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Abstract

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 using the dynamic panel analysis, the vector auto-regression estimation for causality tests and the sectoral observation of the decomposed domestic value creations in all the sample economies could identify an accurate turning point at 2,270 US dollars as per capita GDP in regaining domestic value added share to exports, and could also show 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.

Keyword: Domestic value creation, Global value chains, Asian economies, Value-added-trade data, Supporting industries
JEL Classification Codes: F14, L60, O53

1. Introduction

The global value chains (hereafter GVCs) have been one of the popular trends in global economic activities particularly in Asian area over the past two decades. According to UNCTAD (2013)[1], namely, the World Investment Report 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. World Bank (2016) expressed the GVC trade as "importing to export," or I2E, by referring to the argument of Baldwin and Lopez-Gonzalez (2013).

The GVCs are a concept taken up 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 18 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 (1990, 2005). It states 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 its area, since they include a variety of economies with different factor prices under different development stages and its 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 latecomer's 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.

[1] The World Investment Report is published by the United Nations Conference on Trade and Development (UNCTAD). See the website below:
http://unctad.org/en/pages/DIAE/World%20Investment%20Report/WIR-Series.aspx.

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 matter to optimize the economic contributions of the GVC participation and involvement

The following point should be taken into account 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 not necessarily guarantees 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". Shin (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 (OECD TiVA December

2016)[2]. 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 value-added-trade data have 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 represents 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

This section reviews previous studies on the economic impacts of GVCs in Asian countries, and clarifies 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. Picking up some examples, 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 Chine and Asia have outperformed those in Mexico and Central America due to market diversification by joining the GVCs. Rasiah (2011) picked up 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 sophisticate industries such as commonly-cited items of the Apple iPod and iPhone, most of previous studies have presented that the GVC participation has limited effects on industrial upgrading. Backer (2011), Linden et al. (2009), Xing and

[2] See the website of OECD Stat.: https://stats.oecd.org/.

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. Shin (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. Ye, et al. (2015) applied this concept to an industry-level analysis by using the World Input-Output Tables for 1995-2011. 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 herein pick up 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 20 years, suggested that there might be a set of 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" into more sophisticated way such as 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 contributes to the reviewed literature as follows. First, this study obtains 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 uses the updated OECD value-added-trade data, i.e., OECD TiVA December 2016. To be specific, this study samples the annual data from 1995 to 2014 instead of the discrete sample of 1995, 2000, 2005 and 2008 in Taguchi (2014). What is more important is that this study adopts a dynamic panel estimation instead of a static panel one in terms of ordinary panel estimation. The data observation implies 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 is 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 makes 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

This subsection describes the concept of the "smile curve" as the combination between domestic value added share to exports and per capita GDP presented by Taguchi (2014). The smile curve represents a dynamic evolution process of domestic value creation in exports for a host country who participates in GVCs along with its development stage.

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.

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 a number of 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. The other 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 be a significant momentum to transform local economic structures from "thin" industrialization towards "thick" industrialization. The subsequent analyses in the later sections will try to 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 matter to optimize the domestic value creation through the GVC participation and involvement.

3.2 Dynamic Panel Analysis of Smile Curve

This subsection conducts a dynamic panel analysis of the smile curve in Asian economies. For estimating the smile curve, the following variables are targeted for the estimation as in Taguchi (2014). One is "domestic value added as a share of gross exports (DVA)" in manufacturing sectors, representing domestic productive capacities to produce export goods. The DVA is 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).[3] The DDC represents the domestic value creation by the export industry, while the IDC shows the one by the supporting industries, so that the

[3] 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.

