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East Asian trade integration in the era of global value chains: Prospects and challenges

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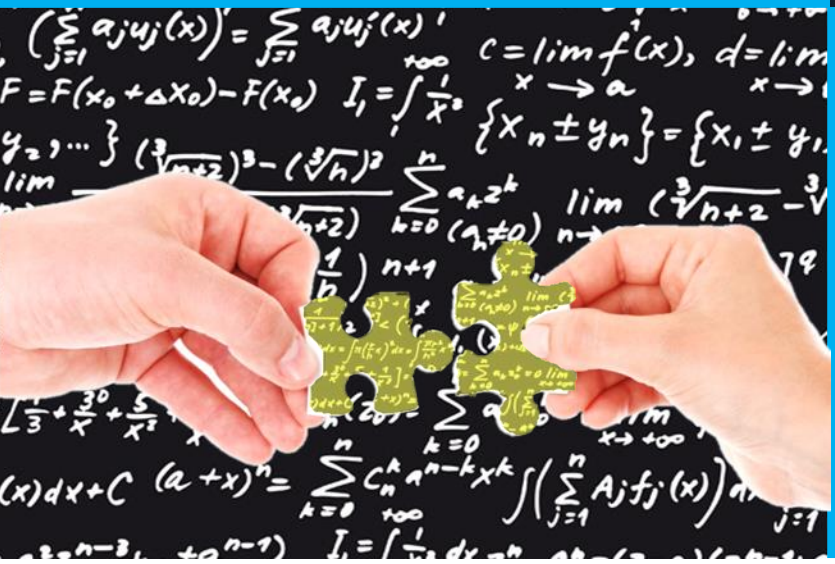
East Asian trade integration in the era of global value chains: Prospects and challenges



Nobuaki Yamashita

ASIA-PACIFIC RESEARCH AND TRAINING NETWORK ON TRADE

Working Paper

NO. 205| 2021

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ASIA-PACIFIC RESEARCH AND TRAINING NETWORK ON TRADE

WORKING PAPER

East Asian trade integration in the era of global value chains: Prospects and challenges

Nobuaki Yamashita[1]

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[1] Royal Melbourne Institute of Technology (RMIT) and Keio University (email: nobu.yamashita@rmit.edu.au). The author would like to thank Witada Anukoonwattaka of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) for the detailed comments on the draft paper and guidance for this project. My thanks also go to Joseph Mariasingham of the Asian Development Bank (ADB) for sharing the ADB-MRIO database for this project, and Trong Anh Trinh for excellent research assistance. Nattabhon Narongkachavana provided supports on formatting and publishing the paper.

Abstract

This paper examines trade integration of East Asian countries through the lens of global value chains (GVCs). It first gauges the extent and involvement of trade in value-added (TiVA) for East Asian countries. The analysis confirms that reliance on backward GVC participation outside of the region still looms large in East Asia. This presents the case for creating policies that would enable the creation of greater global links in addition to focusing on deepening intraregional trade linkages remain important. Sectoral comparisons reveal that Regional Value Chains (RVCs) among East-Asian economies have been increasing its role in East Asian's exports of transport equipment sector while decreasing the role in its exports of textile and apparel sector. Such trend seems to suggest RVC opportunities are available to East Asian economies in sectors that require production to locate close to large and growing markets and suppliers' ability to absorb new technology. Moreover, the study finds enabling policy environment is an important factor to strengthen intraregional value chain linkages. For example, non-tariff measures (NTMs), have become an important part of trade-policy measures and have significantly affected trade flows in RVCs. It is found that NTMs are generally associated with reduced trade in value-added flows, except in the case that NTMs may help ensuring quality standards, such as technical NTMs in the food industry.

Keywords: Global Value Chains, Trade integration, Non-tariff measures

JEL Codes: F13,F23,

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List of abbreviations

ADB MRIO	Asian Development Bank Multi-Region Input-Output
ARTNeT	Asia-Pacific Research and Training Network on Trade
ASEAN	Association of Southeast Asian Nation
BPCB	Bare printed circuit boards
CES	constant elasticity of substitution
CoO	Certificates of Origin
DVA_INTrex	Domestic value added in exports, used by the importer for further export production
FDI	Foreign direct investment
FEALAC	Forum of East Asiaa-Latin America Cooperation
FOB	free on board
FTAs	Free trade agreements
FTZs	Free Trade Zones
FVA	Foreign Value Added
GVCs	Global Value Chains
I-O	Input-output
IP	Intellectual property
ITAs	Information technology agreements
LED	Light-emitting diodes
MFN	Micro, Small-sized and Medium-sized Enterprise
MNEs	Multinational enterprises
NIEs	Newly-industrialized economies
NTMs	Non-tariff measures
OAP	Offshore Assembly Programme
PCBA	Printed circuit board assembly
RHS	right-hand side
RoO	Rules of Origin
RVCs	Regional value chains
SPS	sanitary and phytosanitary
TBT	technical barriers to trade
TiVA	Trade in value-added

UNESCAP	United Nations Economic Social Commission for Asia and the Pacific
WIOD	World Input-Output Database

Introduction

Global value chains (GVCs) have been the key facet of international trade and foreign direct investment (FDI) in East Asia[2], where the production process is vertically separated into two or more stages across two or more countries, involving extensive outsourcing and creating cross-border production networks (Jones and Kierkowski, 2000; Athukorala and Yamashita, 2006). With product fragmentation in GVCs, a country no longer needs to specialize in the production of an entire product, being able instead to focus on some specific and narrow segments where it has a comparative cost advantage. As a consequence, there has been a rapid increase of cross-border trade in parts and components within the East Asian region, linking a diverse set of countries that specialize in different stages of production (Yamashita, 2010).

