The strategic role of Indonesia in Global Value Chains (GVC)

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ABSTRACT: This study looks at the participation of Indonesia in Global Value Chains (GVC) and the role it plays in fragmented structures. Through an international input-output database and by breaking up Gross Exports (GE) into different components of Value Added (VA), it traces the interaction of Indonesia within the global value chain to measure vertical specialization for Indonesia. The results show that Indonesia has significantly gained in integration with Asian value chains, both East Asia and ASEAN. Even though ASEAN as a single production region has gained little over time, Indonesia has gained presence within it. Indonesia lost share in VA trade with NAFTA and Europe and focused on Asia instead. The role of Indonesia across the GVC has experienced a structural change, moving from 50% exports of value added though final goods in 1997 to a supplier of intermediaries (59%) in 2012. Indonesia differs from ASEAN countries regarding foreign value added content in its exports as most of its value added is local (88%), is less globally integrated (12% of vertical trade vs. 35% in ASEAN), is more intra-Asian focused, and has less high-tech exports.

Keywords: vertical specialization, AFTA, production networks, value added trade, global input-output

1 INTRODUCTION

This article measures the "real" participation and temporal changes of Indonesia within fragmented structures by addressing three questions: 1) to what extent is the liberalization process of Indonesia affecting the way it produces goods-services? 2) how does Indonesia integrate (adds value) with the main trading hubs (ASEAN, East Asia, European Union and North America)? and 3) how important is the participation of Indonesia in fragmented structures?

To measure the participation of Indonesia in GVC requires assessing the achievement of Indonesian's liberalization efforts, to distinguish the role of the country in GVC, and its links with other regions. To answer those questions, an adjusted world input-output table is employed to decompose the value added of Indonesia's gross exports according to where the value of Indonesia's gross exports is created and where it is finally absorbed, either through intermediate goods (IPC) or final goods. The study looks at three years 1997, 2004 and 2012, and analyses the links with ASEAN, East Asia (hereafter EA), North America (NAFTA), and the European Union (EU).

2 METHODOLOGY

This paper falls within value added (VA) measurement and vertical specialization. This paper uses Koopman et al.'s (2010; 2012) methodology in which they include linear combinations of previous indicators on VA exports and vertical specialization (VS) such as those developed by Hummels et al. (2001) Daudin et al. (2011) and Johnson and Noguera (2012). While the above empirical methodologies rightly decomposed VA based on direct and some indirect degree, some miss shares of VA embedded in other countries' IPC that cross multiple borders (Wang et al. 2013). The contribution comes as it integrates regions and traces inter-temporal variations. The framework consists of breaking up a country's gross exports (GE) into exports of domestic value added (DV), VA that returns home, foreign VA and double counted terms, all terms according to the source of VA creation and the final destination of VA. The detailed model is depicted by Koopman et al. (2012). Total gross exports are split into nine terms, a further decomposition of Leontief input-output, as follows:

First, data are set as an ICIO Matrix. It is assumed that each G-country produces goods in N differentiated tradable sectors. Goods can be consumed as final goods or intermediate inputs, either exported or used/consumed at home.

$$X_s = \sum_r^G \left(A_{Sr} X_r + Y_{sr} \right), r, s \ldots .. G \tag{1}$$

X_s is the Nx1 gross output vector of country s, Y_{sr} is the NxN final demand vector and A_{sr} is the NxN IO coefficient matrix (Koopman et al. 2012). Equation (1), the G-country, N-sector production and trade system is written as an ICIO matrix notation:

$$\begin{bmatrix} X_{11} & X_{11} & \ldots & X_{1G} \\ X_{21} & X_{22} & \ldots & X_{2G} \\ \vdots & \vdots & \ddots & \vdots \\ X_{G1} & X_{G2} & \ldots & X_{GG} \end{bmatrix} = \begin{bmatrix} B_{11} & B_{12} & \ldots & B_{1G} \\ B_{21} & B_{22} & \ldots & B_{2G} \\ \vdots & \vdots & \ddots & \vdots \\ B_{G1} & B_{G2} & \ldots & B_{GG} \end{bmatrix} = \begin{bmatrix} Y_{11} & Y_{12} & \ldots & Y_{1G} \\ Y_{21} & Y_{22} & \ldots & Y_{2G} \\ \vdots & \vdots & \ddots & \vdots \\ Y_{G1} & Y_{G2} & \ldots & Y_{GG} \end{bmatrix} \tag{2}$$