origin of domestic value creation could be identified. The other key variable is "real per capita GDP (PCY)", denoting the development stage of local economies. The data of DVA, DDC and IDC are retrieved from OECD value-added-trade data (OECD TiVA December 2016), and those of PCY are from UNCTAD STAT[4] by the 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 confine the sample period and countries as follows. The data are divided into the series of "Trade in Value Added (TiVA) – December 2016" for 1995-2011, and those of "TiVA Nowcast Estimate" for 2012-2014. The sample period should thus be for 1995-2014 by combining these two series. The sample countries focus 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 focuses on total manufactures. Then the panel data are constructed with eight Asian countries for 1995-2014 on total manufactures for a dynamic panel estimation. All the data for DVA, DDC, IDC and PCY are 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 investigates the association between DVA and PCY, and also the associations between DDC and PCY and between IDC and PCY. The associations are 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 applies a dynamic panel model, since the observed data in Figure 2 implies that there seem to be a "state-dependent" effect of domestic value added shares to exports (DVA, DDC and IDC) along with PCY. The model equation thus contains lagged dependent variables as regressors for materializing a partial adjustment.[5] The inclusion of lagged dependent variables as regressors requires the application of Generalized Method of Moments (GMM) to obtain a consistent estimator. The GMM estimator eliminates country effects by first-differencing (as in Arellano and Bond, 1991) as well as controls for possible endogeneity of explanatory variables. The first-differenced dependent variables with two lagged periods could be valid instruments provided there is 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 adopts the white period as

[4] See the website: http://unctadstat.unctad.org/EN/.

[5] 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.

the GMM weighting matrix, and conducts the test for autocorrelations and the Sargan-Hansen test on over-identifying restrictions. The test for autocorrelations compute the first and second order serial correlation statistics and the first order statistic is expected to be significant, while the second order one is expected to be insignificant. As for the Sargan-Hansen test, the p-value of the J-statistic is expected to be more than five percent to identify the validity of instrument variables.

Table 1 and Figure 2 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, it has an insignificant coefficient of PCY in a linear equation, but significant 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, 2,270 US dollars. The quadratic estimation of DVA also has expected values of the p-value of the J-statistic and of the first and second order serial correlation statistics (although the first order statistic is weakly significant). As for the case of DDC, there are no significant coefficients of PCY and a square of PCY and no expected values of the p-value of the J-statistic in linear and quadratic equations. Concerning the case of IDC, however, similar to the case of DVA, the valid estimation is found only in in a quadratic specification, where the coefficients of PCY and a square of PCY have significant values with the turning point being 1,862 US dollars, and all the GMM statistics have expected values.

In sum, the estimation outcome tells 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 also shows that the smile curve of IDC is synchronizing with that of DVA, and reaches 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 is 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 staying at the declining phase of domestic value creation.

3.3 VAR Estimation for Causality Test

This subsection further investigates 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 1995-2014. To be specific, the study conducts 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 adopts a VAR model is that it allows for potential endogeneity among the interrelated variables of DVA, DDC and IDC, and lets the data determine their causalities in the Granger sense. The estimation takes 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 reports the estimation outcome of the VAR model (Table 2-1 and 2-2) and the Granger causality tests (Table 2-3). Regarding the combination between DVA and DDC, the causalities from DDC to DVA as well as from DVA to DDC are shown at weakly significant level of 90 %. The direction of causality from DDC to DVA is, however, negative, as far 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 is identified at the conventionally significant level of 95 %, and its direction is positive judging from the estimated model in Table 2-2. The causality from IDC to DVA is, on the other hand, insignificant.

The estimation outcome thus suggests that it is the indirect domestic value creation by the supporting industries (IDC), but not the direct one (DDC) by the export industry, that positively affects the total domestic value creation in exports (DVA) in the Granger-causality sense. The weakly 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.

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 2000 and 2014. The OECD value-added-trade data classifies the manufactures into the following eight categories: “Food products, beverages and tobacco (hereafter food products)”, “Textiles, textile products, leather and footwear (textile products)”, “Wood, paper, paper products, printing and publishing (wood products)”,

"Chemicals and non-metallic mineral products (chemical products)", "Basic metals and fabricated metal products (metal products)", "Machinery and equipment, nec (machinery)", "Electrical and optical equipment (electrical equipment)" and "Transport equipment". The reason why the observed period focuses on the one between 2000 and 2014 is that the times of the Asian financial crisis around 1997-1999 should be excluded to remove the data fluctuation and the observation should be targeted to the recent progress in domestic value creation in exports in Asian economies.