Practical examples of GVCs can be found in Apple's ipad (Kraemer, Linden and Dedrick, 2011), Texas Instruments' high-speed telecommunication chip (Grossman and Rossi-Hansberg, 2006), Mattel's Barbie dolls (Feenstra, 1998) and sewing machines (Watanabe, 1972). An illustrative example comes from the semiconductor industry (Grunwald and Flamm, 1985; Brown and Linden, 2005). One of the most important semiconductor products is an integrated circuit or 'chip', which is a network of tiny wires fabricated on a surface and connecting transistors that switch processing data in binary code on and off. The manufacturing process of the chip consists of three primary discrete value-chain activities: design, wafer fabrication, and test and

[2] East Asia in this paper comprises Australia; Brunei Darussalam; Cambodia; China; Indonesia; Japan; the Lao People's Democratic Republic; Malaysia; Mongolia; the Philippines; Republic of Korea; Singapore; Thailand; Viet Nam; Hong Kong, China; and Taiwan Province of China.

assembly (Brown and Linde, 2005).[3] In this process of specialization in GVCs, the design is the most skill-intensive stage, requiring a very high standard of sophisticated technology and highly-skilled labour. The next step, wafer fabrication, needs to be performed in an extremely clean location but requires relatively lower skills than the design process. The fabrication stage also entails a huge fixed investment to build a plant (called a "fab") that holds a wide variety of expensive equipment. Finally, assembly is typically the process of cutting the wafer into delicate individual chips (or dyes) and packaging them, with the intensive use of manual labour. Among these three value-added activities, assembly is likely to be relocated first in order to benefit from cheaper labour costs overseas, while fabrication is likely to be the next move. Design activities are likely to remain inside the home country. For example, in 2002 the world's leading chipmaker, Intel Corporation in the United States, had its assembly locations and testing facilities mostly in developing countries such as Malaysia, the Philippines, China and Costa Rica. The other sophisticated and high-end value processes, such as wafer fabrication, design and the manufacture of the chips were still concentrated in the United States (UNCTAD, 2002). Assembly and testing facilities have been relocated to Asia (four facilities spreading into China, Malaysia and Viet Nam).

This paper examines the prospects of further intraregional trade integration of East Asian countries (defined in FEALAC) in the context of the ongoing expansion of GVCs. For this purpose, a simple data analysis of aggregated gross exports-based trade data is insufficient. Instead, the paper presents an analysis based on value-added trade data from the international input-output (I-O) table to gauge the extent and involvement of trade in value-added (TiVA) for East Asian countries. It also covers the important issues arising from the use of free trade agreements (FTAs) as well as the effects of

[3]See https://www.intel.com/content/www/us/en/history/museum-making-silicon.html.

non-tariff measures (NTMs) as a policy instrument to promote GVCs for East Asia. The paper also provides a general policy framework for East Asia to maximize the benefits of connecting to GVCs. By bringing all the elements of the analysis together, the paper also tries to highlight the future course of the GVCs evolution.

1. Measuring trade in GVCs

2.1 Definition[4]

GVCs broadly describe the process of breaking up the vertically integrated production process into finer stages and the relocation of each stage to the most suitable localityacross borders. In this study, GVCs cover intra-firm transactions of parts and components, intermediate inputs between parent firms of MNEs and their foreign affiliates, together with international arm's-length subcontracting transactions (inter-firm trade with unaffiliated suppliers) in these items. Additionally, the main focus of this study is on the physical separation of production stages in the manufacturing production process across international borders in East Asia. However, GVC participation in the service industry is beyond the scope of this study.

The creation of production networks was initiated by multinational enterprises (MNEs) during the late 1960s to ensure that they stayed competitive in the global market (Helleiner, 1973; Grunwald and Flamm 1985). This was particularly the case with MNEs based in the United States' electronics and garments industries, which used the Offshore Assembly Programme (OAP), a special government scheme where tax-exemption was granted to re-imported productsy (Finger, 1975). This practice subsequently spread to other heavy industries such as the automobile industry

[4]This subsection is largely drawn from chapter 2 of Yamashita, 2010.

(Watanabe, 1972). In the late 1970s, European MNEs began to get involved with the process of international fragmentation of production. In the late 1980s, Japanese MNEs began to establish assembly operations, mainly in South-East Asia. More recently, MNEs from the newly-industrialized economies (NIEs) in East Asia have begun to contribute to further development of the process.

A number of factors have contributed to the recent surge in worldwide production fragmentation. First, the communication revolution (such as the broadband Internet) led to significant cost reductions by making it easier to coordinate a separated production process across international borders, called service link costs in Jones and Kierzkowski (2000).

Second, the continuous decline in transportation costs, especially through air freight costs and improved containerization methods, has made it cheaper and faster to move parts and components from one location to another (Hummels, 2007). The reduction in transportation costs has also facilitated the international separation of products that have higher values relative to their bulk (e.g., computer chips) (Lall and others, 2004).

Third, product-specific technology advancement has increased the separability of the production process into finer degrees and segments, depending on the factor intensity used (the technical divisibility of the production process) (Jones, 2000). This has facilitated a process once trapped within domestic trade to move across international borders (Krugman, 1995). For example, engineering activities such as the manufacture of automobiles and electronics have increasingly been separated into discrete production stages – the manufacture of components, assembly, testing and packaging – with different skill requirements, scales and factor inputs (Lall and others, 2004). In contrast, the continuous production process of the chemical industry creates technical difficulties in separating the production segment into discrete steps.

Related to this development, progress in modular technology has had the effect of significantly expanding the possibility of global-scale fragmentation networks. In general, modular technology has allowed some components to be standardized for use in multiple final products across different sectors. Examples include computer chips and long-lasting batteries. Computer chips are now used in the manufacturing of computers, automobiles and toasters, while long-lasting batteries originally designed for use in mobile phones are now widely used in electronic organizers, transmitters, radios, lap-top computers and missiles (Jones and Kierzkowski, 2000, Athukorala, 2005; Nishimura, 2005).

