



## DOMESTIC VALUE CREATION IN THE INVOLVEMENT IN GLOBAL VALUE CHAINS IN ASIAN ECONOMIES: ROLE OF SUPPORTING INDUSTRIES



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### ABSTRACT

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This article examines the structural changes in domestic value creation in exports in the involvement process of global value chains with a focus on eight Asian economies, through the quantitative analyses using the updated OECD value-added-trade data. The major research questions are: what is an average turning point in terms of per capita GDP in regaining domestic value added share to exports, and which industries, the export industry or supporting industries, have contributed to regaining domestic value added share to exports. The empirical analyses identified an accurate turning point at 2,032 US dollars as per capita GDP in regaining domestic value added share to exports, and also showed that the supporting industries including service sector, rather than the exporting industry itself, have played an active role to push up the domestic value added share to exports in the involvement process of global value chains. The two strategies, “enterprise clustering” and “linkages development”, facilitating technological transfers from international firms to local ones, contributed to the domestic value creation in the involvement process of global value chains.

**Contribution/ Originality:** The paper’s primary contribution is that the supporting industries including service sector, rather than the exporting industry itself, have played an active role to push up the domestic value added share to exports in the involvement process of global value chains.

## 1. INTRODUCTION

The global value chains (hereafter GVCs) have been a popular trends in global economic activities particularly in Asian area over the past two decades. According to UNCTAD (2013) the GVCs are characterized by the fragmentation of production processes and the international dispersion of tasks and activities among the economies with diversified development stages, which have led to the emergence of borderless production networks. The GVC trade is expressed as “importing to export,” or I2E, in reference to the argument of Baldwin and Lopez-Gonzalez (2013).

The GVCs are a concept used by different schools of economic theory, development studies and international business disciplines. From the perspective of economic analysis, Kimura (2006) described the GVCs in East Asia by using the terminology of “International Production and Distribution Networks”, and by extracting eighteen stylized facts common to such networks based on a number of studies using international trade data, micro-data of

Japanese multinational-enterprises, and casual observations. The theoretical message in Kimura (2006) is that the mechanics of such networks in East Asia must basically follow “fragmentation theory”, which was initially proposed by Jones and Kierzkowski (2005). It stated that a firm’s decision on whether to fragment production processes or not depends on the differences in location advantages (e.g. the differences in factor prices like wages) and the levels of the “service-link costs”, which are costs to link remotely-located production blocks (e.g. costs of transportation, telecommunication and coordination). The larger differences in location advantages and the lower service-link costs encourage firms to facilitate the fragmentation. In this context, Asian economies seem to have the greatest momentum and potential for the GVCs to spread over the region, since they include a variety of economies with different factor prices under different development stages and their public sectors have made policy efforts to reduce the service-link costs through infrastructure development.

The question then arises as to whether developing and emerging market economies, especially latecomers’ economies in Asia, can really achieve sustainable economic growth by participating in and being involved in the GVCs, in other words, whether the GVCs can accelerate the catch-up of latecomers’ economies and can lead to greater convergence among the economies with diversified development stages in Asia. UNCTAD (2013) argued that although the GVCs can make a contribution to economic development through direct GDP and employment gains and by providing opportunities for industrial upgrading, these benefits are not automatic and there are risks involved in the GVC participation; and so public policies are needed to optimize the economic contributions of the GVC participation and involvement.

The following point should be considered when the economic contributions of the GVCs are discussed. At the initial stage of the GVC participation, an underdeveloped economy usually accepts labor-intensive industries and labor-intensive production processes such as assembling activities due to its lower labor costs. It is true that the GVC participation itself creates job opportunities and domestic value added in the host economy, but the dependence only on labor-intensive manufacturing activities does not necessarily guarantee sustainable development of the country-wide economy and industrial upgrading for the following senses.

First, the manufacturing and assembling processes are identified as the low end of the value chain producing the lower value added along with so-called “smile curve”. Shih (1996) and subsequent case studies of individual firms have described a “smile” shaped curve with a vertical axis for value added and a horizontal axis for value chain processes, suggesting that the middle part of the value chain (manufacturing and assembling) creates lower value added than both ends of the value chain (concept/R&D, and sales/after service). Following this argument, accepting only labor-intensive manufacturing activities in the GVCs would produce less value added in an economy.

Second, the continuous dependence on labor-intensive manufacturing in the GVCs participation would lead to the “diminish returns” from the production and a slowdown in the economic growth. As Gill and Kharas (2007) argued in the context of “middle income trap”, the growth based on factor accumulation is likely to deliver steadily worse results, which is a natural occurrence as the marginal productivity of factor inputs declines. To avoid the trap, an economy needs to transform its growth pattern from factor-driven growth to productivity-driven one through industrial upgrading. In the context of the involvement in GVCs, while an economy accepts foreign investors in terms of manufacturing activities, it should upgrade its domestic productive capacities including supporting industries by obtaining the technological transfers from foreign investors.

This article aims to examine the structural changes in domestic value creation in exports in the GVC involvement process with a focus on Asian economies, through the quantitative analyses using the OECD value-added-trade data<sup>1</sup>. The major research questions are:

1. What is an average turning point in terms of per capita GDP in regaining domestic value added share to exports.

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<sup>1</sup> See the website of OECD Stat.: <https://stats.oecd.org/>.

2. Which industries, (the export industry or supporting industries), have contributed to regaining domestic value added share to exports.

The value-added-trade data has been developed recently by several international organizations and the database enables us to identify the contributions of domestic and foreign value added embedded in gross exports, and also the contributions of direct domestic value added by the export industry and indirect one by supporting industries.

The rest of the paper is structured as follows. Section 2 reviews previous studies on the economic impacts of GVCs in Asian countries and clarifies this study's contributions. Section 3 presents the empirical evidence on the domestic value creation in exports in the GVC involvement process with a focus on Asian economies. Section 4 summarizes and concludes.

## 2. LITERATURE REVIEW AND THIS STUDY'S CONTRIBUTION

There has been a plenty of literature on the "firm and industry level" analyses of GVC impacts through case studies. In the field of traditional industries, some upgrading effects have been identified in the context of GVCs.