Table 3 plots the cases of the increase in the domestic value added share to exports from 2000 to 2014 by each sample economy and by each manufacturing sector in each category of DVA, DDC and IDC. Table 3-3 in the category of IDC shows the increase in value added share by diving the supporting industries into service sector and non-service sector.[6] The main observations are as follows. First, the higher per capita GDP the economies have (such as Malaysia and China)[7], the more cases of the increase in value added share they roughly tend to have in each category of DVA, DDC and IDC. Second, the cases of the increase in DVA accompany more of the cases of the increase in IDC than in DDC. Third, even the cases without the increase in DVA have many of the cases of the increase in IDC. Fourth, the service sector as well as no-service sector contribute to the increase in IDC (value added share to exports by supporting industries).

The observations above, in all, suggest 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 contains 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 seems to be linked with the progress in infrastructure development in Asian emerging market economies.

4. Concluding Remarks

[6] 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.

[7] The real per capita GDP in 2014 is 10,399 USD in Malaysia, 5,964 in China, 5,590 in Thailand, 3,693in Indonesia, 2,506 in Philippines, 1,641 in India, 1,565 in Vietnam and 973 in Cambodia (UNCTAD STAT data).

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 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 major findings from the empirical analyses are 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 2,270 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 1,862 US dollars. There appeared to be a synchronization between the DVA smile curve and DDC 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, but also the weak negative causality from DDC to DVA due to the accompanying import effects. Third, the sectoral observation of the decomposed domestic value creation in all the sample economies for 2000-2014 showed that there are more cases of the increase in domestic value added to exports in IDC by the supporting industries including service sector than 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 could identify an accurate turning point at 2,270 US dollars as per capita GDP in regaining domestic value added share to exports, and could also show 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 GVC involvement process.

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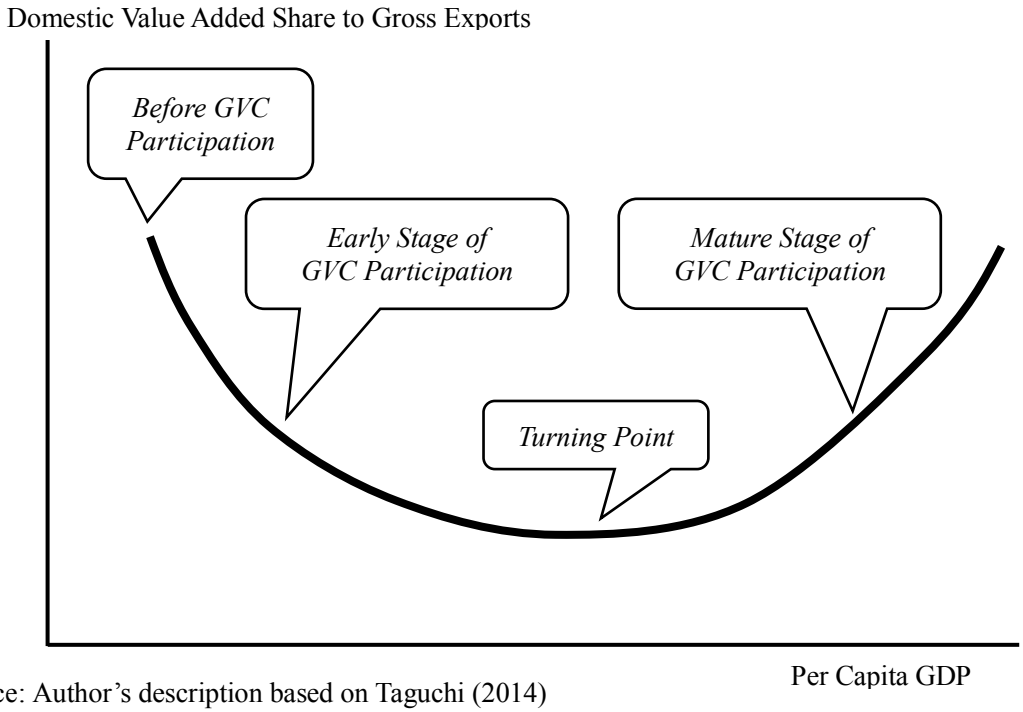
Figure 1 Concept of Smile Curve: A Country Example



Source: Author's description based on Taguchi (2014)

Table 1 Estimation on Domestic Value Creation in Exports in Total Manufactures

[Table 1-1 Domestic Value Added Share to Gross Exports (DVA)]