Fourth, multilateral trade liberalization has added to the rapid growth of fragmentation trade across national borders. Yi (2003) makes the point that even a small tariff reduction has a so-called “magnification effect” on fragmentation trade. This is simply because, unlike finished products, components and unfinished products can cross international borders multiple times before reaching the final stage of the production process. Therefore, any marginal reduction in the protection scheme can significantly lower trade costs.

In summary, the initial stage of international fragmentation of production was motivated simply by lower foreign production costs in order to maintain the international competitiveness of major MNEs from industrial countries. Since then, several important factors – including technological progress and the continuous reduction in transportation and communication costs – have made the option of production fragmentation more attractive to achieve further cost reduction. While intra-firm trade by MNEs still dominates the fragmentation trade, the emergence of contract manufacturers facilitates the international “arm’s-length” transaction of parts and components. Overall, international production networks have steadily begun spreading,

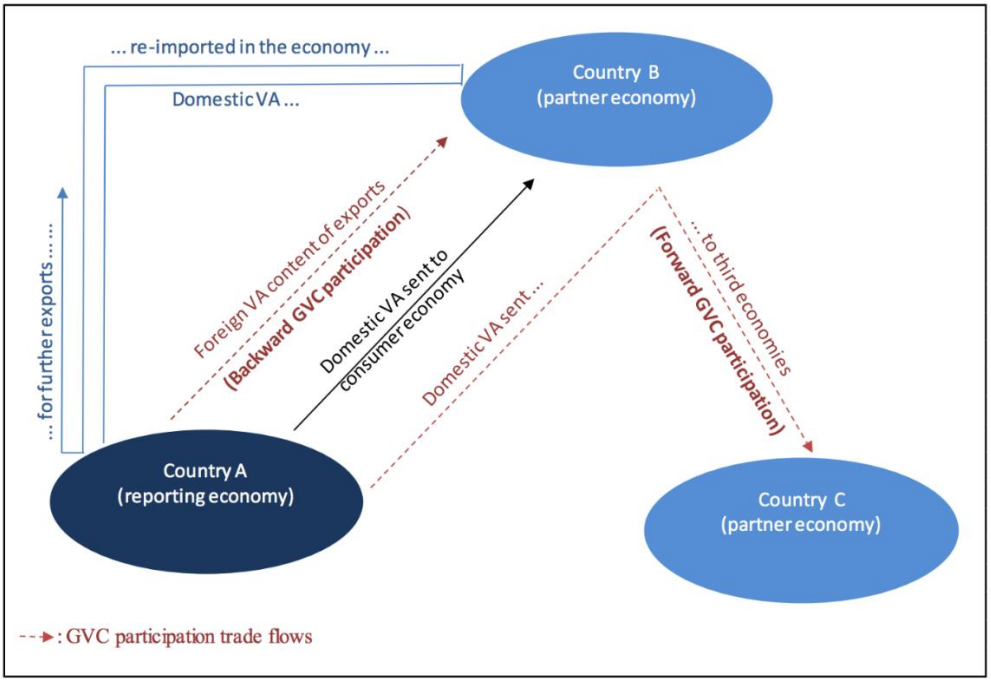
involving many diverse developing countries working at different production stages and tasks.

2.2 Trade in value-added approach

This paper uses Asian Development Bank Multi-Region Input-Output (ADB MRIO) data. This is the extended version of the World Input-Output Database (WIOD) with additional Asian countries (Bangladesh, Malaysia, the Philippines, Thailand and Viet Nam), which makes data available for 35 industries and 63 countries/groups (see the list of countries in Technical Appendix table A2) for 2000 and 2010-2017. Appendix table A1 provides a detailed classification in the decomposition of gross exports and the associated illustration (Appendix figure A1). Within East Asian members of FEALAC, ADB-MRIO includes Australia, Brunei Darussalam, Cambodia, China, Indonesia, Japan, the Lao People's Democratic Republic, Malaysia, Mongolia, the Philippines, the Republic of Korea, Singapore, Thailand and Viet Nam as well as both Hong Kong, China, and Taiwan Province of China. As a comparison, data are tabulated for ASEAN countries as a group.

The decomposition methods in exports documented in Wang, Wei and Zhu (2013) and the terminology used in that paper are followed, allowing decomposition of bilateral gross exports into various value-added and double-counted parts by segregating origins and destinations of value-added. The method is illustrated infigure 1, which provides a visualisation of GVC trade flows in the view of Country A (reporting economy).

Figure 1: GVC participation in trade flows – simplified figure



Note: Adopted from OECD-WTO TiVA.

Among the GVC linkages illustrated, the focus is on the two indicators of GVC linkages. The first indicator corresponds to the value-added of inputs that were imported (foreign value added, FVA) by Country A in order to produce intermediate or final goods/services to be exported. This corresponds to '*backward GVC participation*'[5] and is measured as:

$$GVC_{participation}^{Backward} = \frac{\text{Foreign value added (FVA)}}{\text{Gross exports}}$$

The second indicator corresponds to domestic value-added (DVX) of Country A sent to Country B's exports to country C, i.e., '*forward GVC participation*', and is measured as:

[5] This essentially captures what Hummelsand others (2001) defined as"vertical specialisation in trade" (see theTechnical Appendix to this report for detailed explanations).

$$GVC_{participation}^{Forward} = \frac{\text{Domestic value added (DVA)}}{\text{Gross exports}}$$

The first indicator measures all value-added contents in exports that are sourced from outside a reporting country (hence, referred to the buyer or sourcing perspective of GVCs where an economy imports to produce exports). A larger share of backward participation could be expected by a country that has a greater focus on assembly type of activities. The assembly countries tend to have a large pool of labour with a perfectly elastic labour supply, operating at competitive wages. The second measure (*forward GVC participation*) is the proportion of domestic value-added contents in gross exports that are eventually embedded in a partner country's exports. A measure of forward participation relates to a country's involvement in the upstream structure of GVCs. A country with extensive coverage could be expected to supply domestically value-added parts and components to other countries to comprise the highest proportion in this indicator. Together, these two indicators can be used to portray the degree of participation in GVCs.

