Global-value-chains participation and industrial upgrading in Asian developing economies

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ABSTRACT

Asian economies have been and will be a growth center in the world. One of the driving forces for Asian economic growth seems to be their economic integration through forming global value chains (hereafter GVCs) especially in manufacturing sectors. This chapter aims to investigate the dynamic economic impacts of GVCs participation in Asian developing economies from the following two analytical angles. Since the creation of GVCs usually involves the prevailing foreign direct investment (hereafter FDI) undertaken by transnational corporations, we first examined the impacts of FDI on the growth of GDP and exports focusing on ASEAN economies including latecomers and forerunners in their economic developments, by conducting causality tests in the vector auto-regression model. The analytical outcomes represented the clear causality from FDI to GDP and exports as well as the opposite causality from GDP and exports to FDI for a group of ASEAN economies, although individual economies has different causality relations. It implied that FDI has been a driving force for economic growth through capital accumulation and technological transfers, while FDI inflows have been attracted to the growing economies and markets. It should also be noted that the significant causality from FDI to exports might imply that the inward FDI has facilitated the GVCs participation in Asian economies.

We second examined the economic impacts of GVCs participation by analyzing the value-added-trade data in Asian developing economies. We observed that the GVCs participation in manufacturing sectors has allowed the absolute domestic value added for their exports to contribute to their GDP growth. We also found that the development paths of domestic value added contributions to exports in the GVCs participating economies have followed “smile curve” with its turning point being 5,651 U.S. dollars in per capita GDP. It implied the dynamic impacts of GVCs participation, where at the initial stage of GVCs participation the domestic value added contributions to exports have reduced, but have recovered at the later stage of GVCs involvement with upgrading domestic productive capacities. It should also be noted that the turning points of “smile curves” differed according to manufacturing sectors: the sectors of food, textile, and wood products reached the turning point at lower per capita GDP and at higher ratio of domestic value added contributions to exports than those of machinery, electrical, and transport equipment.

1. INTRODUCTION

Asian economies have been and will be a growth center in the world. For its future, the Asian Development Bank (ADB) presented the scenario called the "Asian century", in which Asian share of global GDP will nearly double from 27 percent in 2010 to 51 percent by 2050 (see ADB, 2011). One of the driving forces for Asian economic growth has been and will be de facto economic integration through forming global value chains (hereafter GVCs) especially in manufacturing sectors. In contrast with Europe, Asia includes countries with quite different historical, cultural, and political background and at different development stages. In addition, there is no top-level management to substitute for WTO discipline, as pointed out by Baldwin (2006). However, the economic integration in Asia has voluntarily developed through creating and enlarging GVCs by effectively utilizing different location advantages with diversified development stages.

The fragmentation of production processes and the international dispersion of tasks and activities within them have led to the emergence of borderless production systems, which may be sequential chains or complex networks, and which may be global, regional, or span only two countries. These systems are commonly referred to as GVCs.[1] GVCs are a concept taken up by different schools: economic theory, development studies and international business disciplines. Kimura (2006) described these systems in East Asia by using the terminology of "International Production and Distribution Network", in such ways as active foreign direct investment, development of cross-border production sharing or fragmentation, sophisticated disintegration of production activities, and the formation of industrial agglomeration, particularly in machinery industries. In his paper, the "18 facts" on "International Production and Distribution Network" in East Asia were identified based on a number of studies using international trade data, micro-data of Japanese multinational-enterprises, and casual observations. One of the important messages in his paper is that the mechanics of such networks in East Asia must basically follow "fragmentation theory", which was first proposed in Jones and Kierzkowski (1990 and 2005). It states that a firm's decision on whether to fragment or not depends on the differences in location advantages (including the differences in factor prices like wages) and the levels of the "service-link costs", which are costs to link remotely-located production blocks. The large differences in location advantages and the lower the service-link costs encourage firms to facilitate the fragmentation. In this context, it can be said that Asia could be the area which has the greatest potential for GVCs to spread all over the area with its large differences in

[1] This description on GVCs is based on the World Investment Report 2013 (UNCTAD, 2013).

location advantages within the area, so long as the issues on the service-link costs were cleared by policy-initiatives.

The question then arises as to whether a developing economy, especially a latecomer's economy in Asia, can really enjoy the improvement of its economic performance in case that the economy accepts and participates in GVCs, in other words, whether GVCs can accelerate the catch-up of latecomers' economies and can lead to greater convergence between economies in Asia. To answer this question, there might be several analytical approaches in macroeconomic frameworks, and we herein focus on the two economic variables: foreign direct investment (FDI) and value added trade to address the issue on economic impacts of GVCs participation.

The FDI may be an important avenue for an economy to gain access to GVCs and increase their participation. In fact, the creation of GVCs has usually involved the prevailing FDI undertaken by transnational corporations. For instance, UNCTAD (2013) identified the statistical relationship between FDI stock in countries and their participation in GVCs. Under this context, we first examine whether the FDI has really led to the growth of GDP and exports focusing on ASEAN economies including latecomers and forerunners in their economic developments.

Second, we focus our analyses on examining value-added-trade patterns on Asian developing economies to investigate the economic impacts of their GVCs participation. It was difficult for the GVCs participation and its contribution to GDP enhancement to be analyzed directly at the country level, until the value-added-trade data have been developed in recent times. Now that the data have been developed, however, it has come to enable us to identify the GDP contribution of domestic value-added embedded in gross exports, and thus to quantify the country-leveled economic impacts created by the GVCs participation in the latecomers' economies.

This Chapter is structured as follows. Section 2 shows the analysis of the economic impacts of FDI, and Section 3 represents the value-added-trade analyses on GVCs participation, and Section 4 summarizes the analytical results and concludes.

2. GLOVAL VALUE CHAINS AND FDI

This section will examine the impacts of inward FDI on the growth of GDP and exports focusing on ASEAN economies including latecomers and forerunners in their economic developments.

Under the endogenous growth theory developed in the 1980s, FDI has been considered to have permanent growth effect in the host country through technology transfer and spillover. Most of empirical studies have found positive effects of FDI on transitional and long-run economic growth through capital accumulation and technical and knowledge transfers. Some of them, however, identified opposite causality from growth to FDI, suggesting that FDI inflows have been attracted to the growing economies and markets. Several studies of an individual economy have identified the causality between FDI and growth / exports: bidirectional causality between each pair of FDI, GDP and exports for China (Liu et al., 2002); unidirectional causality from FDI to GDP for Thailand (Kohpaiboon, 2003), for Pakistan (Ahmad et al. 2004) and for Mexico and Argentina (Cuadros et al., 2004); and bidirectional causality between FDI and GDP for Malaysia and Thailand (Chowdhury and Mavrotas, 2006). The studies targeting a group of economies have also verified their causality: unidirectional causality from FDI to GDP for 24 developing countries (Nair-Reichert and Weinhold, 2000); bidirectional causality between FDI and GDP for 31 countries (Hansen and Rand, 2006); and unidirectional causality from FDI to exports for 9 economies (Cho, 2005). It is Hsiao and Hsiao (2006) that investigated the most comprehensive causalities among all three variables of FDI, GDP and exports together, through such a sophisticated method as panel-data-VAR causality analysis for eight East and Southeast Asian economies with the stationarity of each variable being examined. They also found unidirectional effects of FDI on GDP directly and also indirectly through exports in the panel-data analysis, although the analysis of individual economies represented different causality relations among sample economies.