Nadvi *et al.* (2004) traced how Vietnamese garment and textile firms are inserted into global garment and textile value chains, and examined how the nature of insertion into global value chains leads to favorable gains for state owned and private enterprises, and for textile and garment workers. Frederick and Gereffi (2011) argued that apparel exporters in China and Asia have outperformed those in Mexico and Central America due to market diversification by joining the GVCs. Rasiah (2011) examined the moving-up case of button manufacturing in Qiaotou-city cluster in China in the context of joining GVCs. Zheng and Sheng (2006) showed a case study of the Yunhe wood toy cluster in Zhejiang in China, in which the GVCs has provided external channels of knowledge and learning opportunities for local firms.

As for more sophisticated industries such as the commonly-cited items of the Apple iPod and iPhone, most of the previous studies have showed that the GVC participation has limited effects on industrial upgrading. Backer (2011); Linden *et al.* (2009); Xing and Detert (2010) for instance, argued that the products are designed and conceived in developed countries and manufactured in emerging countries like China with inputs sourced from other third countries; thus manufacturing/ assembly constitutes only a small part of the value added, which is a direct result of the offshoring of these activities to lower-cost countries; and so being integrated in the GVCs is a necessary but not a sufficient condition for capturing value within the GVCs.

Another category of the discussion on the GVC participation effect in the "firm and industry level" analyses is the "smile curve" hypothesis with a focus on the value creation in production processes involved in GVCs. As was stated in the introduction, the concept of the smile curve was initially proposed by Stan Shin, the founder of Acer. Shih (1996) argued that in the case of personal computer industry, both ends of the value chain (concept/R&D, and sales/after service) create higher value added to the product than the middle part of the value chain (manufacturing), by describing the shape of a smile with a vertical axis for value added and a horizontal axis for value chain.

This smile curve logic has been widely used mainly in case studies of individual firms. Baldwin *et al.* (2014) applied this smile-curve logic to an economy-wide analysis by using JETRO-IDE's Asian Input-Output Table with a focus on Asian economies, and verified the existence of the smile curve with a horizontal axis for the stages of industrial processes and a vertical axis for each stage's product value added. Ye *et al.* (2015) also applied this smile-curve concept to an industry-level analysis by using the World Input-Output Tables. Their analysis targeted exports of electrical and optical equipment from China and Mexico and exports of automobiles from Japan and Germany and identified the existence of the smile curve with a vertical axis for value added and a horizontal axis for a distance between producers and consumers along GVCs.

The literature on "country" level analyses of GVC economic impacts has, on the other hand, been scarce probably because such analytical instruments as value-added-trade have been just recently developed by several

international organizations. It was UNCTAD (2013) that addressed, for the first time, the country level analyses of GVC impacts in comprehensive angles by utilizing the UNCTAD-Eora value-added-trade data. Chapter IV of UNCTAD (2013) demonstrated the GVC economic impacts in terms of local-value capture, job creation, technology dissemination as direct effects as well as of upgrading and building long-term productive capabilities as indirect effects.

We therefore derive two major analytical outcomes related to the country-level contributions of domestic value added in GVC participation. First, a statistical analysis of GVC participation and per capita GDP growth rates showed their significant and positive relationship for both developed and developing economies, even while GVC participation requires higher imported contents.

Second, the combinations of GVC participation and domestic value added creation, derived from value added trade patterns of 125 developing countries over twenty years, suggested that there might be a distinct “GVC development path” in host countries participating GVCs; some economies have managed to regain the domestic value added share to exports, after its decline at the initial stage of GVC participation, through upgrading productive capacities within GVCs and by expanding them into higher-value chains, as in the Philippines, Malaysia and Thailand.

Taguchi (2014) applied the aforementioned county-level analyses of GVC effects in UNCTAD (2013) to Asian developing economies for the reason that Asia has been the area that has the greatest potential for GVCs to spread all over the area. In addition, Taguchi (2014) modified the analysis of “GVC development path” in a more sophisticated way by estimating a non-linear, quadratic curve in the relationship between domestic value added share to exports and development stage (per capita GDP) so that the regaining point of domestic value share to exports could be identified in the dynamic GVC involvement process. The analysis covered the samples of the discrete four years (1995, 2000, 2005 and 2008) for eight Asian economies on eight-categorized manufacturing sectors as well as total manufactures, based on the data available in the OECD value-added-trade data (OECD TiVA May 2013).

The findings of the study were summarized as follows. First, an economy’s participation in GVCs in manufacturing sectors allowed an absolute domestic value added for exports to contribute to pushing up GDP growth, which was consistent with the message above in UNCTAD (2013). Second, the GVC development path in terms of the combination between domestic value added share to exports and per capita GDP followed the non-linear “smile curve” (which will be explained in later section). Third, the turning points of smile curves differed according to manufacturing sectors: the sectors of machinery, electrical, and transport equipment reached the turning point at the higher per capita GDP than those of food, textile, and wood products.

This study contributed to the reviewed literature as follows. First, this study obtained a more accurate turning point in the smile curve between domestic value added share to exports and per capita GDP in Asian economies through the following ways. This study used the updated OECD value-added-trade data, i.e., OECD “Trade in Value Added (TiVA)” December 2016 and 2018. To be specific, this study sampled the annual data from 1995 to 2015 instead of the discrete sample of 1995, 2000, 2005 and 2008 in Taguchi (2014). What is more important is that this study adopted a dynamic panel estimation instead of a static panel one in terms of ordinary panel estimation. The data observation implied that there seems to be some inertia and hysteresis effect of domestic value added share to exports against per capita GDP, thereby justifying the application of a dynamic panel model. Another contribution was to provide a deep insight on the structural changes in domestic value creation in exports, by decomposing the domestic value creation into a direct effect by the export industry and an indirect effect by supporting industries. The decomposition made it possible to identify which industries, the export industry or supporting industries, have contributed to regaining domestic value added share to exports.

### 3. EMPIRICAL EVIDENCE

This section first illustrates the concept of the non-linear “smile curve” as the combination between domestic value added share to exports and per capita GDP presented by Taguchi (2014) and then provides empirical evidence on the structural changes in domestic value creation in exports in the GVC involvement process with a focus on Asian economies. The empirical study decomposes the domestic value creation into a direct effect by the export industry and an indirect effect by supporting industries, and identifies which industries, the export industry or supporting industries, have contributed to regaining domestic value added share to exports, through a dynamic panel analysis of the smile curve, a vector auto-regression (VAR) estimation for causality tests and a sectoral observation of the changes in decomposed domestic values in all sample economies.