Gross exports in GVC linkages are further divided into the following two links:

- Domestic value-added of Country A exported to the consumer economy (Country B). This corresponds to the domestic value-added embodied either in final or intermediate goods, or services that are directly consumed by the importing country;
- Domestic value-added that is re-imported in the economy. This outlines the domestic value-added of exported intermediates (or inputs) that are sent back to Country A, embodied in other intermediates and used in export production.

Such a value-added round-trip between two (or more) economies highlights the domestic value-added content present in the imports of an economy.

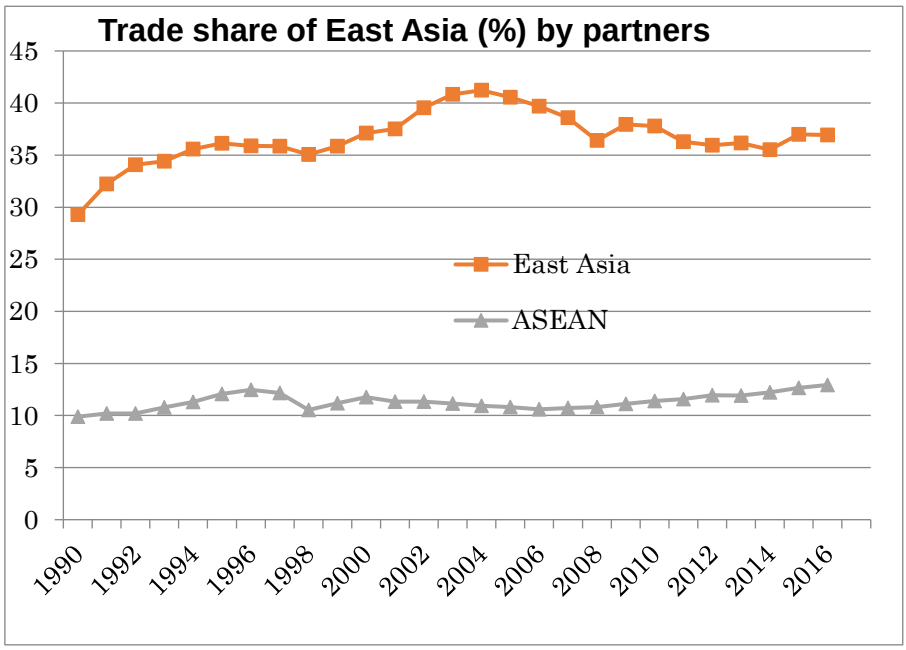
3. GVC participation in East Asia

3.1 Intraregional trade integration

This subsection begins with a general discussion about the process of trade integration in East Asia followed by a review of the process of GVCs in East Asia. Figure 2 shows the degree of intraregional trade share (proportion of intraregional trade) for East Asia as a whole and for ASEAN, which is a subset of the group.[6] The data are drawn from the ADB Regional Cooperation and Integration Database.[7]

Figure 2: Trade integration measures for East Asian countries and ASEAN

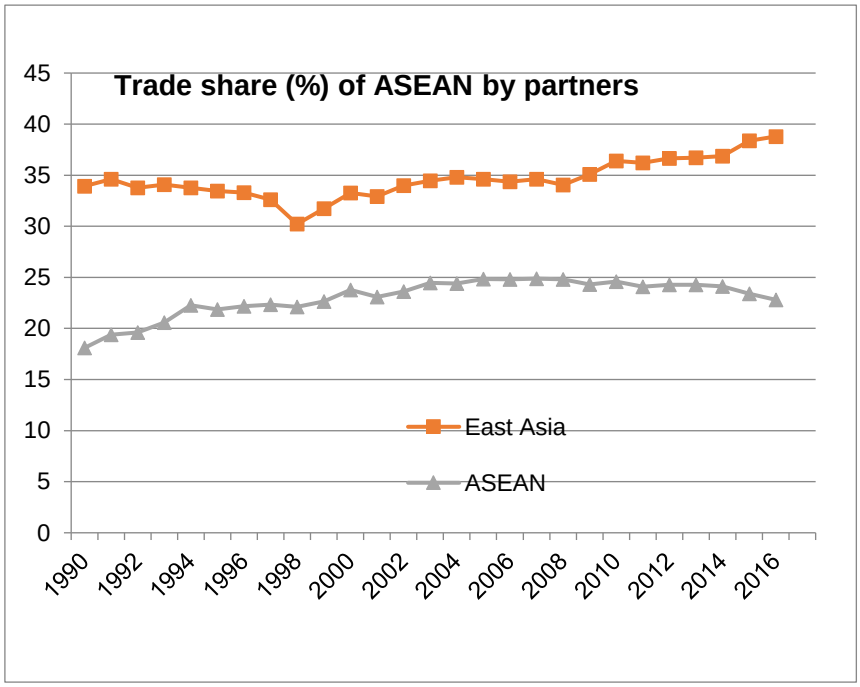
(a) Intraregional trade in East Asia



[6]East Asia comprises Australia, China, Japan, the Republic of Korea, the Democratic People's Republic of Korea, Mongolia, Macau Province of China, Taiwan Province of China and Hong Kong, China, plus ASEAN members Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic,Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam.

[7]See https://aric.adb.org/database/arcii.

(b) Intraregional trade in ASEAN



Source: Asian Regional Integration Centre, ADB. Available athttp://aric.adb.org/integrationindicators.

