

Source: IBS 2017, authors' calculations.

Table 5. Industrial Sectors and Dominant Types of GVC Participation

Sector	Industrial Sector	Dominant GVC Participation
10	Manufacture of Food Products	Non-GVC
11	Manufacture of Beverages	Non-GVC
12	Manufacture of Tobacco Products	Non-GVC
13	Manufacture of Textiles	Non-GVC
14	Manufacture of Wearing Apparel	Non-GVC
15	Manufacture of Leather and Related Products	Import Only
16	Manufacture of Wood and Products of Wood and Cork (Except Furniture) and Articles of Straw and Plating Materials	Import Only
17	Manufacture of Paper and Paper Products	Import Only
18	Printing and Reproduction of Recorded Media	Import Only
19	Manufacture of Coke and Refined Petroleum Products	Import Only
20	Manufacture of Chemicals and Chemical Products	Import Only
21	Manufacture of Basic Pharmaceutical Products and Pharmaceutical Preparations	Import Only
22	Manufacture of Rubber and Plastics Products	Import Only
23	Manufacture of Other Non-Metallic Mineral Products	Import Only
24	Manufacture of Basic Metals	Import Only
25	Manufacture of Fabricated Metal Products, Except Machinery and Equipment	Import Only
26	Manufacture of Computer, Electronic and Optical Product	Import Only
27	Manufacture of Electrical Equipment	Import Only
28	Manufacture of Machinery and Equipment n.e.c	Import Only
29	Manufacture of Motor Vehicles, Trailers and Semi Trailers	Import Only
30	Manufacture of Other Transport Equipment	Import Only
31	Manufacture of Furniture	Import Only
32	Other Manufacture	Import Only
33	Repair and installation of machinery and equipment	Import Only

Source: IBS 2017, authors' calculations.

Table 6. Descriptive Statistics of the Study Variables

Variable	Observations	Mean	Std. Dev.	Min	Max
ln_TFP	30,002	16.410	2.202	6.812	24.759
notGVC	33,577	394	489	0	1
Partgvc_export	33,577	55	228	0	1
Partgvc_import	33,577	524	499	0	1
Partgvc_twoway	33,577	27	161	0	1
ln_capitalintensity	15,917	10.692	1.884	-6.615	22.363
techuse	33,577	16	125	0	1
ln_size	33,577	4.286	1.170	2.996	10.920

Source: IBS 2017, authors' calculations.

Regression Results

The relationship between international engagement and operational efficiency is formally tested using Ordinary Least Squares (OLS) with robust standard errors. As detailed in Table 7, the model demonstrates a solid goodness-of-fit with an R-squared of 0.5891, indicating that nearly 59% of the variance in TFP is explained by the included predictors. To ensure clear interpretation and avoid the "dummy variable trap," purely domestic firms ("Not GVC") are designated as the omitted baseline category.

Table 7. Regression Results

Variables	Dependent: ln_TFP
Partgvc_export	0.2769***
	(0.0450)
Partgvc_import	0.8865***
	(0.0293)
Partgvc_twoway	0.3534***
	(0.0622)
ln_capitalintensity	0.3196***
	(0.0091)
ln_size	1.222***
	(0.0122)
techuse	0.2360***
	(0.0695)
_cons	7.046***
	(0.1009)
Number of observations	13,371
R2	0.5891

***p<0.01, **p<0.05, *p<0.1

The empirical results directly address the primary objective of evaluating the productivity premiums associated with global integration. All functional forms of GVC participation yield positive and statistically significant coefficients at the 1% level. Calculated using the formula $(exp(\beta)$ - 1) $\times$ 100, these coefficients translate into substantial efficiency advantages over non-participating establishments.

The most substantial association is observed in the "Import Only" category (β = 0.8865), yielding a productivity premium of approximately 142.6%. This finding is strongly supported by the study of Amiti and Konings (2007), who demonstrated that in the Indonesian manufacturing context, the gains from "learning-by-importing", specifically through access to superior foreign inputs, are far more significant than those from other trade channels. Economically, this confirms that for domestic firms, bypassing local supply bottlenecks through imported technology and components is the primary engine for bridging the efficiency gap (Verico, 2021). This narrative is further corroborated by Mo et al. (2021) in the context of China, who demonstrate that all forms of importing contribute positively to manufacturing efficiency. Furthermore, the magnitude of this premium suggests that integrated firms successfully bypass the "low-productivity trap" typical of isolated domestic operators in resource-heavy economies.