#### 3.1. Concept of Smile Curve

Figure 1 illustrates the curve with a vertical axis for domestic value added share to exports and a horizontal axis for per capita GDP. At the stage before GVC participation, an economy has a high domestic value added share to exports, in which most of export goods are domestically produced by using its local resources. When an economy participates in GVCs, it faces a decline in domestic value added share to exports at its early stage, since an economy’s production for its exports has to depend highly on imports of parts, components and machineries from foreign countries due to the lack in their productive capacity. At the mature stage of GVC involvement, however, an economy regain and restore the higher domestic value added share to exports, since the dependence on imports of intermediate goods for exports declines due to the expansion of their domestic productive capacities through absorbing the technologies transferred from foreign investors.

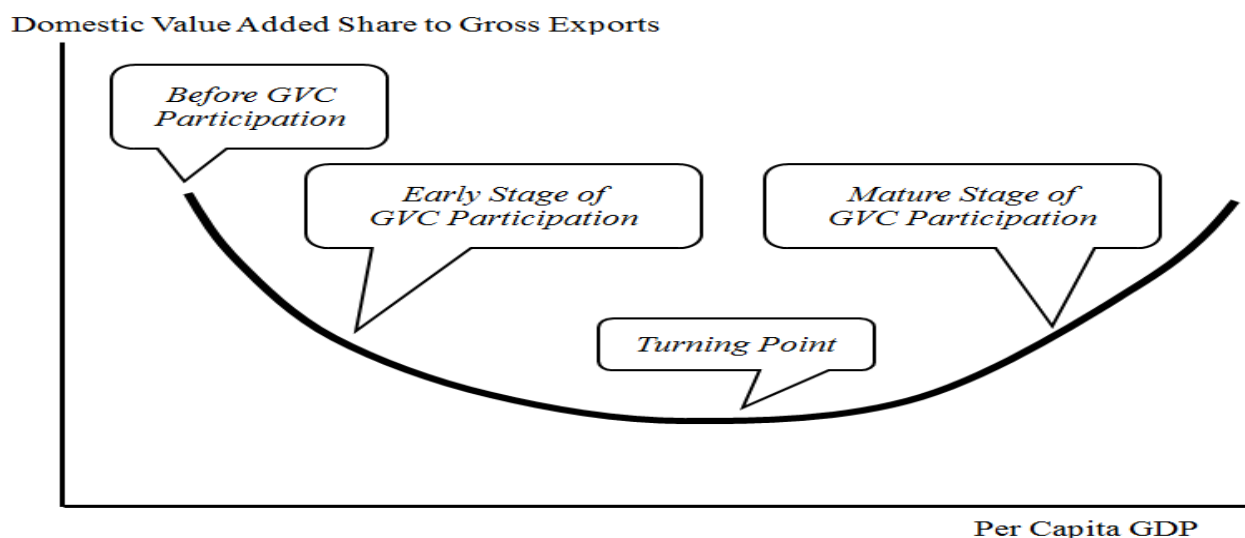


Figure-1. Concept of smile curve: A country example.

Source: Author’s description based on Taguchi (2014).

The domestic value added share to exports, therefore, follows not one-off moves but such a sequence of moves as high, low and high ones along with the economy’s development process, thereby creating the “smile curve” in the host country of GVCs.

The process of enhancing local productive capacities towards the mature stage of GVC involvement is supposed to involve several scenarios as follows. The initial step is that local firms and industries participate in the GVCs through local outsourcing by foreign investors so that they can generate additional domestic value added. The scenarios for regaining domestic value toward the mature stage would, however, differ according to the contributors to the domestic value creation. One scenario is that the exporting firms and industries themselves

would be a main contributor such that they attain industrial upgrading through technology dissemination and skill building.

Another scenario is that the supporting industries and firms could be a major contributor such that local industries and firms extend their activities to producing and supplying parts and components by obtaining technological transfers from the key exporting industries and foreign investors. In particular, the latter scenario could create significant momentum to transform local economic structures from “thin” industrialization towards “thick” industrialization. The subsequent analyses in the later sections will provide evidence on the major contributor through the decomposition of domestic value creation. It should also be noted, however, that the process of regaining domestic value is not necessarily automatic and deterministic, and its achievements differ according to the characteristic of the GVCs and the involved economies. In this context, government policies are needed to optimize the domestic value creation through the GVC participation and involvement.

### 3.2. Dynamic Panel Analysis of Smile Curve

For estimating the smile curve, the following variables were targeted for the estimation as in Taguchi (2014). One was “domestic value added as a share of gross exports (DVA)” in manufacturing sectors, representing domestic productive capacities to produce export goods. The DVA was further decomposed into a “direct” domestic value added content as a share of gross exports (DDC) and an “indirect” domestic value added content as a share of gross exports (IDC).<sup>2</sup> The DDC represented the domestic value creation by the export industry, while the IDC showed the one by the supporting industries, so that the origin of domestic value creation could be identified. The other key variable was “real per capita GDP (PCY)”, denoting the development stage of local economies. The data of DVA, DDC and IDC were retrieved from OECD value-added-trade data (OECD TiVA December 2016 and 2018), and those of PCY were retrieved from UNCTAD STAT’s series of “Gross domestic product per capita, US Dollars at constant prices (2010)”.

Regarding the sample data for estimation, the OECD value-added-trade data limited the sample period and countries as follows. The OECD TiVA December 2016 and 2018 sampled the annual time-series from 1995 to 2013 and from 2005 to 2015, respectively. This study combined these two time-series into the period from 1995 to 2015 by making level adjustments using the discrepancy between both of time-series data in 2005.<sup>4</sup> The sample countries focused on eight Asian economies available in the OECD data: Cambodia, China, India, Indonesia, Malaysia, the Philippines, Thailand and Vietnam. As for the sample sector, this subsection focused on total manufactures. Then the panel data were constructed with eight Asian countries for 1995–2015 on total manufactures for a dynamic panel estimation. All the data for DVA, DDC, IDC and PCY were converted into natural logarithm form for the estimation to avoid the heteroskedastic in the error terms.