B_{sr} denotes the total requirement matrix (Leontief inverse). Next, the VA share matrix by source is build. Vs is the correspondent 1 × N direct VA coefficient vector or GxGN matrix of direct domestic VA for G-countries. Multiplying these direct VA shares with the Leontief inverse matrices produces the G × GN VA share (VB). However, to obtain domestic VA in a country's gross output, a new VA coefficient matrix is created ($\hat{V}_s$), with a GN-by-GN dimension with the direct VA coefficients along the diagonal and exports of VA in the off-diagonal columns. This GNxGN matrix is multiplied by BY to obtain $\hat{V}BY$ matrix.

$$BY = \begin{bmatrix} \hat{V}_1 & 0 & \ldots & 0 \\ 0 & \hat{V}_1 & \ldots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \ldots & \hat{V}_G \end{bmatrix} = \begin{bmatrix} X_{11} & X_{12} & \ldots & X_{1G} \\ X_{21} & X_{22} & \ldots & X_{2G} \\ \vdots & \vdots & \ddots & \vdots \\ X_{G1} & X_{G2} & \ldots & X_{GG} \end{bmatrix}$$
$$= \begin{bmatrix} V_1 \sum_r^G B_{1r} Y_{r1} & V_1 \sum_r^G B_{1r} Y_{r2} & \cdots & V_1 \sum_r^G B_{1r} Y_{rG} \\ V_2 \sum_r^G B_{2r} Y_{r1} & V_2 \sum_r^G B_{2r} Y_{r2} & \cdots & V_2 \sum_r^G B_{2r} Y_{rG} \\ \vdots & \vdots & \ddots & \vdots \\ V_G \sum_r^G B_{Gr} Y_{r1} & V_G \sum_r^G B_{Gr} Y_{r2} & \cdots & V_G \sum_r^G B_{Gr} Y_{rG} \end{bmatrix} \tag{3}$$

Next gross exports are decomposed. A country's total VA exports, denoted by $VT_{s*} = \sum_{r \neq s}^G VX_{sr} = V_s \sum_{r \neq s}^G \sum_{g=1}^G B_{sg} Y_{gr}$ are rewritten according to where and how the VA is absorbed.

$$VT_{s*} = V_s \sum_{r \neq s}^G B_{ss} Y_{sr} + V_s \sum_{r \neq s}^G B_{sr} Y_{rr} + V_s \sum_{r \neq s}^G \sum_{t \neq s,r}^G B_{sr} Y_{rt} \tag{4}$$

Equation (4) is the VA export decomposition equation, including VA in a country's *s* final goods exports to *r*; 2nd VA in intermediate exports; 3rd VA in re-exports to *t* countries. Country's gross exports are defined as

$$E_{s*} = \sum_{r \neq s}^G E_{sr} = \sum_{r \neq s}^G A_{sr} X_r + Y_{sr} \tag{5}$$

Equation (5) can be further decomposed according to where the intermediate and final goods are finally absorbed.

$$\begin{aligned} uE_{s*} &= V_s B_{SS} E_{s*} + \sum_{r \neq s}^G V_r B_{rs} E_{s*} \\ &= VT_{s*} + \left\{ V_s \sum_{r \neq s}^G B_{sr} Y_{rs} + V_s \sum_{r \neq s}^G B_{sr} A_{rs} X_s \right\} \\ &\quad + \left\{ \sum_{r \neq s}^G \sum_{r \neq s}^G V_t B_{ts} Y_{sr} + \sum_{r \neq s}^G \sum_{r \neq s}^G V_t B_{ts} A_{sr} X_r \right\} \end{aligned} \tag{6}$$