Variales	DVA	DVA
PCY	0.028	-2.011 ***
	(1.273)	(-4.876)
PCY^2		0.130 ***
		(3.161)
DVA-1	0.746 ***	0.611 ***
	(5.882)	(5.761)
DVA-2	0.033	-0.062
	(0.290)	(-0.473)
Turning Point USD		2,270
Prob (J-statistic)	0.050	0.195
AR(1) Prob	NA	0.069
AR(2) Prob	0.843	0.669
Sample size	136	136

[Table 1-2 Direct Domestic Value Added Share to Gross Exports (DDC)]

Variales	DDC	DDC
PCY	-0.037	-1.483
	(-0.739)	(-1.655)
PCY^2		0.094
		(1.641)
DDC-1	0.692 ***	0.584 ***
	(6.761)	(10.514)
DDC-2	-0.042	-0.066
	(-1.344)	(-1.199)
Turning Point USD		
Prob (J-statistic)	0.001	0.001
AR(1) Prob	0.000	0.000
AR(2) Prob	0.127	0.105
Sample size	136	136

[Table 1-3 Indirect Domestic Value Added Share to Gross Exports (IDC)]

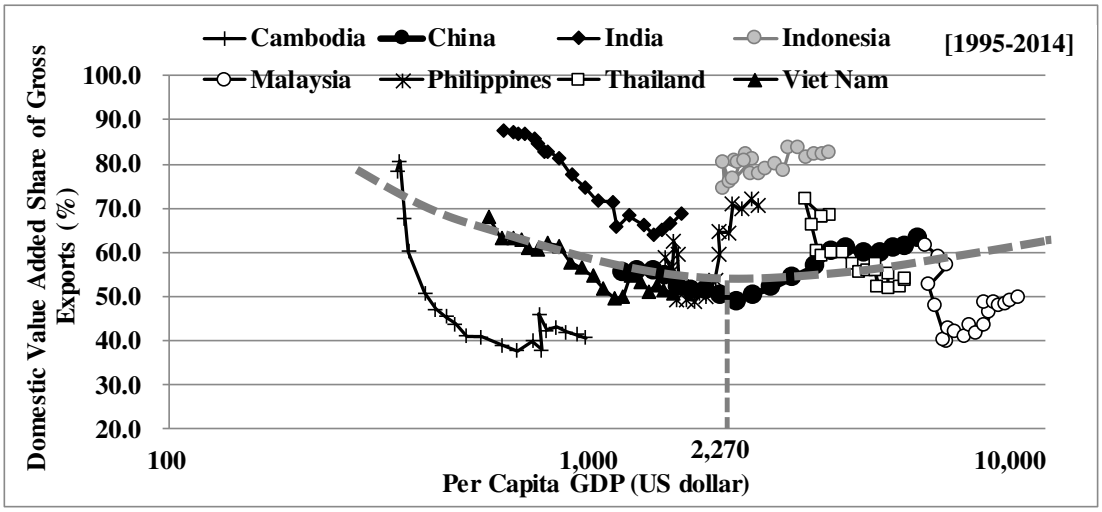
Variales	IDC	IDC
PCY	0.023	-5.050 ***
	(0.618)	(-3.346)
PCY^2		0.335 ***
		(3.287)
IDC-1	0.765 ***	0.660 ***
	(10.708)	(9.009)
IDC-2	-0.044	-0.138 ***
	(-1.134)	(-2.918)
Turning Point USD		1,862
Prob (J-statistic)	0.021	0.088
AR(1) Prob	0.000	0.000
AR(2) Prob	0.681	0.606
Sample size	136	136

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. *** denotes the rejection of null hypothesis at the 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.