Our study basically follows Hsiao and Hsiao (2006) in our analytical methodology with a focus on the impact of FDI on GDP as well as the one of FDI on exports. Our contributions are to extend the sample period of Hsiao and Hsiao (2006), i.e. from 1986 to 2004 towards the period from 1984 to 2012, and to target all of ASEAN economies including such latecomers as Cambodia, Lao PDR, Myanmar and Vietnam whereas Hsiao and Hsiao (2006) focus rather on forerunning economies.

Methodology and data

We examine the bilateral Granger causalities between FDI and GDP and between FDI and exports by their time-series data of individual economies and also by their panel data of all sample economies.

The sample economies are ten ASEAN economies, and the sample period is from 1984 to 2012. The data for FDI (inward stock), GDP and exports are retrieved from UNCTADSTAT[2] and expressed in real and natural logarithm terms: *fdi*, *gdp* and *ext*[3].

[2] See http://unctadstat.unctad.org/EN/.

[3] All the data are deflated by GDP deflator retrieved from "Key Indicators for Asia and the Pacific 2014" by ADB.

We then construct a vector autoregression model with p-lag, VAR(p), for *fdi* and *gdp* as well as for *fdi* and *ext* to test the bilateral Granger causalities as follows.

$$y_t = \mu + V_1 y_{t-1} + \cdots + V_p\, y_{t-p} + \varepsilon_t$$

where y_t is a (2 × 1) column vector of the endogenous variables: $y_t = (fdi_t \ gdp_t)'$ or $y_t = (fdi_t \ ext_t)'$, μ is a (2 × 1) constant vector, each of V_1 and V_2 is a (2 × 2) coefficient matrix, each of y_{t-1} and y_{t-2} is a (2 × 1) vector of the lag endogenous variables, and ε_t is a (2 × 1) vector of the random error terms in the system. The lag length p is selected by the minimum Akaike Information Criterion (AIC) with maximum lag equal to 2 under the limited number of observations.

Before examining the causality relations, we check the stationarity of the time-series and panel data by employing a unit root test, and if needed, a cointegration test for them. Based on the data property, we select either the level series or the first-difference series in the VAR estimation. Regarding a unit root test, we adopt the augmented Dickey-Fuller (ADF) test for the time-series data analysis of individual economies, and the Levin, Lin and Chu (LLC) test for the panel data analysis of all sample economies. The both tests are conducted by including "intercept" and "trend and intercept" in the test equation. Table 1 reports the test results for the combination of *fdi* and *gdp* and that of *fdi* and *ext*. In Cambodia and Vietnam for the combination of *fdi* and *gdp*, and in the panel group for any combinations, both variables are stationary in their level series, and so we use their level series for the VAR estimation. In Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, and Thailand for any combinations, a set of variables are not stationary in the level, but stationary in the first-difference, which are supposed to be the case of $I(1)$, and then can be further examined by Johansen cointegration test. For the remaining cases, we use the first-difference series for the estimation. Table 2 represents the results of Johansen cointegration test with "intercept" and "trend and intercept" being included in the test equation. Both the trace test and the Maximum-eigenvalue test indicate that the level series are cointegrated in Lao PDR and Malaysia for the combination of *fdi* and *gdp*, and in Malaysia and Singapore for the combination of *fdi* and *ext*. The final selection of the level or first-difference series for the VAR model analysis of individual economies is described in the rightmost column of Table 2.

Estimated Causalities and Discussion

We now show the estimation outcomes on the bilateral Granger causalities between FDI and GDP and between FDI and exports by their time-series data of individual economies and also by their panel data of all sample economies (see Table 3). The main findings are as follows. First, regarding the panel data analysis, the very clear bidirectional causalities are significantly identified in both the combination of FDI and GDP and that of FDI and exports. Second, as for the time-series data analysis of individual economies, each economy has different causality relations. When we focus on the direction from FDI to GDP, Lao PDR, Singapore, Thailand and Vietnam have its significant causality, while Philippines, Singapore and Thailand have the significant causality from FDI to exports.

Such latecomers as Myanmar are, at least, turned out not to represent the causalities from FDI to GDP and exports. When we focus on the case of Myanmar, for instance, we might pick up the following possible reasons for no causalities. First, the inward FDI share to GDP in 2013 is still much lower in Myanmar (23.2%) than those in Thailand (45.4) and Vietnam (47.8).[4] This fact might suggest that the role of FDI in Myanmar has been too small to give some impacts on GDP. Second, the inward FDI in Myanmar has highly depended on oil and gas sectors; the oil and gas sector occupies 69% whereas the manufacturing sector does only 5%, in the industrial composition of the inward FDI during the period from fiscal year of 1989 to 2010 in Myanmar.[5] The natural resources exploration by foreign investors might have not so much involved domestic production capacity. The lower contribution of FDI in manufacturing sector in Myanmar might come from its lack of infrastructure development that can be typically indicated by its lower ranking in the Logistic Performance Index by the World Bank.[6]

There should be, however, some reservations in the time-series data analysis of individual economies since the number of observations in a sample country is limited only to 29 of annual data. This point seems to be in line with Hsiao and Hsiao (2006), which argues that the time-series analysis on an individual country cannot yield a general rule.

The panel data analysis of all sample economies, on the other hand, represents the clear causality from FDI to GDP and exports as well as the opposite causality from GDP and exports to FDI. It suggests that as a general tendency as a whole ASEAN, FDI has been a driving force for economic growth through capital accumulation and technical and knowledge transfers, while FDI inflows have been attracted to the growing economies and markets. This finding is also consistent with Hsiao and Hsiao (2006), which verified the significant effects of FDI on GDP directly and also indirectly through exports in the panel-data analysis. It should also be noted that the significant causality

[4] The data for FDI and GDP in 2013 are also based on UNCTADSTAT.

[5] The data for the industrial composition of the inward FDI in Myanmar are based on DICA, MNPED http://www.dica.gov.mm/dicagraph%200.htm.

[6] See http://lpisurvey.worldbank.org/international/global.

from FDI to exports may imply that the inward FDI has facilitated the participation of international production networks.

3. GLOVAL VALUE CHAINS AND VALUE-ADDED-TRADE

This section investigates the economic impacts of GVCs participations in Asian developing economies from the different angle from previous section, with a focus on examining their value-added-trade patterns.

When it comes to the literature on the impact analyses of GVCs, it can be classified into firm- and industry-level analyses and country-level ones. Among them, there have been rather a plenty of literature on the firm- and industry-level analyses through some kinds of case studies, e.g. Nadvi et al. (2004) for Vietnamese garment and textile firms, Lizbeth (2011) for Brazilian industries of furniture and footwear, Lee and Gereffi (2013) for mobile phone, and Backer (2011) for the Apple iPod.