As for the specification of estimation model, the study first investigated the association between DVA and PCY, and also the associations between DDC and PCY and between IDC and PCY. The associations were examined by a quadratic equation as well as a linear one, for the purpose of identifying the “smile curve”. For the estimation methodology, the study applied a dynamic panel model, since the observed data in Figure 2-1 implied that there seemed to be a “state-dependent” effect of domestic value added shares to exports (DVA, DDC and IDC) along with PCY. The model equation thus contained lagged dependent variables as regressors for materializing a partial

<sup>2</sup> The precise composition of the “domestic value added” is the “direct domestic value added content”, the “indirect domestic value added content” and the “re-imported domestic value added content”. Since the last one has a small share to gross exports, it is omitted in this study’s analysis.

<sup>3</sup> See the website: <http://unctadstat.unctad.org/EN/>.

<sup>4</sup> The OECD TiVA December 2018 revises that of 2016, for instance, by changing the benchmark statistics from the 1993 System of National Accounts to the 2008 one. See the website:

<https://www.oecd.org/industry/ind/tiva-2018-differences-tiva-2016.pdf>

adjustment.<sup>5</sup> The inclusion of lagged dependent variables as regressors required the application of Generalized Method of Moments (GMM) to obtain a consistent estimator. The GMM estimator eliminated country effects by first-differencing (as in Arellano and Bond (1991)) as well as controlled for possible endogeneity of explanatory variables. The first-differenced dependent variables with two lagged periods could be valid instruments provided there was no second-order autocorrelation in the error terms. The explanatory variable of PCY with one lagged period was also used as an instrumental variable, since PCY could be correlated with the error term. The estimation adopted the white period as the GMM weighting matrix, and conducted the test for autocorrelations and the Sargan-Hansen test on over-identifying restrictions. The test for autocorrelations computed the first and second order serial correlation statistics and the first order statistic was expected to be significant, while the second order one was expected to be insignificant. As for the Sargan-Hansen test, the p-value of the J-statistic was expected to be more than five percent to identify the validity of instrument variables.

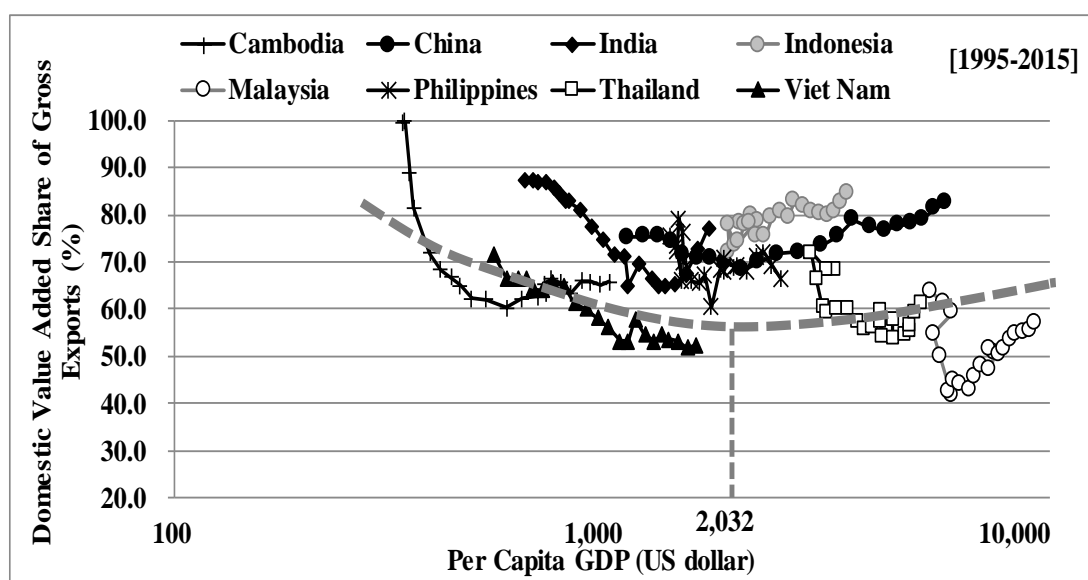


Figure-2.1. Domestic value added share to gross exports (DVA).

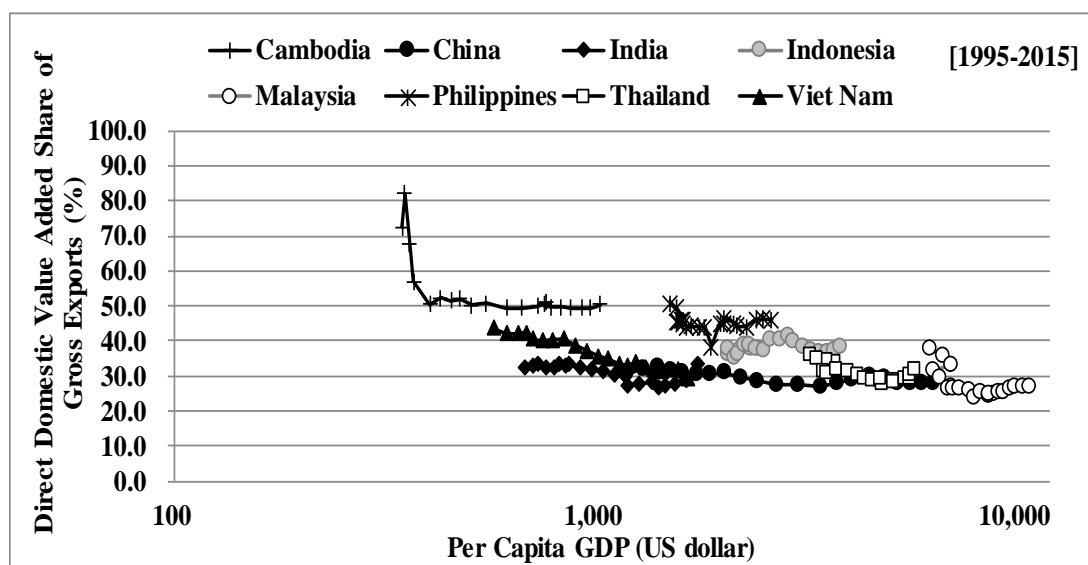


Figure-2.2. Direct domestic value added share to gross exports (DDC).