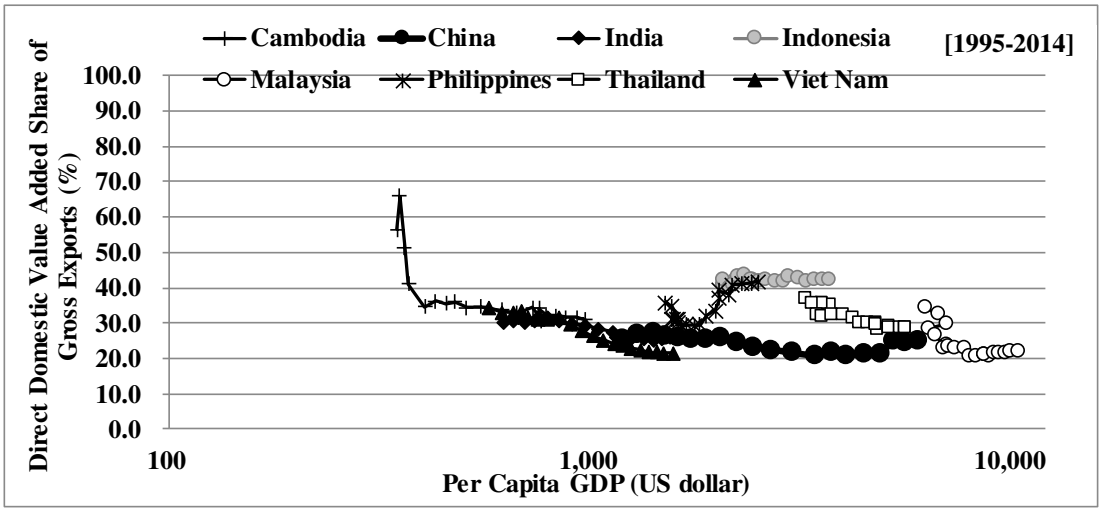
Source: Author's estimation based on OECD value-added-trade data and UNCTAD STAT

Figure 2 Trends in Domestic Value Creation in Exports in Total Manufactures

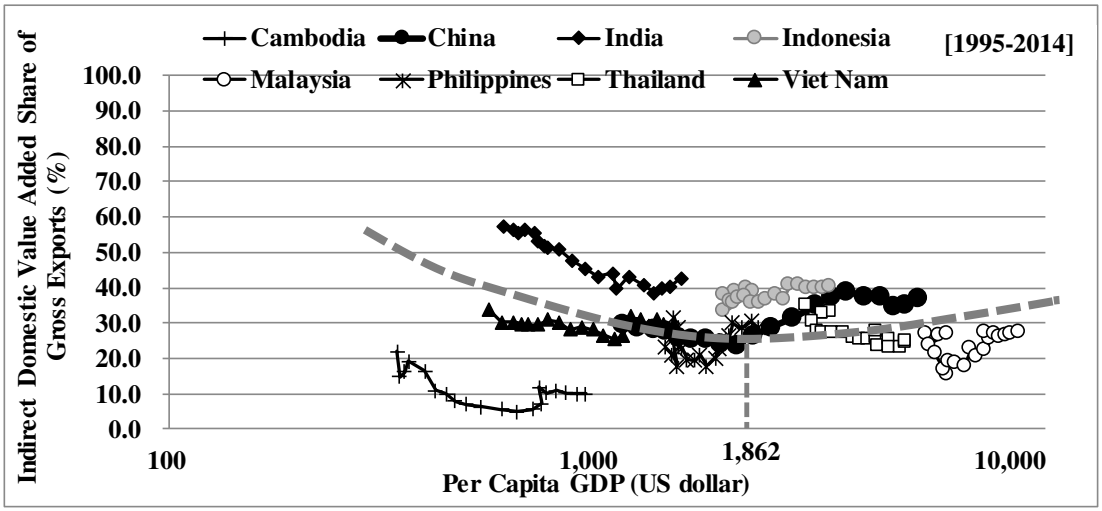
[Figure 2-1 Domestic Value Added Share to Gross Exports (DVA)]



[Figure 2-2 Direct Domestic Value Added Share to Gross Exports (DDC)]



[Figure 2-3 Indirect Domestic Value Added Share to Gross Exports (IDC)]



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

Table 2 VAR Estimation on Domestic Value Creation in Exports in Manufactures

[Table 2-1 Domestic Value Added (DVA) and its Direct Content (DDC)]

	DDC	DVA
DDC-1	0.918 ***	-0.089 **
	[35.040]	[-2.274]
DVA-1	0.022	0.994 ***
	[1.505]	[44.671]
C	0.840	2.625 **
	[1.019]	[2.116]
adj. R^2	0.925	0.947

[Table 2-2 Domestic Value Added (DVA) and its Indirect Content (IDC)]

	IDC	DVA
IDC-1	1.004 ***	0.089 **
	[32.907]	[2.222]
DVA-1	-0.033	0.904 ***
	[-1.322]	[27.073]
C	1.732 *	2.664 **
	[1.826]	[2.126]
adj. R^2	0.956	0.947