The literature on the country-level analyses of GVCs impacts has, on the other hand, been scarce probably because such analytical instruments as value-added-trade have been just recently developed by several organizations. It seems to be UNCTAD (2013), i.e. the World Investment Report that addressed, for the first time, the country-level analyses of GVCs impacts in the comprehensive angles by utilizing its newly developed value-added-trade. UNCTAD (2013) presented the comprehensive analyses on GVCs in its Chapter IV, demonstrating the GVCs impacts in terms of local-value capture, job creation, technology dissemination as well as of upgrading and building long-term productive capabilities. We herein introduce three major analytical outcomes related to the country-level contributions of domestic value added in GVCs participation, which our paper tries to apply and extend to Asian developing economies. First, a statistical analysis correlating GVCs participation and per capita GDP growth rates showed a significant and positive relationship for both developed and developing economies, even where GVCs participation requires higher imported contents. Second, the different 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 “GVCs development paths” in host countries participating GVCs; Some economies have managed, often after participating GVCs at the cost of domestic value share, to regain domestic value added share, by upgrading within GVCs and by expanding into higher-value chains. Third, the overall GVCs development paths of countries is an average of the development paths of many industries and GVCs activities, which may have followed different levels of industrial sophistication, from resource-based exports to low-, medium- and high-tech manufacturing exports, to exports of knowledge-based services.

This section tries to apply aforementioned county-level analyses in UNCTAD (2013) to Asian developing economies for the reason that Asia can be the area which has the greatest potential for GVCs to spread all over the areas. In addition, we develop the analysis of "GVCs development paths" in such more sophisticated ways to estimate a non-linear, quadratic curve in the relationship between domestic value added share to exports and development stage (per capita GDP) so that we can obtain the regaining point of domestic value added share in GVCs participation process. We conduct this analysis of dynamic impacts of GVCs participation in Asian developing economies in each manufacturing sector as well as in total manufacturing.

Analytical Framework by Value Added Trade

For examining the economic impacts of GVCs participation in Asian developing economies, we first clarify an analytical framework with value-added-trade data. The data of value added trade, which have recently been developed by several international organizations, enable us to examine the GVCs from the country-level perspective, i.e., the origin of value added creation in exports and its contribution to GDP. The structure of value added trade is described in a simplified form in Figure 1. We suppose that raw materials, parts and components extracted and produced in Country A are exported to Country B for their processing and manufacturing by 10 units, and then re-exported to Country C for their final demand by 25 units. The ordinary account of gross exports is totaled into 35 units (10 units in Country A plus 25 units in Country B). The new account named "value added trade" makes it possible to divide gross exports into their domestic value added (e.g. 15 units in Country B) and foreign (imported) value added (e.g. 10 units in Country B), and thus to extract net value added exports from gross exports. In this case, the total exports of value added are 25 units (10 units in Country A plus 15 units in Country B). We also know the double account of total gross exports as 10 units (35 units minus 25 units). According to UNCTAD (2013), at the global level, about 5 trillion U.S. dollars of the 19 trillion U.S. dollars in 2010 world exports are "double counted" in global trade figures.

Regarding value added trade statistics, value added in trade can be estimated on the basis of international input-output tables that depict the economic interactions between countries. Due to the growing demand for analyses, several institutions such as UNCTAD, OECD, WTO, IDE-JETRO, have sought to compile value added trade using different methodologies.[7] UNCTAD (2013) utilized the UNCTAD-Eora GVC Database built by UNCTAD in collaboration with the Eora project. On the other hand, this study uses "OECD-WTO Trade in Value Added (TiVA) database", because this database is only the one that is open to the public since May 21, 2013.[8]

By using the data on value added trade, we can extract the following three key variables to analyze the structure of GVCs: 1) Foreign value added as a share of gross exports (FVX), 2) Domestic value added as a share of gross exports (DVX), and 3) Domestic value added in exports as a ratio of GDP (DVY). This study focuses all the exports on those of manufacturing sectors. We interpret FVX as a proxy of GVCs participation ratio, since the foreign value added incorporated into exports is a form of a multi-stage trade process in GVCs from the upstream perspective. UNCTAD (2013), however, added one more element: the exported value added incorporated in third-country exports from the downstream perspective as GVCs participation ratio. This study does not include the latter element as GVCs participation index for the following two reasons. First, the OECD-WTO TiVA database does not classify the portion of exported value added embedded in third-country exports. Second, the downstream element in GVCs is sometimes dominant in a group of countries exporting natural resources and raw materials. This study is, however, targeting the conventional GVCs in manufacturing sectors in Asian developing countries, and not targeting the GVCs in commodity-exporting group. Thus, FVX might be justified to be as a GVCs participation indicator in this paper. The DVY is an indicator to measure the extent to which domestic value added in exports contributes to the GDP of an economy.

Hypothesis on Development Paths of GVCs Participation

We next present a hypothesis on the development paths of GVCs participation, which illustrates the dynamic evolution process of domestic value added creation for GVCs participants in the context of aforementioned value-added-trade framework (see Figure 2).[9] At the early stage before GVCs participation, an economy stays at high DVX and low DVY, in which most of exports are domestically produced and their contribution to GDP is small. When an economy participate in GVCs, it moves to the stage with low DVX and high DVY, since an economy's production for its exports have to depend highly on imports of parts, components and machineries from foreign countries, whereas its absolute production value for exports contributes a lot to its rising GDP. At the matured stage of GVCs involvement, an economy can enjoy a combination

[7] There has also been a trial to unify the methodologies to estimate value added trade. See, for instance, Koopman et al. (2012).

[8] It can be downloaded through http://stats.oecd.org/.

[9] The essence of the hypothesis comes from the description in UNCTAD (2013).

of high DVX and high DVY; its production for exports continues to contribute to GDP growth, and at the same time, the dependence on imports for its exports declines due to the expansion of domestic productive capacities.

The process of enhancing local productive capacities may involve a number of mechanisms: the key exporting industries may provide opportunities for local industries to participate in GVCs, which will leads to generating additional value added through local outsourcing within and across industries; and/or the key exporting industries themselves may attain their industrial upgrading through technology dissemination and skill building, which will improve their productivity and will facilitate their entries and expansions towards higher valued sectors. It should be noted that these development paths are not always realized automatically and its achievements differ according to the characteristic of the GVCs and the involved countries. Government policies also matter to optimize the economic contributions of the GVCs participation and involvement.

Based on the hypothesis on the development paths, we extract empirical evidence from the following perspectives. The first one is the relationship between GVCs participation and its GDP contribution. It can be examined by estimating a linear-positive correlation between FVX and DVY. The second one is the association between the contribution of domestic value added to exports and development stages. It can be addressed by estimating a correlation between DVX and per capita GDP (hereafter PCY). As the hypothesis shows, the DVX will follow not one-off moves but such a sequence of moves as high, low and high ones along development process, thereby creating "smile curve".[10] The empirical evidence will be presented in the next sub-section.