Establishments engaged in "Two-way" trade show a premium of 42.4% (β = 0.3534), while "Export Only" firms exhibit a significant advantage of 31.9% (β = 0.2769). These results align with the empirical findings of Del Prete et al. (2017) and Montalbano and Pietrobelli (2018), which identified that exposure to international competition and global buyers compels firms to implement rigorous quality standards and optimize production processes. However, the notable disparity between the import-only premium and the export-only premium points to a structural reality consistent with the "capability trap" discussed by Rigo (2020). While exporting improves efficiency, Indonesian firms appear to derive significantly higher returns from the direct embodiment of technology in foreign inputs rather than from innovation purely triggered by market-driven export competition.

Finally, the control variables confirm the critical role of internal firm characteristics. Firm size (β = 1.222), capital intensity (β = 0.3196), and technology utilization (β = 0.2360) all show positive and highly significant associations. These outcomes are consistent with the studies of Griffith et al. (2004) and Criscuolo and Timmis (2017), which emphasize that a firm's scale and technological foundations are fundamental to its "absorptive capacity." Specifically, the positive and significant impact of technology use reinforces the argument that global integration alone is insufficient; firms must possess the internal infrastructure to effectively capture and utilize knowledge spillovers. Without these internal capabilities, domestic establishments risk remaining in low-value assembly roles even when integrated into global networks.

5. CONCLUSION

This study investigated the productivity dynamics of Indonesian manufacturing firms through the functional lens of Global Value Chain (GVC) participation. By deploying firm-level census data, this research successfully bypassed the aggregation biases inherent in macroeconomic indices, providing a granular mapping of how international engagement shapes industrial efficiency. The empirical evidence demonstrates a clear, statistically significant productivity hierarchy among global participants. While all forms of international integration yield efficiency gains, the most profound finding is the massive productivity premium associated with import-driven participation, which reaches approximately 142.6% over non-participating establishments. This substantial advantage for importers, compared to the more modest premiums for two-way (42.4%) and export-only (31.9%) establishments, underscores the unique structural reality of Indonesia's industrial integration.

Theoretically, these results offer a nuanced validation of the "learning-by-importing" framework within a resource-heavy, developing economy context. The disproportionate magnitude of the import premium suggests that bypassing domestic supply-side bottlenecks through the procurement of high-quality foreign intermediate goods and machinery is the primary engine for technological catch-up in Indonesia. However, this reliance highlights a systemic vulnerability. Consistent with the "capability trap" discourse, these findings imply that while global integration successfully bridges efficiency gaps, it may simultaneously reinforce a structural dependency where domestic firms remain efficient "downstream" processors rather than independent innovators. The positive and significant roles of firm size and technology use further confirm that internal absorptive capacity remains a fundamental prerequisite; global spillovers cannot be effectively internalized without a robust domestic technological foundation.

From a policy perspective, these insights necessitate a strategic shift in Indonesia's industrial roadmap. The evidence suggests that overly restrictive trade barriers on critical intermediate inputs may inadvertently stifle the very efficiency gains needed for national competitiveness. Consequently, policymakers must strike a delicate balance between Local Content Requirements (TKDN) and the undeniable necessity for advanced foreign components that sustain high-productivity operations. Industrial strategies should transcend traditional export-promotion paradigms, focusing instead on facilitating deep technological absorption and internal capability building. Ensuring that domestic firms possess the infrastructure to master imported technologies, rather than merely utilizing them, is vital to escaping low-value assembly roles and moving toward genuine functional upgrading within global production networks.

While providing a robust baseline of pre-pandemic industrial dynamics, this study acknowledges the methodological boundaries of its cross-sectional design. The associations identified between GVC participation and productivity premiums provide a strong correlational foundation but do not imply absolute causality. To advance this research agenda, future studies should transition toward longitudinal panel datasets to rigorously isolate causal mechanisms and address potential self-selection biases. Furthermore, subsequent research should strive to incorporate more sophisticated GVC proxies, such as micro-level input-output linkages or firm-level foreign value-added tracking, to capture the full depth of production fragmentation beyond binary trade statuses. Finally, executing targeted sectoral analyses to track the evolution of these premiums across different technological tiers will provide a more precise, evidence-based compass for navigating Indonesia's future industrial upgrading trajectory.

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