<sup>5</sup> This study includes two-year lagged dependent variables that show the best fit in estimation performance after the trial estimations by including one-year to three-year lagged dependent variables.

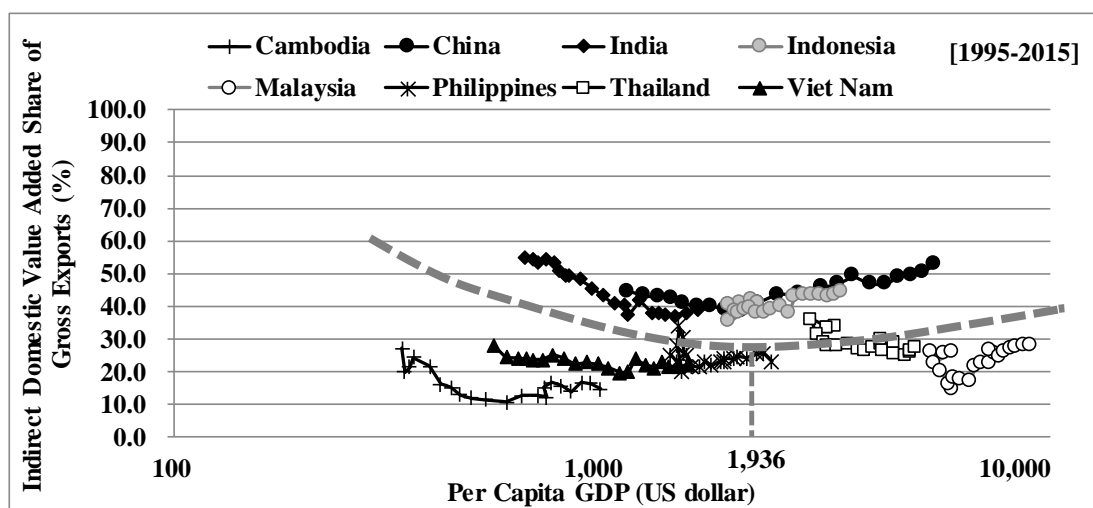


Figure-2.3. Indirect domestic value added share to gross exports (IDC).

Source: OECD value-added-trade data and UNCTAD STAT.

Table 1.1 and Figure 2-1 represent the estimation outcome of the smile curve on total domestic value creation (DVA) and on its direct (DDC) and indirect (IDC) value creations for total manufactures. Focusing on the case of DVA in Table 1.1 and Figure 2-1, it had a weakly (90 percent level) significant coefficient of PCY in a linear equation, but a conventionally significant (95 percent level) coefficients of PCY (negative) and a square of PCY (positive) in a quadratic equation with the turning point being a reasonable level of PCY, namely, 2,032 US dollars. The quadratic estimation of DVA also had the expected values of the p-value of the J-statistic and of the first and second order serial correlation statistics. As for the case of DDC in Table 1.2 and Figure 2-2, there were no significant coefficients of PCY and a square of PCY in linear and quadratic equations. Concerning the case of IDC in Table 1.3 and Figure 2-3, however, similar to the case of DVA, the valid estimation was found only in a quadratic specification, where the coefficients of PCY and a square of PCY had conventionally (95 percent level) significant values with the turning point being 1,936 US dollars (the p-value of the J-statistic was not fully satisfactory though the p-values of the first and second order serial correlation statistics were expected ones).

Table-1.1. Domestic value added share to gross exports (DVA).

Variables	DVA	DVA
PCY	0.026 *	-2.834 **
	(1.670)	(-2.381)
PCY <sup>2</sup>		0.186 **
		(2.449)
DVA-1	0.743 ***	0.499 ***
	(10.543)	(3.530)
DVA-2	0.047	-0.057
	(0.720)	(-0.907)
Turning point USD		2,032
Prob (J-statistic)	0.189	0.335
AR(1) Prob	0.000	0.003
AR(2) Prob	0.203	0.803
Sample size	152	152



Table-1.2. Direct domestic value added share to gross exports (DDC).

Variables	DDC	DDC
PCY	-0.020	-2.062
	(-0.658)	(-1.626)
PCY <sup>2</sup>		0.131
		(1.611)
DDC-1	0.741 ***	0.491 **
	(4.794)	(2.302)
DDC-2	-0.068	-0.106
	(-0.674)	(-0.969)
Turning Point USD		
Prob (J-statistic)	0.284	0.412
AR(1) Prob	0.000	0.006
AR(2) Prob	0.082	0.053
Sample size	144	144

Table-1.3. Indirect domestic value added share to gross exports (IDC).

Variables	IDC	IDC
PCY	0.017	-6.293 ***
	(0.388)	(-7.062)
PCY <sup>2</sup>		0.415 ***
		(6.551)
IDC-1	0.612 ***	0.425 ***
	(6.676)	(4.248)
IDC-2	0.025	-0.176 *
	(0.226)	(-1.926)
Turning point USD		1,936
Prob (J-statistic)	0.001	0.023
AR(1) Prob	0.000	0.000
AR(2) Prob	0.000	0.571
Sample size	144	144

**Note:** DVA, DDC and IDC denote domestic value added content, direct one and indirect one as a share of gross exports respectively, and PCY denotes per capita real GDP. \*, \*\* and \*\*\* denote the rejection of null hypothesis at the 90, 95 and 99% level of significance. T-statistic is in parentheses attached in the coefficients. J-statistic and its probability represent the results of the Sargan-Hansen test of over-identifying restrictions. AR (k) probability shows the p-value of a test that the average auto-covariance in residuals of order k is zero.

**Source:** Author's estimation based on OECD value-added-trade data and UNCTAD STAT

In sum, the estimation outcome showed us that the non-linear smile curve could be identified in the cases of total domestic value creation (DVA) and indirect domestic value creation (IDC). Figure 2-1 also shows that the smile curve of IDC was synchronizing with that of DVA, and reached a turning point a bit earlier than that of DVA. These results thus imply that the movement of total domestic value creation in exports originates from that from the supporting industries.