Empirical Evidence on Dynamic Impacts of GVCs Participation

Before presenting the empirical evidence based on the aforementioned perspectives, we clarify the data available for sample countries and periods. Regarding the data for value added trade of "Gross exports", "Foreign value added content of gross exports" and "Domestic value added embodied in gross exports", the OECD-WTO TiVA database that we use confines sample countries to 24 developing countries and sample years to 5 years of 1995, 2000, 2005, 2008 and 2009. We adopt 8 Asian developing countries for: Cambodia, China, India, Indonesia, Malaysia, Philippines, Thailand and Vietnam. As for sample years, we exclude the year of 2009 that was seriously influenced by the world Lehman Shock. In all variables, we extract manufacturing

[10] The "smile curve" originated from Baldwin (2012) in the different context of firm-level analysis, which described the connection between manufacturing stages and stage's share of product's total value added.

sectors from 15 to 37 in the code of the International Standard Industrial Classification of All Economic Activities Rev.3.1. The data of GDP and per capita GDP are retrieved from "World Economic Outlook Database October 2013" by International Monetary Funds in terms of "Gross domestic product, current prices, U.S. dollars" and "Gross domestic product per capita, current prices, U.S. dollars", and selected by the same countries and years as the data of value added trade. In sum, we construct panel data with 8 Asian countries for 4 years of 1995, 2000, 2005 and 2008, to conduct the following panel estimation.

Regarding the first perspective, namely, the relationship between GVCs participation (FVX) and its GDP contribution (DVY), Table 4 reported the estimation outcomes (Figure 3 described simply their relationship). In panel estimation, we usually assume a country-specific effect, and adopt either fixed-effect model or random-effect one according to its correlation with the explanatory variable (the former in case of the existence of the correlation and the latter in its absence). Based on the statistics of the Wu-Hausman test (see Hausman, 1978), which is used to help choose between these two models, we adopt random-effect model. Under this model, we could get an expected outcome, i.e., a positive correlation at 99 percent significant level between DVY and FVX. Thus, it suggested that an economy's participation in GVCs allows an absolute domestic value added for exports to contribute to GDP growth, and this outcome is perfectly consistent with those of UNCTAD (2013).

As for the second perspective, namely, the association between the contribution of domestic value added to exports (DVX) and development stages (PCY), Table 5 represented the estimation outcomes (Figure 4 described their relationship). We also adopt random-effect model following the Wu-Hausman test results. We could obtain also expected results: the coefficient of PCY is significantly negative; the one of a square of PCY is discernibly positive; and the turning points in PCY are 5,651 U.S. dollars in the estimation. Thus, the U-shape, smile curves were identified in the development path of domestic value added contribution to exports along with the development stages. In particular, it should be noted that the estimation outcome was not valid in linear regression, and only valid in quadratic equation with all coefficients being significant at 99 percent level, and that the turning point of per capita GDP, 5,651 U.S. dollars is highly reasonable level. It might be said that the estimated "smile curves" consistently quantify the "GVCs development paths" described in UNCTAD (2013), and that following the curves shown in Figure 4, Malaysia, Thailand and China appear to be passing their turning point, thereby entering the stage of regaining domestic value added share in GVCs participation process with the expansion of domestic productive capacities through local outsourcing and industrial upgrading.

As UNCTAD (2013) suggested, the overall GVCs development paths of countries is nothing more than an average of the different GVCs development paths in a variety of industries, and so the smile curves estimated above may differ in their shapes and turning points according to manufacturing sectors. We therefore estimate the DVX – PCY relationships in each of eight manufacturing sub-sector categories: “Food products, beverages and tobacco”, “Textiles, textile products, leather and footwear”, “Wood, paper, paper products, printing and publishing”, “Chemicals and non-metallic mineral products”, “Basic metals and fabricated metal products”, “Machinery and equipment”, “Electrical and optical equipment” and “Transport equipment”. As Table 6 reported, all the coefficients of PCY are significantly negative and those of a square of PCY are discernibly positive, and thus the smile curves were identified in the development paths of all manufacturing categories.

The most noteworthy finding is that the turning points of smile curves differ a lot and even represent a clear contrast according to manufacturing sectors as the sectoral “smile curve” in Figure 5 illustrated. The sectors of food, wood and textile products reach the turning point at lower per capita GDP ranging from 5,100 to 5,400 U.S. dollars and at higher ratio of domestic value added contributions to gross exports from 57% to 71%. On the contrary, the sectors of machinery, electrical, and transport equipment face the turning point at higher per capita GDP ranging from 5,800 to 6,400 U.S. dollars and at lower ratio of domestic value added contributions to gross exports from 37% to 49%. It suggests that the sectors of food, wood and textile products, which require relatively less sophisticated technologies and a smaller number of supply chains, can attain the higher degree of localization of production capacity necessary for exports at the earlier time; on the other hand, the sectors of machinery, electrical, and transport equipment, which involve relatively more sophisticated technologies and a larger number of supply chains, take a longer time to raise up the local production capacity, since such sectors need to acquire a lot of technology transfer along with long supply-chains and also to materialize transferred technology for their local production.

4. CONCLUSION

This chapter investigated the dynamic economic impacts of GVCs participation in Asian developing economies. The creation of GVCs usually involves the prevailing FDI undertaken by transnational corporations, and for Asian developing economies the inward FDI could be an important avenue to gain access to GVCs. Under this context, we first examined whether the FDI has really led to the growth of GDP and exports focusing on ASEAN economies including latecomers and forerunners in their economic developments, by conducting causality tests in the vector auto-regression model. The analytical outcomes represented the clear causality from FDI to GDP and exports as well as the opposite causality from GDP and exports to FDI for a group of ASEAN economies, although individual economies has different causality relations. It implied that FDI has been a driving force for economic growth through capital accumulation and technological transfers, while FDI inflows have been attracted to the growing economies and markets. It should also be noted that the significant causality from FDI to exports might imply that the inward FDI has facilitated the GVCs participation in Asian economies.

We second examined the economic impacts of GVCs participation by analyzing the value-added-trade data in Asian developing economies. We observed that the GVCs participation in manufacturing sectors has allowed the absolute domestic value added for their exports to contribute to their GDP growth. We also found that the development paths of domestic value added contributions to exports in the GVCs participating economies have followed "smile curve" with its turning point being 5,651 U.S. dollars in per capita GDP. It implied the dynamic impacts of GVCs participation, where at the initial stage of GVCs participation the domestic value added contributions to exports have reduced, but have recovered at the later stage of GVCs involvement with upgrading domestic productive capacities. It should also be noted that the turning points of "smile curves" differed according to manufacturing sectors: the sectors of food, textile, and wood products reached the turning point at lower per capita GDP and at higher ratio of domestic value added contributions to exports than those of machinery, electrical, and transport equipment.