VT_{s*} in equation (6) indicates the VA exports in final goods, and four different flows of the country's VA exports. Based on each country's gross output identity, $X_s = (I - A_{ss})^{-1} Y_{ss} + (I - A_{ss})^{-1} E_{s*}$ and $X_r = (I - A_{rr})^{-1} Y_{rr} + (I - A_{rr})^{-1} E_{r*}$ and substituting into equation (6) the new equation:

$$\begin{aligned} uE_{s*} = & \left\{ V_s \sum_{r \neq s}^G B_{ss} Y_{sr} + V_s \sum_{r \neq s}^G B_{sr} Y_{rr} \right. \\ & \left. + V_s \sum_{r \neq s}^G \sum_{r \neq s}^G B_{sr} Y_{rr} \right\} \\ & + \left\{ V_s \sum_{r \neq s}^G B_{sr} Y_{rs} + V_s \sum_{r \neq s}^G B_{sr} A_{rs} (I - A_{ss})^{-1} Y_{ss} \right\} \\ & + V_s \sum_{r \neq s}^G B_{sr} A_{rs} (I - A_{ss})^{-1} E_{s*} \\ & + \left\{ \sum_{t \neq s}^G \sum_{t \neq s}^G V_t B_{ts} Y_{sr} \right. \\ & \left. + \sum_{t \neq s}^G \sum_{t \neq s}^G V_t B_{ts} A_{sr} (I - A_{rr})^{-1} Y_{rr} \right\} \\ & + \sum_{t \neq s}^G V_t B_{ts} Y_{sr} \sum_{t \neq s}^G (I - A_{ss})^{-1} E_{r*} \end{aligned} \tag{7}$$

Equation (7) contains nine different terms based on the sources of creation and destination. The first three terms represent the VA in exports; the fourth and fifth include VA initially being exported, but eventually returning home. The seventh and eighth terms include foreign VA in the home's country exports. The sixth and ninth terms are double counted terms.

Table 1. Accounting gross exports. 1997, 2004 and 2012 (Share of total gross exports).