Figure 2(a) shows a somewhat gradual decline in the intra-East Asian trade share, especially since the mid-2000s. This flattening in the degree of trade integration in East Asia could be attributed to several factors. First, expansion of production networks in East Asian, which was driving trade integration from the 1990s to the mid-2000s, has reached saturation point. As has been well-documented in the literature (e.g., Panagetsu and Armstrong, 2018), the phase of East Asian trade integration before the 2000s was characterised by the market-driven China and Asian NIEs growing more rapidly, assisted by a series of the policy reforms in trade and FDI in this region. By the early 2000s, tariff rates for manufacturing in East Asia were low enough for policy or regional trade agreements (RTAs) to have little influence on the expansion of production networks in East Asia (Athukorala and Yamashita, 2006). Second, the China factor – which was a large contributor to East Asian integration through trade – has gradually changed, moving away from trade-oriented growth to a more mature

economy driven by services and consumption. These factors are examined more systematically below.

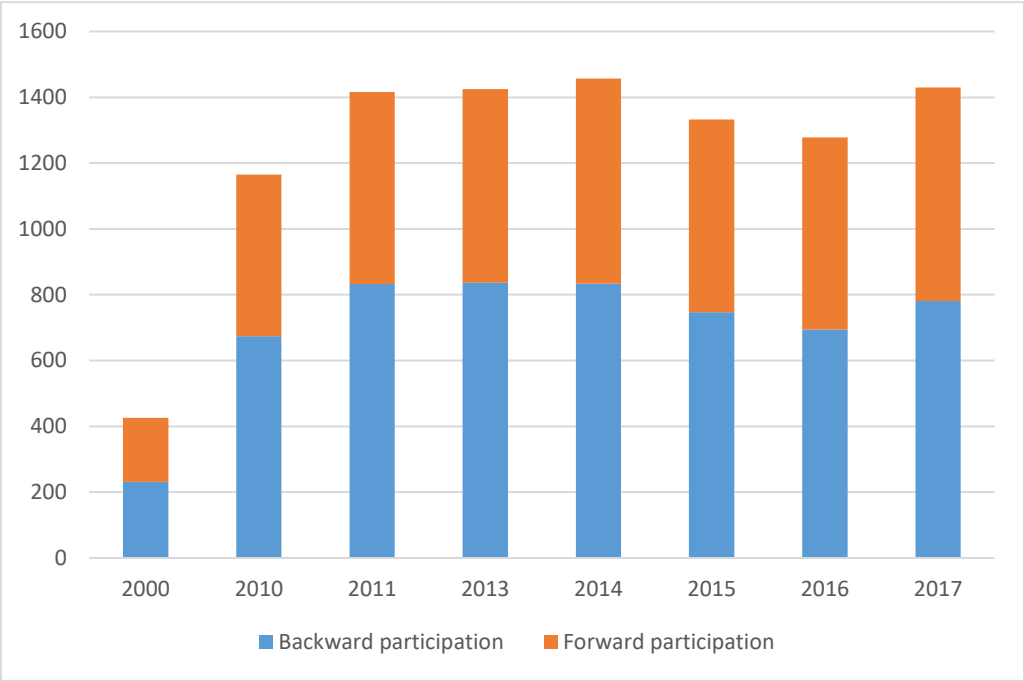
Figure (2b) shows that the dependency of ASEAN on East Asia has grown in recent years. This change could be largely driven by the rapid expansion of China as the export market for ASEAN; imports from China have also grown at the same time. As in the case of intra-East Asian integration, the share of ASEAN intraregional trade has been stable.

3.2 GVC participation in East Asia

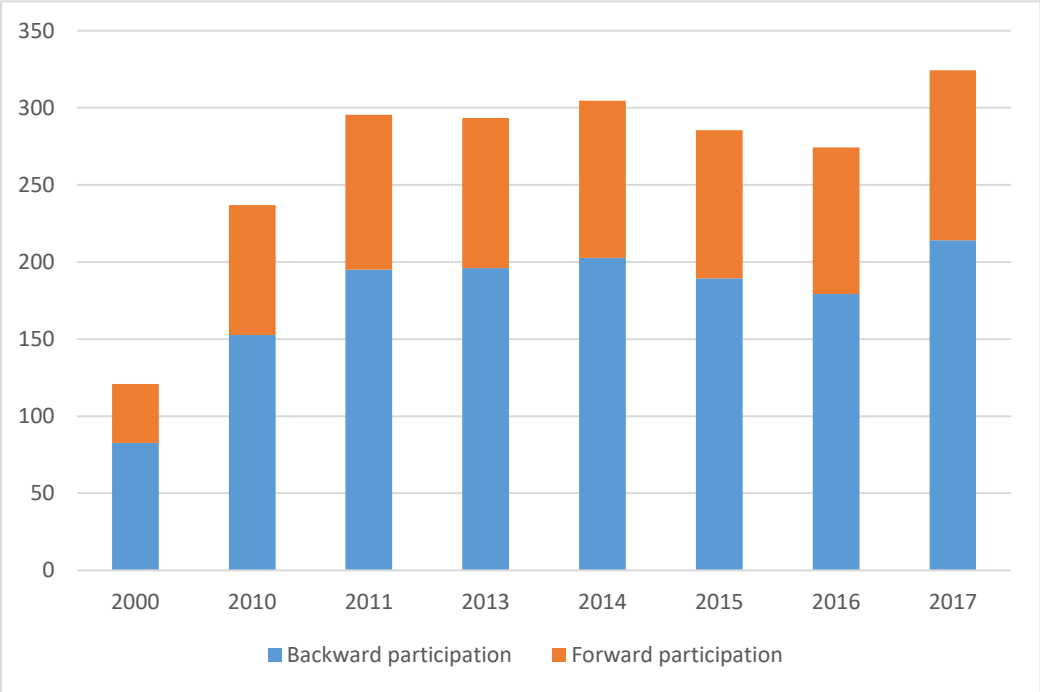
Figure 3 presents the value of both forward and backward GVC participation. Figure 3(a) shows that backward and forward participation in East Asia is about the same proportion in gross exports. This reflects the mixed patterns of GVC participation within the group because East Asia includes a diverse set of countries whose roles are different within GVCs. For example, Japan is more involved through forward linkages as a provider of parts and components. On the other hand, China is more involved in backward linkages as a point of the assembly country importing parts and components to be included as exports to the third countries.