Table 1 Results of ADF and LLC Unit Root Tests

Combination of *fdi* and *gdp*

ADF Unit Root Test

		level		first difference		For estimation
		intercept	trend & intercept	intercept	trend & intercept	
Brunei	*fdi*	-3.71**	-2.09	-2.94*	-3.35*	first difference
	gdp	-0.34	-7.07***	-9.70***	-9.24***	
Cambodia	*fdi*	-8.05***	-4.21**	-	-	level
	gdp	-7.54***	-1.81	-	-	
Indonesia	*fdi*	-2.07	-2.04	-3.66**	-3.59**	$I(1)$
	gdp	-2.99**	-1.33	-5.38***	-5.27***	
Lao PDR	*fdi*	-2.36	-2.19	-2.93*	-3.04	$I(1)$
	gdp	-1.69	-1.93	-5.13***	-5.88***	
Malaysia	*fdi*	-1.05	-1.64	-5.27***	-5.20***	$I(1)$
	gdp	-0.61	-1.88	-4.88***	-4.79***	
Myanmar	*fdi*	-2.50	-2.28	-3.71**	-4.02**	$I(1)$
	gdp	-2.79*	0.61	-3.28**	-4.98***	
Philippines	*fdi*	0.10	-2.01	-4.40***	-4.53***	$I(1)$
	gdp	-1.26	-0.68	-4.31***	-4.59***	
Singapore	*fdi*	-0.63	-3.92**	-5.86***	-5.91***	$I(1)$
	gdp	-0.59	-2.30	-3.84***	-3.83**	
Thailand	*fdi*	-1.32	-2.36	-5.70***	-5.84***	$I(1)$
	gdp	-0.86	-2.27	-3.98***	-3.91**	
Vietnam	*fdi*	-3.81***	-6.74***	-	-	level
	gdp	-3.61**	-7.41***	-	-	

LLC Unit Root Test

		level		first difference		For estimation
		intercept	trend & intercept	intercept	trend & intercept	
Panel data	*fdi*	-1.70**	-1.21	-	-	level
	gdp	-2.01**	-0.21	-	-	

Combination of *fdi* and *ext*

ADF Unit Root Test

		level		first difference		For estimation
		intercept	trend & intercept	intercept	trend & intercept	
Brunei	*fdi*	-3.71**	-2.09	-2.94*	-3.35*	first difference
	ext	-1.94	-3.72*	-4.94***	-5.11***	
Cambodia	*fdi*	-8.05***	-4.21**	-11.10***	-10.41***	first difference
	ext	-2.30	-1.76	-12.77***	-12.96***	
Indonesia	*fdi*	-2.07	-2.04	-3.66**	-3.59**	$I(1)$
	ext	-2.60	-2.37	-4.78***	-4.87***	
Lao PDR	*fdi*	-2.36	-2.19	-2.93*	-3.04	$I(1)$
	ext	-1.33	-2.21	-6.02***	-6.13***	
Malaysia	*fdi*	-1.05	-1.64	-5.27***	-5.20***	$I(1)$
	ext	-1.75	-1.57	-4.17***	-4.42***	
Myanmar	*fdi*	-2.50	-2.28	-3.71**	-4.02**	$I(1)$
	ext	-0.85	-1.57	-4.61***	-4.49***	
Philippines	*fdi*	0.10	-2.01	-4.40***	-4.53***	$I(1)$
	ext	-0.51	-0.18	-4.15***	-5.61***	
Singapore	*fdi*	-0.63	-3.92**	-5.86***	-5.91***	$I(1)$
	ext	-0.35	-2.26	-5.27***	-5.19***	
Thailand	*fdi*	-1.32	-2.36	-5.70***	-5.84***	$I(1)$
	ext	-1.59	-1.90	-4.10***	-4.16**	
Vietnam	*fdi*	-3.81***	-6.74***	-13.99***	-14.10***	first difference
	ext	-1.41	-2.06	-4.55***	-4.47***	

LLC Unit Root Test

		level		first difference		For estimation
		intercept	trend & intercept	intercept	trend & intercept	
Panel data	*fdi*	-1.70**	-1.21	-	-	level
	ext	-2.64***	1.36	-	-	

Note: (1) The lag length in the test equation follows automatic selection by Schwarz Info Criterion. (2) ***, **, * denote rejection of null hypothesis of "series has a unit root" at the 1%, 5% and 10% level of significance, respectively.

Table 2 Results of Johansen Cointegration Test

Combination of *fdi* and *gdp*

	intercept		trend & intercept		For estimation
	trace	max-eigen	trace	max-eigen	
Brunei	-	-	-	-	first difference
Cambodia	-	-	-	-	level
Indonesia	9.10	6.15	16.30	12.21	first difference
Lao PDR	26.80***	21.33***	27.67**	21.53**	level
Malaysia	17.13**	15.74**	26.73**	19.52**	level
Myanmar	16.83**	10.21	18.05	11.35	first difference
Philippines	2.01	1.95	11.01	9.09	first difference
Singapore	5.56	5.15	20.37	15.85	first difference
Thailand	6.26	4.16	8.22	5.94	first difference
Vietnam	-	-	-	-	level

Combination of *fdi* and *ext*

	intercept		trend & intercept		For estimation
	trace	max-eigen	trace	max-eigen	
Brunei	-	-	-	-	first difference
Cambodia	-	-	-	-	first difference
Indonesia	10.83	7.22	13.02	8.88	first difference
Lao PDR	15.05*	10.17	16.60	11.31	first difference
Malaysia	19.50**	16.16**	21.89	16.96	level
Myanmar	7.13	6.43	10.60	7.87	first difference
Philippines	1.70	1.67	13.93	12.37	first difference
Singapore	7.31	6.65	26.3**	19.80**	level
Thailand	10.31	8.01	14.67	8.77	first difference
Vietnam	-	-	-	-	first difference

Note: ***, **, * denote rejection of null hypothesis of “no cointegrating equations” at the 1%, 5% and 10% level of significance, respectively.