Another observation from the perspective of individual country's position in the smile curves of DVA and IDC in Figure 2-1 was that such forerunners as Malaysia, China, Thailand, Indonesia and Philippines are already passing the turning point by regaining domestic value creation, whereas such latecomers as Cambodia, Vietnam and India are still at the declining phase of domestic value creation.

The serious question then arises on how to nurture local productive capacities in manufacturing sectors in the context of the GVCs involvement in order to pass the turning point. UNCTAD (2013) proposed the following key strategies as well as such general policies as workforce skills development, for building up domestic productive capacities of developing economies: "enterprise clustering" and "linkages development".

The enterprise clustering enables the local small and medium-sized enterprises (SMEs) to enjoy "collective efficiency" to enhance their productivity with clustered firms. The linkage development provides the local SMEs with the necessary externalities for successful participation in GVCs as first, second, or third-tier suppliers. These

two strategies in line with the GVCs involvement facilitate technological transfers from international firms to local ones, thereby contributing to enhancing the local productive capacities even in sophisticated manufacturing sectors.

### 3.3. VAR Estimation for Causality Test

This subsection further investigated the statistical relationship among total domestic value creation in exports (DVA), its direct value creation by the export industry (DDC) and its indirect value creation by the supporting industries (IDC), for the same sample as the one of the previous analysis in 3.2, namely, total manufactures in the eight Asian economies for 1995-2015. To be specific, the study conducted Granger-causality tests for the combination between DVA and DDC and for the one between DVA and IDC under VAR model estimations. The reason why the study adopted a VAR model was that it allowed for potential endogeneity among the interrelated variables of DVA, DDC and IDC, and let the data determine their causalities in the Granger sense. The estimation took one-year lag length, following the Schwarz Information Criterion with maximum lag being equal to two year lags under the limited number of observations.

Table 2.1 reports the estimation outcome of the VAR model Table 2.1 and Table 2.2 and the Granger causality tests Table 2.3. Regarding the combination between DVA and DDC, the causality from DDC to DVA was shown at a conventionally significant level of 99 %. The direction of causality from DDC to DVA was, however, negative as the estimated VAR model in Table 2.1 indicates. As for the combination between DVA and IDC, the clear causality from IDC to DVA was identified at the conventionally significant level of 99 %, and its direction was positive judging from the estimated model in Table 2.2. The causality from DVA to IDC was, on the other hand, negatively significant.

The estimation outcome thus suggested that it was the indirect domestic value creation by the supporting industries (IDC), but not the direct one (DDC) by the export industry, that positively affected the total domestic value creation in exports (DVA) in the Granger-causality sense. The negative causality from DDC to DVA could be interpreted such that the direct domestic value creation by the export industry should induce an increase in foreign value added in terms of the imports of necessary materials, parts and components for exports, thereby reducing the total domestic value share to exports finally.

**Table-2.1. Domestic value added (DVA) and its direct content (DDC).**

	DDC	DVA
DDC-1	0.936 *** [-49.150]	-0.077 *** [-2.957]
DVA-1	0.001 [0.110]	0.971 *** [43.607]
C	1.860 * [1.809]	4.271 *** [3.014]
adj. R <sup>2</sup>	0.948	0.932

**Table-2.2. Domestic value added (DVA) and its indirect content (IDC).**

	IDC	DVA
IDC-1	1.015 *** [50.187]	0.077 *** [2.887]
DVA-1	-0.045 ** [-2.267]	0.893 *** [33.609]
C	2.428 ** [2.258]	4.305 *** [3.025]
adj. R <sup>2</sup>	0.962	0.932

Table-2.3. Granger causality tests.

Null Hypothesis	Lags	F-Statistic
DDC does not Granger cause DVA	1	8.749 *** (negative)
DVA does not Granger cause DDC	1	0.012
IDC does not Granger cause DVA	1	8.337 ***
DVA does not Granger cause IDC	1	5.140 ** (negative)

Note: DVA, DDC and IDC denote domestic value added content, direct one and indirect one as a share of gross exports respectively, and PCY denotes per capita real GDP. \*\*\*, \*\*, \* denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance. T-statistic is in parentheses attached in the coefficients.

Source: Author's estimation based on OECD value-added-trade data and UNCTAD STAT.

### 3.4. Sectoral Observation of Decomposed Domestic Value Creation

This subsection observes the changes in the decomposed domestic value creations in exports of DVA (total domestic value added share to exports), DDC (direct domestic value added share to exports) and IDC (indirect domestic value added share to exports) in more details, by the eight manufacturing sectors in all sample economies, focusing on the period between 2005 and 2015.

The OECD value-added-trade data classified the industries into the following eight categories: “Food products, beverages and tobacco (hereafter food products)”, “Textiles, wearing apparel, leather and related products (textile products)”, “Wood and paper products, printing (wood products)”, “Chemicals and non-metallic mineral products (chemical products)”, “Basic metals and fabricated metal products (metal products)”, “Computers, electronic and electrical equipment (electrical equipment)”, “Machinery and equipment, nec (machinery)” and “Transport equipment”. The first year of 2005 and the last year of 2015 in the observation corresponded to the first and last year of the newly-estimated OECD TiVA database (December 2018), where the recent progress in domestic value creation in exports in Asian economies could be covered.

Table 3-1 plots the cases of the increase in the domestic value added share to exports from 2005 to 2015 by each sample economy and by each manufacturing sector in each category of DVA Table 3-1, DDC Table 3-2 and IDC Table 3.3. Table 3.3 in the category of IDC shows the increase in value added share by dividing the supporting industries into service sector and non-service sector.<sup>6</sup>

The main observations were as follows. First, the cases of the increase in DVA were accompanied with more of the cases of the increase in IDC than in DDC. Second, even the cases without the increase in DVA had many of the cases of the increase particularly in IDC. Third, the service sector as well as no-service sector contributed to the increase in IDC.

Table-3.1. Domestic Value Added Share to Gross Exports (DVA).