Gross exports in billion of US doubts		Domestic Value added exports DV			Domestic value added returns home		Pure double counting	Foreign value added FV		Pure double counting			
		In direct final exports	In IPCs absorbed by direct importers	In IPCs re-exports to third countries	In final exports	In IPC exports	In IPC exports produced in home	in final exports	in IPC exports	In IPC exports produced abroad	Value added exports (VT)	Foreign Content Vs	VA that crosses nations at least twice
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(13)	(14)
1997													
EAST ASIA	$961	53.1%	28.5%	5.9%	0.4%	0.4%	0.1%	7.1%	3.5%	1.3%	87.5%	12.0%	12.8%
ASEAN	$449	37.5%	21.9%	5.6%	0.2%	0.1%	0.2%	19.8%	8.3%	4.3%	65.1%	32.4%	33.0%
Singapore	$170	27.4%	15.6%	3.2%	0.2%	0.1%	0.3%	31.2%	11.5%	4.6%	46.2%	47.3%	47.8%
Malaysia	$93	36.5%	22.5%	7.4%	0.4%	0.2%	0.3%	17.6%	8.1%	6.4%	66.4%	32.1%	33.1%
Thailand	$72	45.6%	24.9%	6.7%	0.1%	0.1%	0.1%	13.2%	7.2%	4.0%	77.2%	24.4%	24.7%
Indonesia	$63	50.9%	30.7%	7.5%	0.1%	0.1%	0.0%	6.1%	3.4%	1.7%	89.1%	11.1%	11.4%
Philippines	$38	45.2%	27.4%	6.3%	0.1%	0.1%	0.0%	11.9%	5.8%	2.6%	79.0%	20.4%	20.6%
Vietnam	$12	45.6%	26.1%	6.1%	0.0%	0.0%	0.0%	12.9%	6.7%	3.0%	77.9%	22.6%	22.6%
NAFTA	$1,336	55.3%	28.4%	4.3%	1.6%	1.2%	0.2%	5.5%	2.8%	0.8%	87.9%	9.1%	12.0%
EU	$2,472	50.0%	21.9%	5.0%	0.4%	0.2%	0.1%	14.4%	5.6%	2.3%	76.8%	22.3%	23.0%
2004													
EAST ASIA	$1,743	48.2%	29.1%	6.6%	0.5%	0.4%	0.1%	8.7%	4.9%	2.2%	83.9%	15.8%	16.8%
ASEAN	$662	31.6%	21.4%	6.5%	0.2%	0.1%	0.3%	21.3%	9.5%	6.4%	59.6%	37.2%	37.7%
Indonesia	$83	45.3%	32.2%	9.7%	0.1%	0.1%	0.0%	6.4%	3.8%	2.5%	87.3%	12.7%	13.0%
NAFTA	$1,767	52.5%	29.8%	4.7%	1.8%	1.3%	0.1%	5.7%	3.1%	0.9%	87.0%	9.7%	12.9%
EU	$4,021	46.5%	23.0%	5.5%	0.4%	0.3%	0.1%	14.7%	6.2%	2.9%	75.0%	23.9%	24.7%
2012													
EAST ASIA	$4,109	55.4%	21.7%	5.5%	0.5%	0.5%	0.1%	10.6%	4.1%	2.0%	82.6%	16.8%	17.9%
ASEAN	$1,504	30.5%	24.5%	7.1%	0.2%	0.1%	0.2%	19.4%	9.4%	5.7%	62.1%	34.5%	35.0%
Singapore	$555	22.9%	15.8%	4.0%	0.1%	0.0%	0.3%	30.2%	11.5%	5.9%	42.7%	47.5%	48.0%
Malaysia	$266	24.5%	30.1%	10.5%	0.3%	0.3%	0.4%	12.6%	13.1%	11.1%	65.1%	36.8%	37.7%
Thailand	$268	41.9%	22.3%	5.8%	0.1%	0.1%	0.1%	17.7%	7.6%	4.0%	69.9%	29.4%	29.7%
Indonesia	$213	28.5%	45.5%	14.1%	0.4%	0.3%	0.1%	3.6%	4.6%	3.1%	88.0%	11.3%	12.1%
Philippines	$77	45.2%	29.7%	8.5%	0.1%	0.1%	0.0%	8.9%	5.5%	3.2%	83.3%	17.6%	17.8%
Vietnam	$125	46.8%	16.5%	4.0%	0.0%	0.0%	0.0%	22.6%	6.7%	3.1%	67.3%	32.4%	32.5%
NAFTA	$3,130	50.6%	30.7%	6.0%	1.4%	1.2%	0.2%	5.3%	3.3%	1.2%	87.2%	9.8%	12.6%
EU	$6,132	46.8%	18.2%	5.9%	0.4%	0.2%	0.2%	18.2%	5.8%	3.7%	70.9%	27.6%	28.4%

[a] Notes: VT Column (10) = (1)+(2)+(3); VS column (13) = (7)+(8)+(9) Column (14) equal sum (4) through (9). East Asia (EA): Japan, China, Rep of Korea, Taiwan. ASEAN: Singapore, Malaysia, Thailand, Indonesia, Philippines, Vietnam. NAFTA: USA, Canada, and Mexico. EU: France, Germany, Austria, Belgium, Finland, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, UK.

This research uses the YNU-GIO Table, Inter Country Input-Output table (ICIO) developed by the CESSA. It includes 29 endogenous countries, 59 exogenous countries and 35 industries. Sato and Shrestha (2014) carried out a series of harmonization in the data, linking OECD input-output tables with data on trade flows from UN COMTRADE.