Table 3 Results of Granger Causality Test

Combination of *fdi* and *gdp*

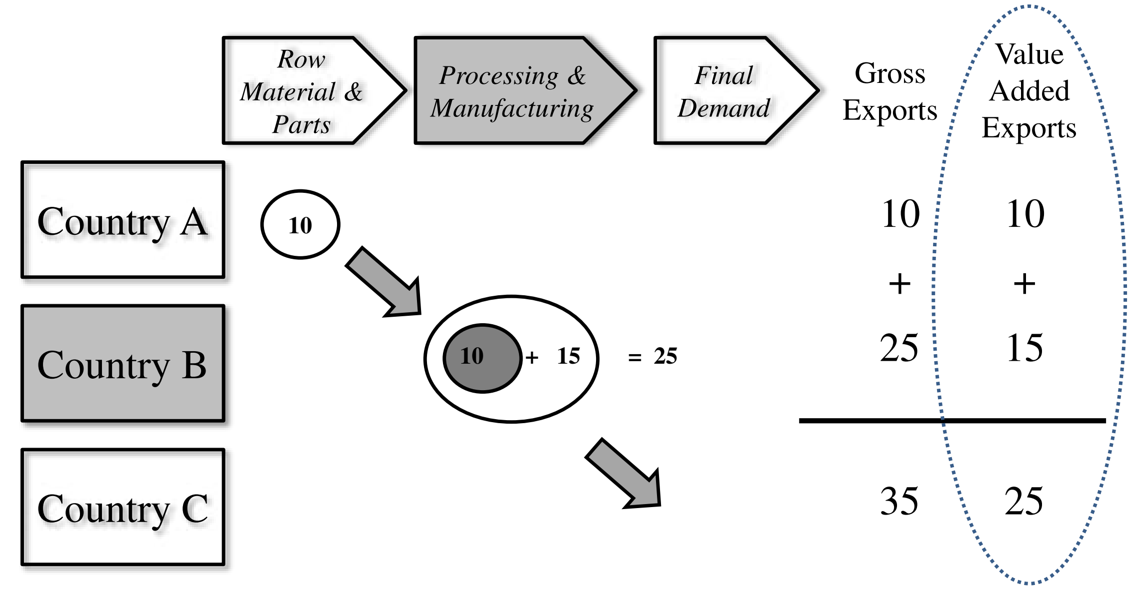
	Lags	Null Hypothesis	F-Statistic
Brunei	1	D(FDI) does not Granger Cause D(GDP)	0.52
		D(GDP) does not Granger Cause D(FDI)	0.03
Cambodia	2	FDI does not Granger Cause GDP	0.46
		GDP does not Granger Cause FDI	5.61**
Indonesia	1	D(FDI) does not Granger Cause D(GDP)	0.03
		D(GDP) does not Granger Cause D(FDI)	0.00
Lao PDR	2	FDI does not Granger Cause GDP	3.79**
		GDP does not Granger Cause FDI	0.10
Malaysia	1	FDI does not Granger Cause GDP	0.12
		GDP does not Granger Cause FDI	7.76**
Myanmar	1	D(FDI) does not Granger Cause D(GDP)	0.03
		D(GDP) does not Granger Cause D(FDI)	0.31
Philippines	1	D(FDI) does not Granger Cause D(GDP)	0.00
		D(GDP) does not Granger Cause D(FDI)	0.94
Singapore	2	D(FDI) does not Granger Cause D(GDP)	6.76***
		D(GDP) does not Granger Cause D(FDI)	0.31
Thailand	1	D(FDI) does not Granger Cause D(GDP)	21.84***
		D(GDP) does not Granger Cause D(FDI)	3.09*
Vietnam	2	FDI does not Granger Cause GDP	12.80***
		GDP does not Granger Cause FDI	16.76***
Panel data	2	FDI does not Granger Cause GDP	20.85***
		GDP does not Granger Cause FDI	9.44***

Combination of *fdi* and *ext*

	Lags	Null Hypothesis	F-Statistic
Brunei	1	D(FDI) does not Granger Cause D(EXT)	0.95
		D(EXT) does not Granger Cause D(FDI)	0.41
Cambodia	2	D(FDI) does not Granger Cause D(EXT)	0.80
		D(EXT) does not Granger Cause D(FDI)	6.19**
Indonesia	1	D(FDI) does not Granger Cause D(EXT)	0.38
		D(EXT) does not Granger Cause D(FDI)	0.69
Lao PDR	1	D(FDI) does not Granger Cause D(EXT)	2.06
		D(EXT) does not Granger Cause D(FDI)	0.00
Malaysia	1	FDI does not Granger Cause EXT	0.00
		EXT does not Granger Cause FDI	6.21**
Myanmar	1	D(FDI) does not Granger Cause D(EXT)	1.13
		D(EXT) does not Granger Cause D(FDI)	3.76*
Philippines	2	D(FDI) does not Granger Cause D(EXT)	11.55***
		D(EXT) does not Granger Cause D(FDI)	3.26*
Singapore	2	FDI does not Granger Cause EXT	3.55**
		EXT does not Granger Cause FDI	0.02
Thailand	1	D(FDI) does not Granger Cause D(EXT)	8.52***
		D(EXT) does not Granger Cause D(FDI)	0.71
Vietnam	1	D(FDI) does not Granger Cause D(EXT)	0.01
		D(EXT) does not Granger Cause D(FDI)	0.16
Panel data	2	FDI does not Granger Cause EXT	5.58***
		EXT does not Granger Cause FDI	8.27***

Note: ***, **, * denote rejection of null hypothesis at the 1%, 5% and 10% level of significance, respectively.

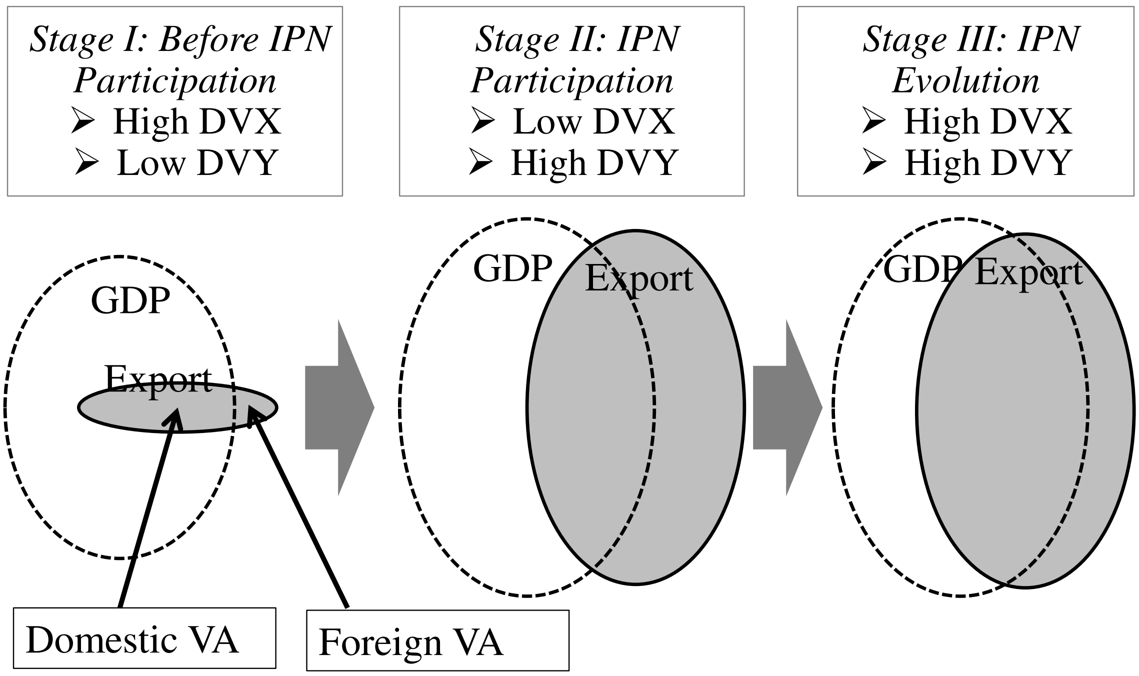
Figure 1 Structure of Value Added Trade



For Country B, Gross Exports (GR) = 25, Domestic VA = 15, Foreign VA = 10
IPN Participation Ratio = FVX (Foreign VA / GR) = 10 /25

Source: Author’s description based on UNCTAD (2013)