	Cambodia	Vietnam	India	Philippines	Indonesia	Thailand	China	Malaysia
Food	+				+	+	+	+
Textile	+			+	+	+	+	+
Wood	+			+	+	+	+	+
Chemical	+	+		+	+	+	+	+
Metal	+	+		+	+	+	+	
Electrical	+			+	+	+	+	+
Machinery	+			+	+	+	+	+
Transport	+			+	+		+	+

<sup>6</sup> The service sector here is retrieved from “Total Services including Construction activities (code: C45T95)” in the OECD value-added-trade data. The value added share of the non-service sector is calculated by subtracting that of the service sector from that of IDC (total supporting industries), and thus the non-service sector contains the primary sectors such as agriculture and mining and the manufacturing sectors other than the exporting sector.

**Table-3.2.** Direct domestic value added share to gross exports (DDC).

	Cambodia	Vietnam	India	Philippines	Indonesia	Thailand	China	Malaysia
Food	+			+			+	
Textile	+		+	+		+	+	+
Wood			+	+		+	+	
Chemical	+		+	+	+	+		
Metal	+			+	+	+		
Electrical			+	+		+	+	+
Machinery				+		+		+
Transport	+		+	+	+	+	+	

**Table-3.3.** Indirect domestic value added share to gross exports (IDC).

	Cambodia	Vietnam	India	Philippines	Indonesia	Thailand	China	Malaysia
Food	+n	+s	+s	+s	+n +s	+n	+s	+n +s
Textile	+n +s	+n +s	+s	+s	+s	+s	+s	+s
Wood	+s	+n +s	+s	+s	+n +s	+n	+s	+n +s
Chemical	+n +s	+n +s	+s	+s	+n +s	+s	+s	+n +s
Metal	+n	+n +s	+s	+s	+n +s	+n +s	+s	+s
Electrical	+n +s		+s	+n +s			+n +s	+n +s
Machinery	+n +s		+s	+n +s	+n +s		+n +s	+n +s
Transport	+n +s		+s	+s	+n +s		+s	+n +s

**Note:** DVA, DDC and IDC denote domestic value added content, direct one and indirect one as a share of gross exports respectively. The s and n mean service sector and non-service sector. "+" represents an increase in the respective value shares from 2005 to 2015.

**Source:** OECD value-added-trade data.

The observations above, in all, suggested that the supporting industries including service sector, rather than the exporting industry itself, have played an active role to push up the domestic value added in exports totally. The service sector defined in the OECD value-added-trade data includes such public services as transportation, telecommunication, real estate, research and development (R&D), education, health and the other social work. Thus, the greater contribution of the service sector to domestic value creation in exports seemed to be linked with the progress in infrastructure development in Asian emerging market economies. The impact of the service sector on domestic value creation should, however, be further investigated by future research such as case studies, in order to identify the most influential public service provided by central and local governments.

#### 4. CONCLUDING REMARKS

This article examined the structural changes in domestic value creation in exports in the GVC involvement process with a focus on eight Asian economies, through the quantitative analyses using the updated OECD value-added-trade data. The major research questions were: what is an average turning point in terms of per capita GDP in regaining domestic value added share to exports, and which industries, the export industry or supporting industries, have contributed to regaining domestic value added share to exports.

The major findings from the empirical analyses were as follows.

First, the dynamic panel analysis identified the non-linear smile curves in the combination between total domestic value added share to exports (DVA) and real per capita GDP with the turning point being 2,032 US dollars, and in the combination between the "indirect" domestic value added share to exports (IDC) and real per capita GDP with the turning point being 1,936 US dollars. There appeared to be a synchronization between the DVA smile curve and IDC smile curve, which implies that the domestic value movement in exports originates from the one from the supporting industries.

Second, the vector auto-regression (VAR) estimation verified the clear positive causality from IDC to DVA. Third, the sectoral observation of the decomposed domestic value creation in all the sample economies for 2005-2015 showed that the DVA increases were accompanied with more cases of the increase in IDC by the supporting industries including the service sector than the increase in DDC by the exporting industry.

To sum up, the empirical analyses using the dynamic panel analysis, the VAR estimation for causality tests and the sectoral observation of the decomposed domestic value creations in all the sample economies identified an accurate turning point at 2,032 US dollars as per capita GDP in regaining domestic value added share to exports, and also showed that the supporting industries including the service sector, rather than the exporting industry itself, have played an active role to push up the domestic value added share to exports in the GVC involvement process.

The strategic implication of this study was the significance of the supporting industries to create domestic values for exports. The involvement of local firms and industries in the supporting industries as first, second and third-tier suppliers would require the government to create clear strategies for “enterprise clustering” and “linkages development to facilitate technological transfers from foreign investors, as was mentioned in Section 3.2. At the same time, in order to reinforce service industries to support export-oriented manufacturing, the government is also expected to promote infrastructure development in the areas of transportation, telecommunication, education, and so on.

The remaining issue in this study could be to explore the theoretical underpinnings for justifying the hypothesized “smile curve”. This study focuses mainly on empirical analyses for verifying the smile curve. However, to identify the theoretical mechanism for an economy to regain the domestic value creation for exports would also be important in order for the government to recognize the necessary conditions for reaching and fastening the turning point in the smile curve.

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Appendix: Changes in domestic value added share to exports for 2005-2015.

Total Manufactures	Cambodia	Vietnam	India	Philippines
Domestic value added	4.8	-6.5	-2.0	2.0
Direct value added by exporting industry	0.9	-6.3	2.0	2.0
Indirect value added by supporting industries	3.9	-0.1	-4.1	0.0
Non-services (primary & manufacturing)	2.3	-0.2	-4.8	-0.9
Services	1.6	0.1	0.7	0.9
Food products	Cambodia	Vietnam	India	Philippines
Domestic value added	12.9	-3.5	-1.2	-0.9
Direct value added by exporting industry	0.1	-3.5	-3.2	0.5
Indirect value added by supporting industries	12.9	0.1	2.0	-1.4
Non-services (primary & manufacturing)	14.4	-0.2	-0.8	-2.9
Services	-1.6	0.3	2.7	1.5
Textile products	Cambodia	Vietnam	India	Philippines
Domestic value added	6.3	-4.6	-1.1	1.4
Direct value added by exporting industry	3.6	-8.5	1.1	0.3
Indirect value added by supporting industries	2.7	3.8	-2.2	1.1
Non-services (primary & manufacturing)	0.3	3.0	-3.7	-0.5
Services	2.4	0.8	1.5	1.6
Wood products	Cambodia	Vietnam	India	Philippines
Domestic value added	0.0	-2.7	-2.6	1.5
Direct value added by exporting industry	-1.4	-5.9	1.7	4.4
Indirect value added by supporting industries	1.4	3.3	-4.4	-2.8
Non-services (primary & manufacturing)	-0.4	2.6	-6.7	-3.4
Services	1.8	0.6	2.3	0.5
Chemical products	Cambodia	Vietnam	India	Philippines
Domestic value added	6.2	1.0	-0.1	2.2
Direct value added by exporting industry	0.3	-7.2	6.3	2.0
Indirect value added by supporting industries	5.9	8.3	-6.5	0.1
Non-services (primary & manufacturing)	4.1	6.8	-6.8	-1.5
Services	1.8	1.5	0.3	1.7
Metal products	Cambodia	Vietnam	India	Philippines