3 RESULTS AND DISCUSSION

Table 1 presents the accounting of Indonesia versus East Asia (EA), ASEAN, NAFTA and the EU for 1997, 2004 and 2012. The column number indicates the order of each term in the equation (7). All figures are expressed as share of each region's gross exports (GE).

3.1 *Indonesia gross export decomposition*

Column 1 in Table 1 indicates that Indonesia increased its exports of domestic value added (DV) through final goods by 89% in value terms. However, as a share of gross exports, it fell from 51% in 1997 to 29% in 2012, a low DV through final goods versus Thailand, the Philippines and Vietnam, as well as with EA and NAFTA (more than 50%).

DV through intermediary goods (column 2) directly absorbed by importers reached 46% in 2012, an increase from 31% share in 1997, and 401% more in value terms. Re-exports concept of trade (col 3) reports growth of 525% versus 1997, a shift from 7% as share of GE in 1997 to 14% in 2012. VA through IPC accounts for nearly 60%, stating a strategic role of Indonesia as supplier of IPC within GVC.

Foreign content (FV) embedded in Indonesian exports (column 7 to 9) represents 11.8%, a low share versus ASEAN region (largest share with 35%). Out of the 22% of FV embedded in ASEAN exports, Indonesia supplies 2%, while FV from extra ASEAN accounts for 78%, 30% alone from East Asia.

Indonesia registered 2.6% of double counted VA (column 6 and 9), a small amount but a large change in value terms from 1997 to 2012, indicating a more dynamic Indonesia within vertical trade.

Indonesia experienced a small change in vertical trade, with only 12% of GE under it, half of ASEAN's level. Indonesian exports were highly supported by one-way trade (75%) with IPCs accounting for 45%.

3.2 *Interactions of Indonesian in GVC*

Table 2 presents the accounting of gross exports based on main blocs of value added aggregated at regional level. Column 10 indicates VA exports, specifying who exports (row) and who absorbs the VA (column). Since 1997, East Asia has accounted

Table 2. Accounting gross exports. 1997 and 2012 based on Origin-destination of value added.

Gross exports in billion of US dollars		Value-added exports (VT) (10)						VS Foreign content of region (VS) (11)						Domestic content in region's exports (13)					Value added that crosses nations at least twice (14)					
		EA	ASEAN	*IDN*	*NAFTA*	EU	OE	EA	ASEAN	*IDN*	*NAFTA*	EU	OE	EA	ASEAN	*IDN*	*NAFTA*	EU	EA	ASEAN	*IDN*	*NAFTA*	EU	OE
Region		Accounting of Gross Exports 1997																						
$960.73	EA	20%	12%	2%	24%	10%	20%	3%	1.81%	0.24%	3%	1%	3%	20%	12%	2%	24%	10%	3%	2%	0%	3%	1%	0%
$449.2	ASAAN	18%	12%	1%	13%	8%	13%	7%	7.41%	0.88%	6%	4%	7%	18%	12%	2%	13%	8%	7%	8%	1%	6%	4%	1%
$63.04	*IDN*	30%	12%	0%	15%	12%	21%	3%	2.01%	0.00%	2%	1%	3%	30%	12%	0%	15%	12%	4%	2%	0%	2%	1%	3%
$1,335.61	NAFTA	16%	4%	1%	33%	14%	18%	1%	0.39%	0.04%	5%	1%	2%	16%	5%	1%	35%	15%	1%	1%	0%	7%	1%	0%
$2,47.86	EU	4%	2%	0%	10%	38%	22%	1%	0.56%	0.07%	3%	17%	6%	4%	2%	0%	10%	49%	1%	1%	0%	3%	28%	0%
		Accounting of Gross Exports 2012																						
Region		EA	ASEAN	*IDN*	*NAFTA*	EU	OE	EA	ASEAN	*IDN*	*NAFTA*	EU	OE	EA	ASEAN	*IDN*	*NAFTA*	EU	EA	ASEAN	*IDN*	*NAFTA*	EU	OE
$4,109.13	EA	22%	9%	2%	19%	10%	20%	4%	2.08%	0.33%	4%	2%	5%	23%	9%	2%	19%	10%	5%	2%	0%	4%	2%	1%
$1,503.51	ASEAN	22%	11%	2%	8%	7%	10%	10%	7.52%	1.46%	4%	4%	9%	22%	12%	2%	8%	7%	10%	8%	1%	4%	4%	3%
$213	*IDN*	34%	17%	0%	11%	9%	16%	4%	3.09%	0.00%	1%	1%	3%	35%	18%	0%	11%	9%	4%	4%	0%	1%	1%	2%
$3,130.03	NAFTA	19%	4%	1%	34%	14%	15%	2%	0.53%	0.05%	5%	1%	2%	19%	5%	1%	35%	14%	2%	1%	0%	7%	2%	0%
$6,131.74	EU	8%	2%	0%	9%	34%	17%	3%	0.81%	0.07%	3%	18%	7%	8%	2%	0%	9%	40%	3%	1%	0%	3%	24%	1%