Figure 2 Development Paths of GVCs Participation



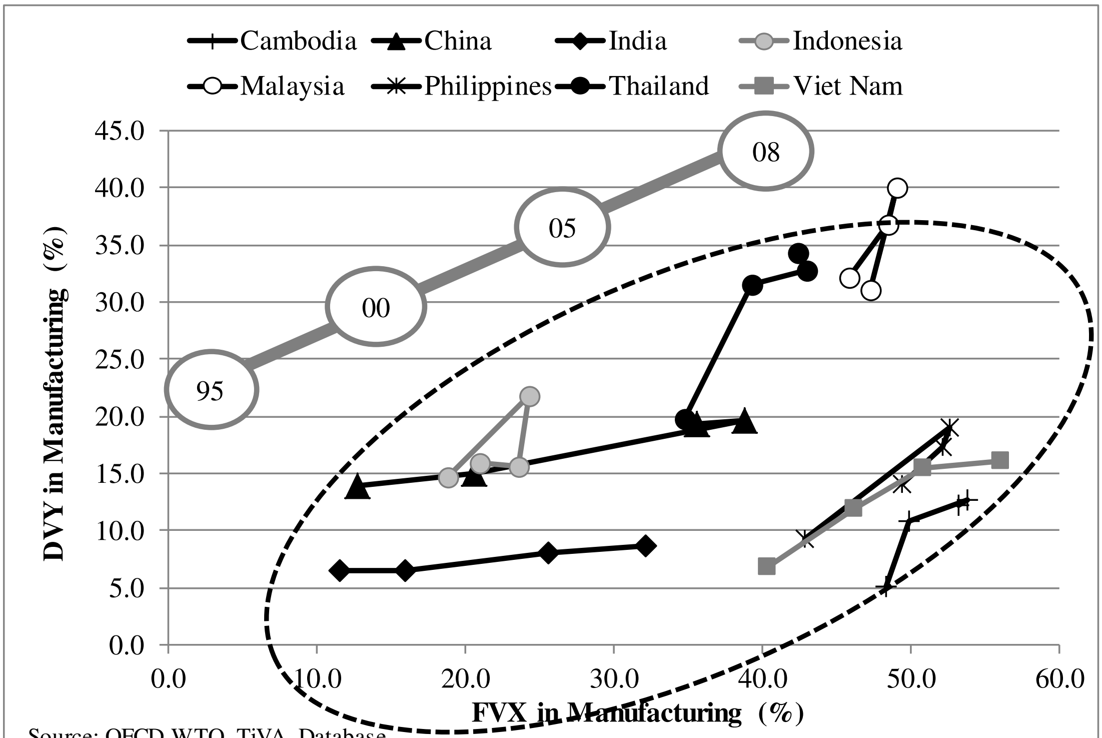
Source: Author’s description

Table 4 Estimation on GDP Contribution with GVCs Participation

Variales	DVY
Const.	3.379
	(0.665)
FVX	0.379 ***
	(4.011)
Adj R**2	0.330
Sample size	32
<the Wu-Hausman Test>	
Chi-Sq. Statistic	0.584
Chi-Sq. d.f.	1
Prob.	0.444
Estimation Type	Random

Note:
1) The T-value is shown in parenthese.
2) One, two, or three asterisks indicate that a coefficient estimate is significantly different from zero at 10, 5, or 1% percent level, respectively.
Source: OECD TiVA Data May 2013

Figure 3 Linkage between GVCs Participation and GDP Contribution



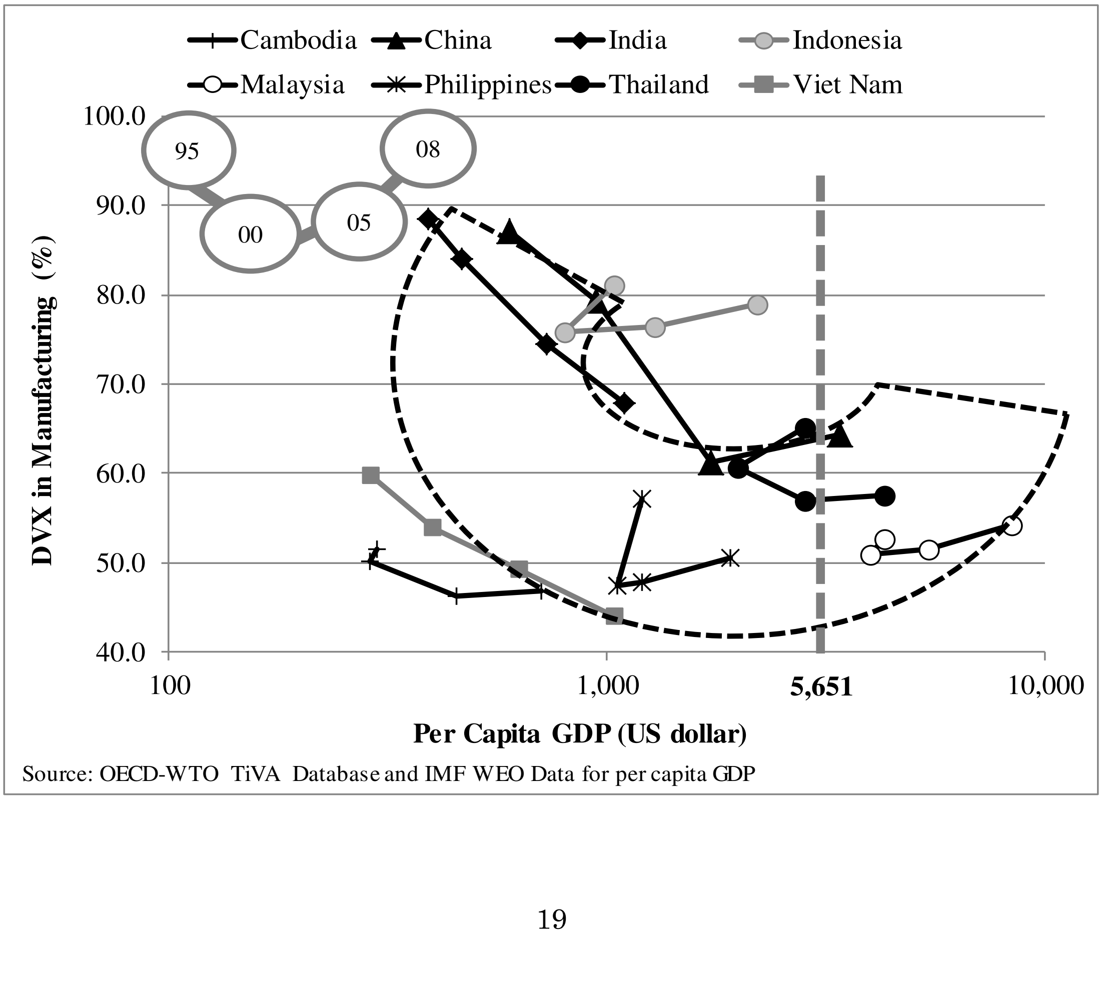
Source: OECD-WTO TiVA Database

Table 5 Estimation on Development Paths of GVCs Participation

Variales	DVX	
Const.	65.385 ***	72.581 ***
	(12.274)	(12.346)
PCY	$-2.062*10^{-3}$	$-8.815*10^{-3}$ ***
	(-1.687)	(-3.597)
PCY^2		$7.800*10^{-7}$ ***
		(3.039)
Turning Point		5,651
Adj R**2	0.058	0.265
Sample size	32	32
<the Wu-Hausman Test>		
Chi-Sq. Statistic	0.042	1.919
Chi-Sq. d.f.	1	2
Prob.	0.836	0.383
Estimation Type	Random	Random