Figure 3: Backward and forward GVC participation in exports (US$ billion)

(a)East Asia



(b)ASEAN



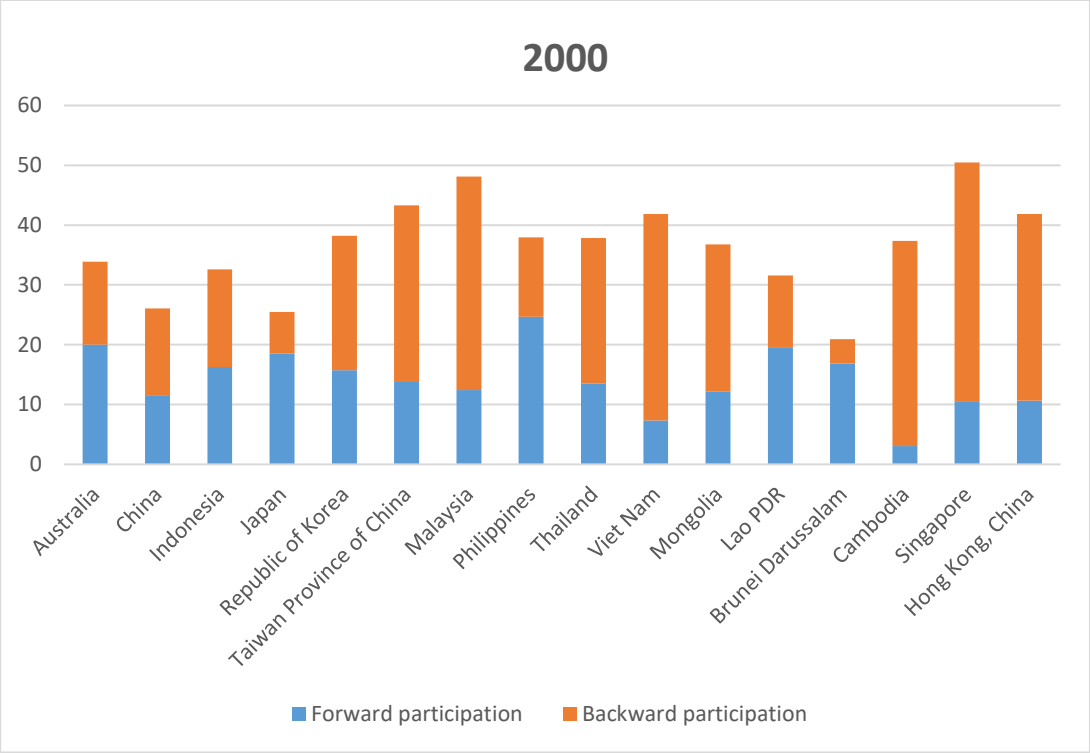
Note: See the definition of forward and backward participation in Section 2 of the main text. Also refer to figure 1.

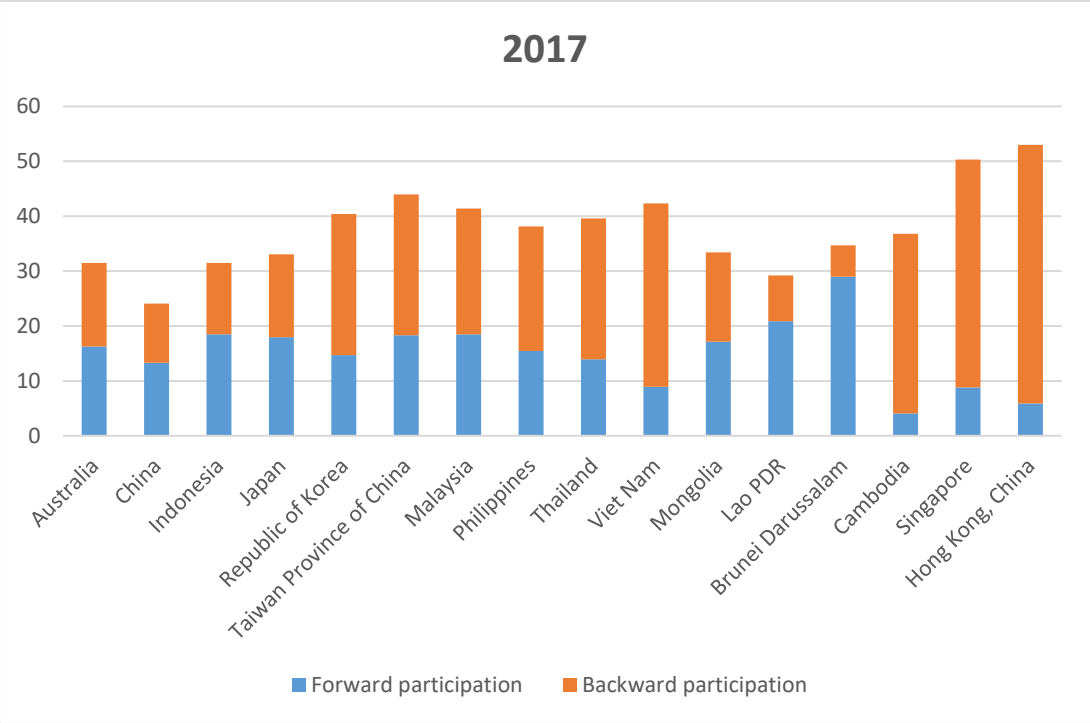
Figure 3(b) shows that the proportion of backward participation in ASEAN outweighs that of forward participation in gross exports: This implies that GVC participation by most of ASEAN countries is based on backward linkages sourcing intermediate inputs from other countries for their export production. The share of backward GVC participation shows a country's reliance on foreign inputs. The imported inputs tend to be diverse, ranging from natural resources, parts and components, service provision or other inputs.