for the largest export target of Indonesian DV (34% in 2012), while DV to ASEAN countries accounted for 17% and NAFTA decreased from 15% to 11%. More than 50% of Indonesia's DV exports remained in Asia.

ASEAN significantly increased its participation in multiple cross border trade from 27% in 1997 to 35% in 2012 (col 14). Indonesia changed less than 1%, however, in value accounts for an increase in 256%.

The largest share of FV embedded in Indonesian exports comes from East Asia (4%), followed by ASEAN 3.09%, while only 3.87% of Indonesian VA is embedded in other regions. Indonesia exports more than 60% of its VA in parts and components.

Out of the 14% of VA created through exports of IPCs that will be further re-exported (col 3), 80% belongs to Asian countries. Indonesia shifted focus to EA rather than building ASEAN chains. Within ASEAN, Indonesia has the largest expansion to EA.

The Indonesian DV that crosses nations at least twice (MCB, 14) was kept at 4% of GE, increasing its share with ASEAN countries by 2% but lowering with NAFTA, the EU and OE. ASEAN levels have at least twice as much share of GE under (14) than Indonesia. However, Indonesia appears better integrated and producing more under vertical structures, increasing MCB trade from $7.2 billion US in 1997 to $25.6 in 2012 and increasing common GE with ASEAN from US$ 3.9 to more than US$ 22 billion in 2012, more than five-fold growth.

Indonesia has a small dependency (11%) with foreign supplies, but signals possible low sophisticated exports. Malaysia 32%, Vietnam 22.6%, and Thailand 17.7%, who are more engaged in manufacturing, tend to have larger levels of VS.

While East Asia offers a larger market and a channel for indirect exports (11% of VA), it also creates dependency, competition and potential risk.

3.3 *Participation of Indonesia in vertical trade*

Indonesia significantly increased its participation in fragmented structures in value terms; however, not in share from its gross exports. Vertical structures in Indonesia are expanding at a slower speed than other countries. Even though the participation of Indonesia in other regions exports has increased in the last 15 years (from US$ 9.2 to US$ 44.7) there is no sign of supply chain development in the country.

4 CONCLUSION

This study looks at the process of liberalization-integration of Indonesia and at the role it plays in vertical structures. Indonesia is a strong supplier of intermediate goods (59%) rather than of final goods.

Indonesia has created a strong presence in Asia value chains, mainly East Asia and lowering trade with the EU and NAFTA.

Indonesia's participation in fragmented structures is increasing; however, it is still small (12% of GE) compared to other regions (ASEAN 35%). Its VA through re-exports is growing as well. Exports take mainly domestic VA, contrary to ASEAN high foreign VA. However, the larger GDP content in Indonesian exports does not necessarily mean better supply chain.

Finally, a fragmented production structure matters for Indonesian exports as it is helping to increase the value of exports; however, the participation is rather small. Indonesia is less dependent on vertical exports versus ASEAN.

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