[Table 2-3 Granger Causality Tests]

Null Hypothesis	Lags	F-Statistic
DDC does not Granger Cause DVA	1	2.864 *
DVA does not Granger Cause DDC	1	2.570 *
IDC does not Granger Cause DVA	1	4.939 **
DVA does not Granger Cause IDC	1	1.749

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

Table 3 Increase in Domestic Value Added Share to Exports from 2000 to 2014

[Table 3-1 Domestic Value Added Share to Gross Exports (DVA)]

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

[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	+			+			+	+
Machinery				+	+		+	
Electrical				+	+	+	+	
Transport				+	+	+	+	

[Table 3-3 Indirect Domestic Value Added Share to Gross Exports (IDC)]

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

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 2000 to 2014.

Source: OECD value-added-trade data

Appendix Changes in Domestic Value Added Share to Exports for 2000-2014

Total Manufactures	Cambodia	Vietnam	India	Philippines
Domestic value added	-6.4	-9.8	-16.2	10.9
Direct value added by exporting industry	-5.3	-9.5	-5.6	10.8
Indirect value added by supporting industries	-1.1	-0.4	-10.7	0.1
Non-services (primay & manufacturing)	0.2	-1.8	-10.2	-3.9
Services	-1.2	1.4	-0.5	4.0
Food products	Cambodia	Vietnam	India	Philippines
Domestic value added	-2.6	-7.2	-3.1	-1.5
Direct value added by exporting industry	0.0	-4.5	-5.0	-1.1
Indirect value added by supporting industries	-2.7	-2.7	1.9	-0.4
Non-services (primay & manufacturing)	-1.5	-5.3	-3.6	-4.3
Services	-1.2	2.7	5.5	3.9
Textile products	Cambodia	Vietnam	India	Philippines
Domestic value added	-6.6	9.2	-7.7	14.7
Direct value added by exporting industry	-4.9	-7.8	-6.6	8.0
Indirect value added by supporting industries	-1.7	17.0	-1.2	6.7
Non-services (primay & manufacturing)	-0.5	9.7	-7.8	1.7
Services	-1.2	7.3	6.6	5.0
Wood products	Cambodia	Vietnam	India	Philippines
Domestic value added	-2.7	-20.4	-6.6	1.8
Direct value added by exporting industry	-1.0	-6.0	-11.6	-19.8
Indirect value added by supporting industries	-1.7	-14.5	4.9	21.6
Non-services (primay & manufacturing)	-0.6	-18.1	-0.7	12.4
Services	-1.1	3.6	5.6	9.2
Chemical products	Cambodia	Vietnam	India	Philippines
Domestic value added	-4.9	-7.9	-19.0	2.4
Direct value added by exporting industry	-2.0	-15.0	-10.2	3.9
Indirect value added by supporting industries	-0.2	7.1	-8.8	-1.5
Non-services (primay & manufacturing)	1.5	5.4	-6.7	-3.1
Services	-1.6	1.7	-2.1	1.6
Metal products	Cambodia	Vietnam	India	Philippines
Domestic value added	-0.7	-6.1	-12.1	4.0
Direct value added by exporting industry	0.5	-3.6	-0.9	4.8
Indirect value added by supporting industries	-3.0	-2.5	-11.3	-0.9
Non-services (primay & manufacturing)	-2.1	0.1	-8.2	-5.5
Services	-0.9	-2.6	-3.1	4.7
Machinery	Cambodia	Vietnam	India	Philippines
Domestic value added	1.5	-12.6	-11.9	13.2
Direct value added by exporting industry	-1.0	-5.0	-1.9	17.8
Indirect value added by supporting industries	0.7	-7.6	-10.1	-4.7
Non-services (primay & manufacturing)	0.5	-5.0	-8.6	-3.7
Services	0.2	-2.7	-1.4	-1.0
Electrical equipment	Cambodia	Vietnam	India	Philippines
Domestic value added	1.5	-10.7	-8.6	14.4
Direct value added by exporting industry	-0.4	-6.4	-0.9	18.1
Indirect value added by supporting industries	2.2	-4.4	-7.9	-3.8
Non-services (primay & manufacturing)	2.3	-2.7	-12.0	-7.8
Services	-0.1	-1.7	4.1	4.0
Transport equipment	Cambodia	Vietnam	India	Philippines
Domestic value added	-12.7	-4.5	-11.0	4.3
Direct value added by exporting industry	-4.4	-5.7	-1.9	0.2
Indirect value added by supporting industries	-2.1	1.2	-9.3	4.0
Non-services (primay & manufacturing)	-0.2	2.4	-8.8	-2.5
Services	-1.9	-1.2	-0.5	6.5