Domestic value added	1.2	1.6	-3.6	3.0
Direct value added by exporting industry	0.8	-6.1	-2.0	5.8
Indirect value added by supporting industries	0.4	7.7	-1.6	-2.8
Non-services (primay & manufacturing)	0.9	6.4	-3.0	-3.8
Services	-0.5	1.3	1.4	0.9
Electrical equipment	Cambodia	Vietnam	India	Philippines
Domestic value added	2.3	-14.1	-1.6	5.6
Direct value added by exporting industry	-4.0	-7.9	3.7	3.0
Indirect value added by supporting industries	6.3	-6.2	-5.4	2.6
Non-services (primay & manufacturing)	3.4	-4.8	-5.4	0.7
Services	2.9	-1.4	0.0	1.8
Machinery	Cambodia	Vietnam	India	Philippines
Domestic value added	3.4	-7.3	-3.4	2.5
Direct value added by exporting industry	-0.3	-3.6	-0.6	0.0
Indirect value added by supporting industries	3.6	-3.7	-2.8	2.5
Non-services (primay & manufacturing)	2.2	-3.5	-3.7	1.3
Services	1.4	-0.2	0.9	1.2
Transport equipment	Cambodia	Vietnam	India	Philippines
Domestic value added	2.3	-6.5	-1.0	1.5
Direct value added by exporting industry	0.5	-1.5	3.3	2.3
Indirect value added by supporting industries	1.8	-5.0	-4.3	-0.8
Non-services (primay & manufacturing)	0.7	-4.2	-4.9	-1.7
Services	1.1	-0.8	0.6	0.8

Total Manufactures	Indonesia	Thailand	China	Malaysia
Domestic value added	7.0	3.9	9.7	9.6
Direct value added by exporting industry	0.8	3.0	0.3	3.2
Indirect value added by supporting industries	6.1	1.0	9.2	6.5
Non-services (primay & manufacturing)	4.9	1.6	-0.6	4.8
Services	1.3	-0.6	9.8	1.7
Food products	Indonesia	Thailand	China	Malaysia
Domestic value added	3.9	4.1	1.8	1.5
Direct value added by exporting industry	-3.1	-1.8	1.8	-2.6
Indirect value added by supporting industries	6.9	5.9	0.0	4.1
Non-services (primay & manufacturing)	6.7	7.4	-7.0	1.9
Services	0.3	-1.5	7.0	2.2
Textile products	Indonesia	Thailand	China	Malaysia
Domestic value added	0.1	5.3	7.3	2.6
Direct value added by exporting industry	-0.1	5.7	3.7	1.2
Indirect value added by supporting industries	0.1	-0.4	3.5	1.4
Non-services (primay & manufacturing)	-2.1	-1.5	-5.3	-0.2
Services	2.2	1.0	8.8	1.7
Wood products	Indonesia	Thailand	China	Malaysia
Domestic value added	4.6	2.0	6.3	0.8
Direct value added by exporting industry	-5.9	0.3	0.6	-3.0
Indirect value added by supporting industries	10.4	1.7	5.6	3.8
Non-services (primay & manufacturing)	7.8	2.7	-4.3	2.2
Services	2.6	-1.0	9.9	1.7
Chemical products	Indonesia	Thailand	China	Malaysia
Domestic value added	5.4	1.0	8.2	2.0
Direct value added by exporting industry	0.8	1.4	-0.5	-1.9
Indirect value added by supporting industries	4.5	-0.4	8.7	3.9

Non-services (primary & manufacturing)	1.7	-0.9	-1.6	3.4
Services	2.8	0.5	10.2	0.6
Metal products	Indonesia	Thailand	China	Malaysia
Domestic value added	5.6	3.4	7.4	-2.1
Direct value added by exporting industry	-3.9	0.8	-2.2	-1.7
Indirect value added by supporting industries	9.5	2.6	9.5	-0.3
Non-services (primary & manufacturing)	6.7	2.1	-1.8	-0.6
Services	2.9	0.6	11.3	0.3
Electrical equipment	Indonesia	Thailand	China	Malaysia
Domestic value added	5.2	6.4	13.1	9.9
Direct value added by exporting industry	11.0	8.6	0.1	6.6
Indirect value added by supporting industries	-5.8	-2.1	12.5	3.4
Non-services (primary & manufacturing)	-3.3	-0.8	2.5	1.5
Services	-2.4	-1.3	10.0	1.9
Machinery	Indonesia	Thailand	China	Malaysia
Domestic value added	16.8	-1.1	8.9	6.8
Direct value added by exporting industry	-3.5	0.6	-3.2	6.6
Indirect value added by supporting industries	20.3	-1.7	12.1	0.3
Non-services (primary & manufacturing)	14.9	-1.1	0.9	0.1
Services	5.4	-0.5	11.2	0.1
Transport equipment	Indonesia	Thailand	China	Malaysia
Domestic value added	8.1	2.8	7.3	4.0
Direct value added by exporting industry	7.4	4.0	0.1	-2.2
Indirect value added by supporting industries	0.7	-1.2	7.1	6.2
Non-services (primary & manufacturing)	0.0	-0.8	-1.9	4.3
Services	0.7	-0.4	9.0	1.9

Source: OECD value-added-trade data.

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