Note:
1) The T-value is shown in parenthese.
2) One, two, or three asterisks indicate that a coefficient estimate is significantly different from zero at 10, 5, or 1% percent level, respectively.
Source: OECD TiVA Data May 2013

Figure 4 Development Paths of GVCs Participation (Hypothesis of Smile Curve)



Source: OECD-WTO TiVA Database and IMF WEO Data for per capita GDP

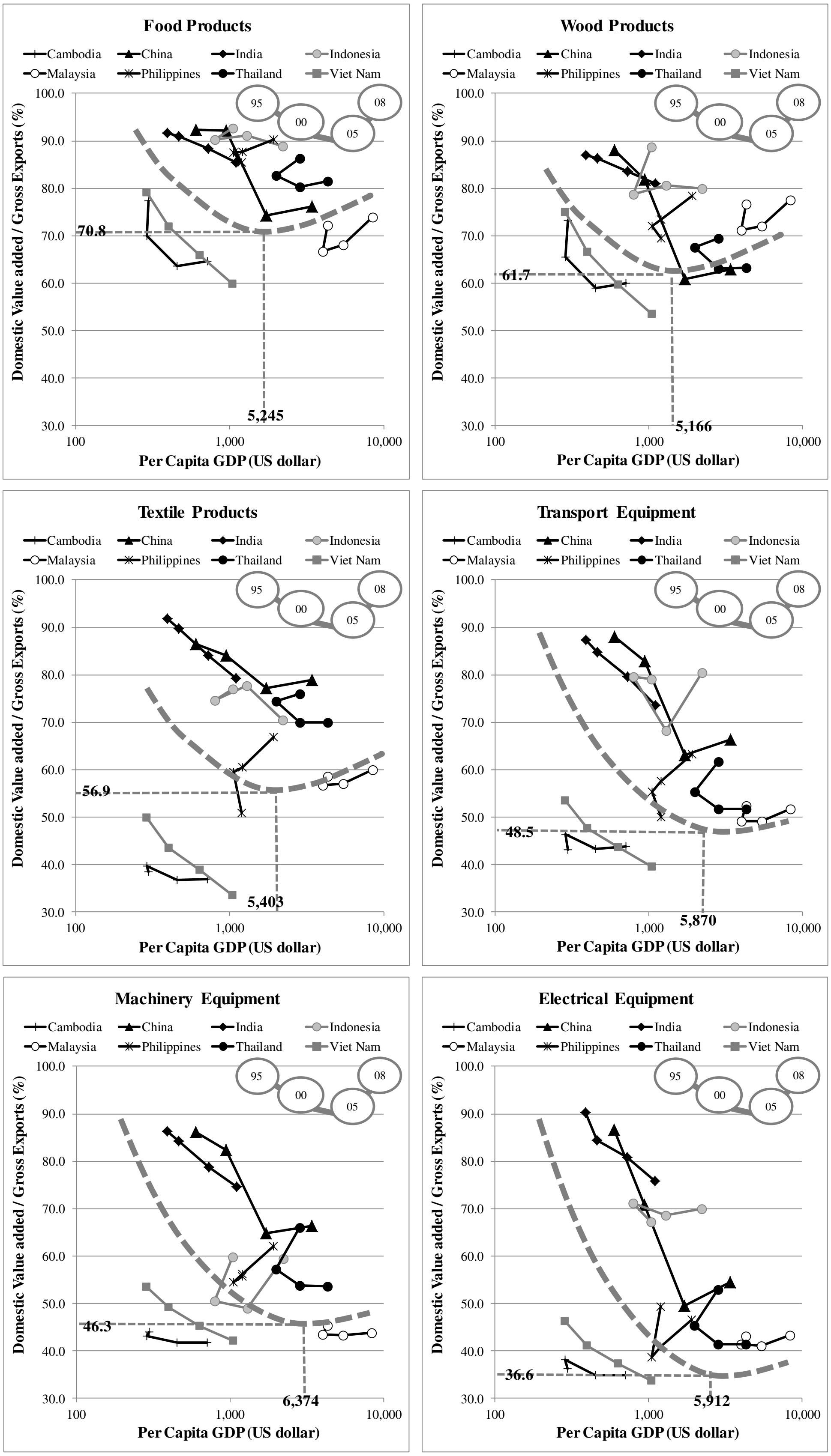
Table 6 Estimation on Development Paths of GVCs Participation by Sectors

Variales	DVX Asia			
	Food products, beverages and tobacco	Textiles, textile products, leather and footwear	Wood, paper, paper products, printing and publishing	Chemicals and non-metallic mineral products
Const.	88.256 ***	69.926 ***	82.066 ***	72.510 ***
	(23.555)	(10.214)	(18.729)	(13.731)
PCY	$-6.661*10^{-3}$ ***	$-4.830*10^{-3}$ **	$-7.894*10^{-3}$ ***	$-8.022*10^{-3}$ ***
	(-3.417)	(-2.399)	(-3.281)	(-3.111)
PCY^2	$6.350*10^{-7}$ ***	$4.470*10^{-7}$ **	$7.640*10^{-7}$ ***	$7.940*10^{-7}$ ***
	(3.022)	(2.162)	(2.911)	(2.889)
Turning Point	5,245	5,403	5,166	5,052
Average DVX	80.3	64.1	72.7	63.1
Adj R^{**2}	0.203	0.103	0.209	0.185
Sample size	32	32	32	32
Estimation Type	Random	Random	Random	Random

Variales	DVX Asia			
	Basic metals and fabricated metal products	Machinery and equipment, nec	Electrical and optical equipment	Transport equipment
Const.	70.362 ***	65.220 ***	65.469 ***	69.928 ***
	(10.097)	(10.819)	(8.534)	(10.608)
PCY	$-8.410*10^{-3}$ ***	$-5.941*10^{-3}$ **	$-9.767*10^{-3}$ ***	$-7.291*10^{-3}$ ***
	(-3.488)	(-2.487)	(-3.456)	(-2.803)
PCY^2	$6.890*10^{-7}$ ***	$4.660*10^{-7}$ *	$8.260*10^{-7}$ ***	$6.210*10^{-7}$ **
	(2.763)	(1.870)	(2.815)	(2.290)
Turning Point	6,103	6,374	5,912	5,870
Average DVX	59.6	57.4	53.1	60.7
Adj R^{**2}	0.253	0.141	0.261	0.170
Sample size	32	32	32	32
Estimation Type	Random	Random	Random	Random

Note:
1) The T-value is shown in parenthese.
2) One, two, or three asterisks indicate that a coefficient estimate is significantly different from zero at 10, 5, or 1% percent level, respectively.
Source: OECD TiVA Data May 2013

Figure 5 Smile Curve by Manufacturing Sectors



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