Total Manufactures	Indonesia	Thailand	China	Malaysia
Domestic value added	6.4	-6.4	11.9	10.2
Direct value added by exporting industry	2.2	-3.6	-0.6	-1.5
Indirect value added by supporting industries	4.2	-2.8	11.5	11.9
Non-services (primay & manufacturing)	3.8	-1.5	3.5	5.2
Services	0.4	-1.3	8.0	6.7
Food products	Indonesia	Thailand	China	Malaysia
Domestic value added	2.5	-3.3	9.4	4.2
Direct value added by exporting industry	3.0	-1.4	-5.4	-5.4
Indirect value added by supporting industries	-0.5	-2.0	14.6	9.7
Non-services (primay & manufacturing)	-2.7	-2.0	7.7	0.7
Services	2.3	0.0	6.9	9.0
Textile products	Indonesia	Thailand	China	Malaysia
Domestic value added	5.2	-2.1	13.6	-2.5
Direct value added by exporting industry	2.8	-1.5	1.0	-5.8
Indirect value added by supporting industries	2.3	-0.7	12.3	3.4
Non-services (primay & manufacturing)	-1.5	-0.5	1.8	-3.6
Services	3.8	-0.1	10.5	7.0
Wood products	Indonesia	Thailand	China	Malaysia
Domestic value added	3.1	-11.8	9.5	8.4
Direct value added by exporting industry	3.9	-12.9	2.3	6.6
Indirect value added by supporting industries	-0.9	1.0	6.7	1.9
Non-services (primay & manufacturing)	-3.6	-2.8	1.2	-3.4
Services	2.7	3.8	5.5	5.2
Chemical products	Indonesia	Thailand	China	Malaysia
Domestic value added	5.8	-5.2	12.1	-2.7
Direct value added by exporting industry	-0.9	-4.2	-2.8	-3.6
Indirect value added by supporting industries	6.8	-1.0	14.5	0.8
Non-services (primay & manufacturing)	3.6	-1.2	6.1	-2.6
Services	3.2	0.2	8.3	3.4
Metal products	Indonesia	Thailand	China	Malaysia
Domestic value added	10.6	-14.4	10.0	5.0
Direct value added by exporting industry	-4.4	-11.9	4.4	4.1
Indirect value added by supporting industries	15.0	-2.5	5.5	0.9
Non-services (primay & manufacturing)	15.4	-2.5	1.6	-3.4
Services	-0.4	0.0	3.8	4.4
Machinery	Indonesia	Thailand	China	Malaysia
Domestic value added	5.0	-7.8	10.6	12.7
Direct value added by exporting industry	4.4	-5.3	0.7	-0.2
Indirect value added by supporting industries	0.5	-2.5	9.3	13.1
Non-services (primay & manufacturing)	-3.7	-0.2	3.1	6.7
Services	4.1	-2.4	6.2	6.4
Electrical equipment	Indonesia	Thailand	China	Malaysia
Domestic value added	2.5	-1.6	21.4	6.2
Direct value added by exporting industry	7.7	0.7	0.1	-2.2
Indirect value added by supporting industries	-5.3	-2.4	19.3	8.6
Non-services (primay & manufacturing)	-2.4	-1.3	8.3	2.3
Services	-2.9	-1.1	11.0	6.2
Transport equipment	Indonesia	Thailand	China	Malaysia
Domestic value added	1.3	-3.0	13.3	-5.0
Direct value added by exporting industry	12.7	0.6	4.3	-14.9
Indirect value added by supporting industries	-11.5	-3.6	8.4	9.9
Non-services (primay & manufacturing)	-12.6	-2.4	2.6	7.9
Services	1.1	-1.3	5.8	2.0

Source: OECD value-added-trade data