The heterogeneity of GVC participation in a cross-country comparison is considered first. Figure 4 tabulates these two ratios for each country in East Asia for the years 2000 and 2017. As is commonly understood, economies such as Singapore and Hong Kong, China, with their significant presence in entrepôt trade, hold a high share of backward participation, accounting for the bulk of gross exports over the whole period. Japan has contributed to GVCs in a different way. In 2000, there was a larger share of forward GVC participation. This is in stark contrast to an assembly-based country such as China, where backward GVC participation is higher. However, in more recent years, there has been a mild increase in the share of the backward GVC participation. Japan has, over time, become more reliant on foreign value-added in its gross exports, possibly by replacing domestically produced parts and components with imported parts and components from ASEAN and other developing East Asian economies. This trend may be partly driven by Japanese multinational firms changing their sourcing patterns, importing foreign-manufactured intermediate inputs and using them for exports.

Figure 4: East Asia GVC participation by country (percentage of gross exports)

2000 and 2017





Note: See the definition of forward and backward participation in Section 2 in the main text. Also refer to figure 1.

In fact, some evidence shows that Japanese firms have increased sourcing parts and components from other economies, particularly China, the Republic of Korea and Taiwan Province of China, for the electronics and computer industries (Yamashita, 2010). Even though the data show some ongoing substitution between domestic and foreign value-added in gross exports , it does not mean that there has been a direct substitution between domestic and foreign value-added. This may be still driven by the expanded production of Japanese MNEs overseas, through the shifting of the domestic value-added to overseas locations. Indeed, there is no clear evidence that there has been a direct substitution between home employment and overseas employment among Japanese multinational firms (Yamashita, 2010).

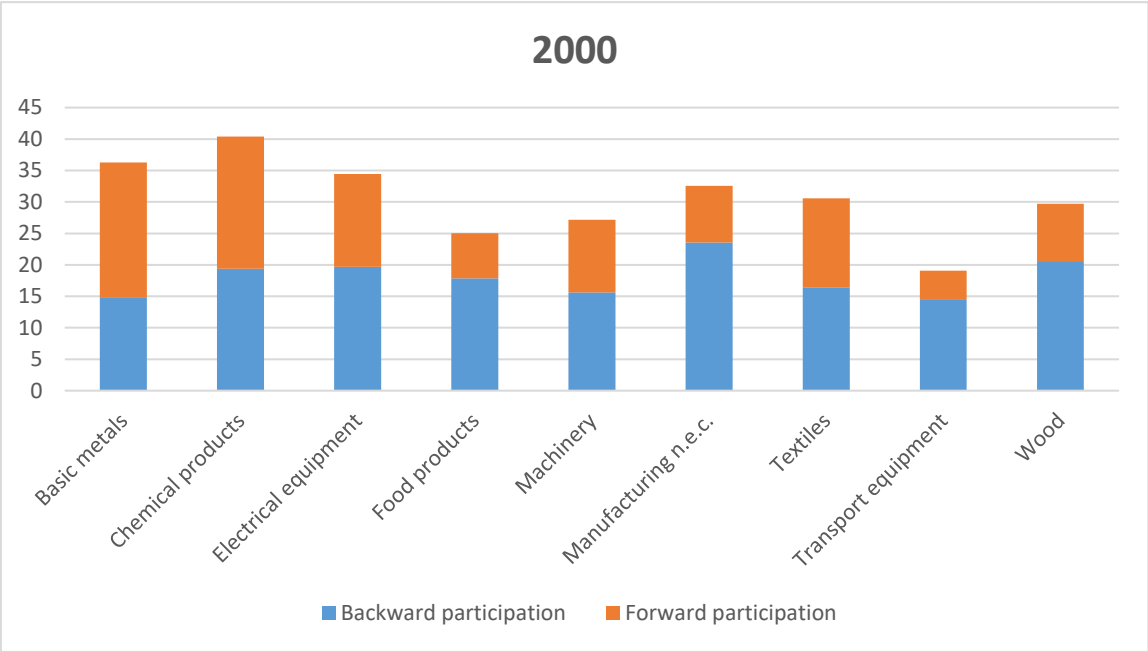
In contrast, China started with the larger share of backward GVC participation in gross exports in 2000; however, the share of China's backward integration declined mildly in 2017 with an increase in forward participation. This increase could be due to the expanded manufacturing base within China, mostly driven by MNE production. China is in transition to a country with a higher share of forward participation while having a broad base for backward participation. Perhaps, as a result of the domestic economy becoming more technologically upgraded and the continued expansion in MNE activities, China's role in GVC may also be changing, graduating from a pivotal assembly centre that imports parts and components and exporting final assembled products to industrial countries in Europe and North America, into providing domestically produced parts and components to other assembly locations.

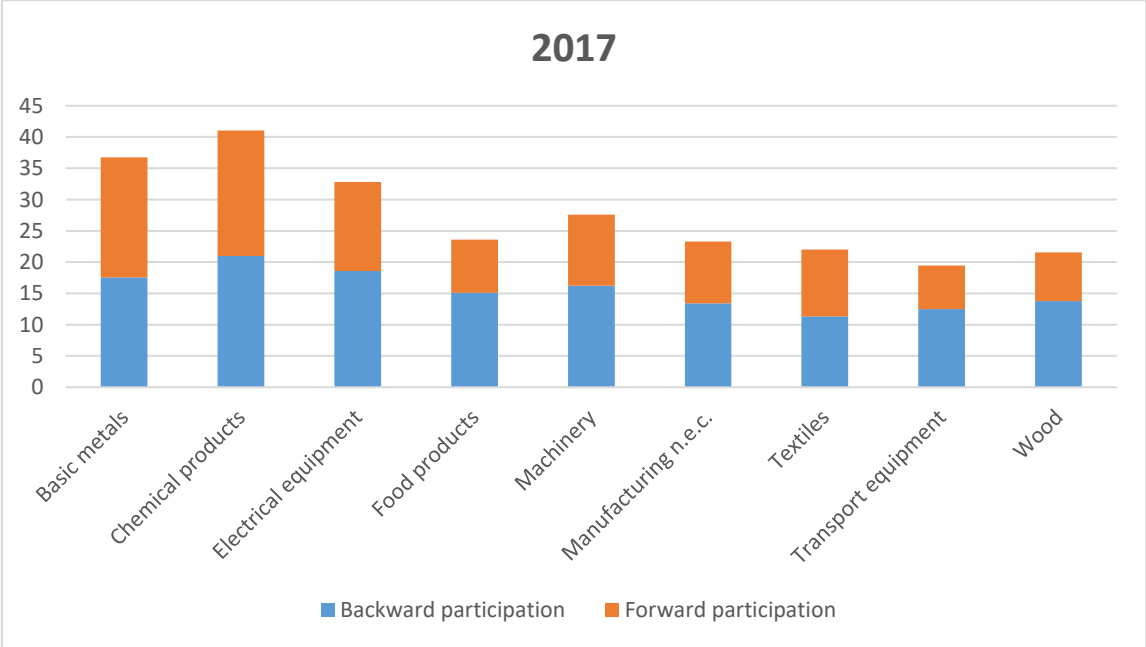
While ASEAN countries have been actively integrating with GVCs during recent decades, the degree of participation varies among the income groups. Middle-income countries like Malaysia and Thailand have maintained a high percentage of GVC participation since the year 2000, accounting for more than 40 per cent of gross exports. The higher proportion of backward participation indicates that these two

countries are mostly engaged with the assembly type of activities. It should also be pointed out that in Malaysia, while the combined share of GVC participation has declined during recent years, its composition has changed. While the share of backward participation has declined, contributing to a reduction in the overall share, the importance of forward participation has gained in its share of the total. This could be a sign of the structural change of Malaysia's move from an assembly-heavy country to being a provider of parts and components to other parts of GVCs. A similar change is not observed for Thailand. There has not been much development for Viet Nam and Cambodia in terms of their contribution to GVC participation. Backward participation accounts for the majority of GVCs.

It is also noted that resource-abundant countries (for example, Australia, the Lao People's Democratic Republic and Mongolia) are also having significant share of GVC participation in gross exports. For example, backward and forward GVC participation account for more than 30 per cent of gross exports from Australia in 2017. The results are partly because of their exports of natural resources which are used as inputs for manufacturing production in other countries. These exports of raw materials are captured because the national I-O table does not permit the separation of imported intermediate inputs between ordinal intermediate inputs such as gas and oil, and intermediate inputs such as parts and components arising from the movement and transactions of MNE manufacturing operations . While raw materials are mainly driven by resource endowments (shown by the above example of Australia being one of the largest resource exporters), the parts and components trade is influenced by totally different factors. For this reason, the TiVA approach based on the national I-O tables tends to assign high involvement for resource-rich countries.

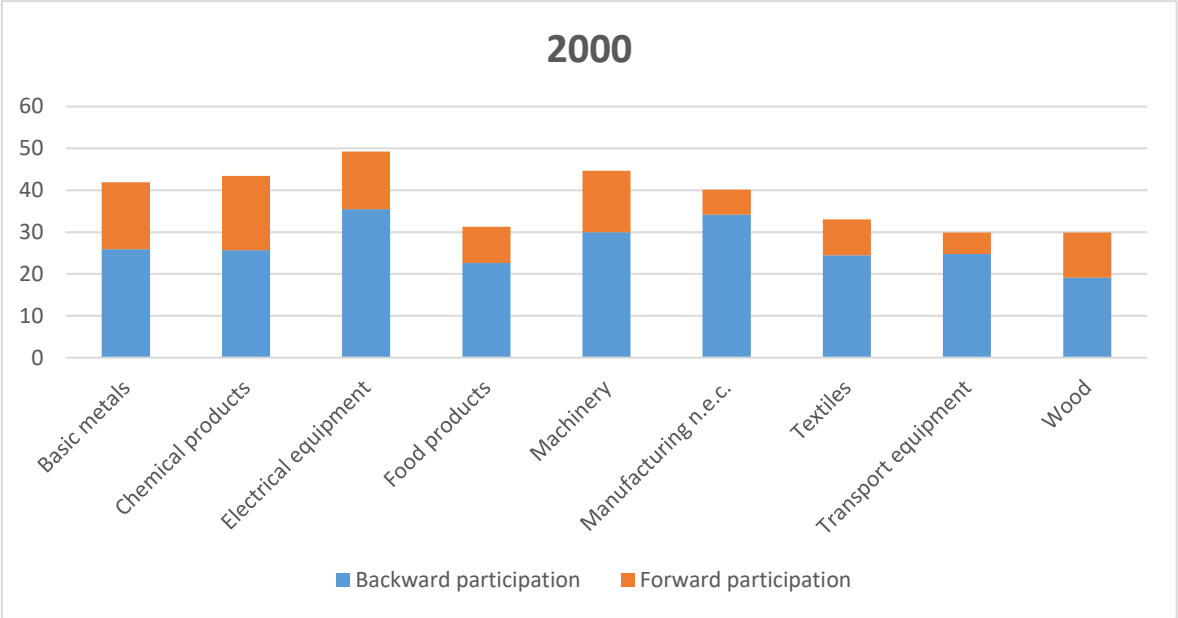
Figure 5: The proportion of backward and forward GVC participation in gross exports, by industry, in East Asia – 2000 and 2017

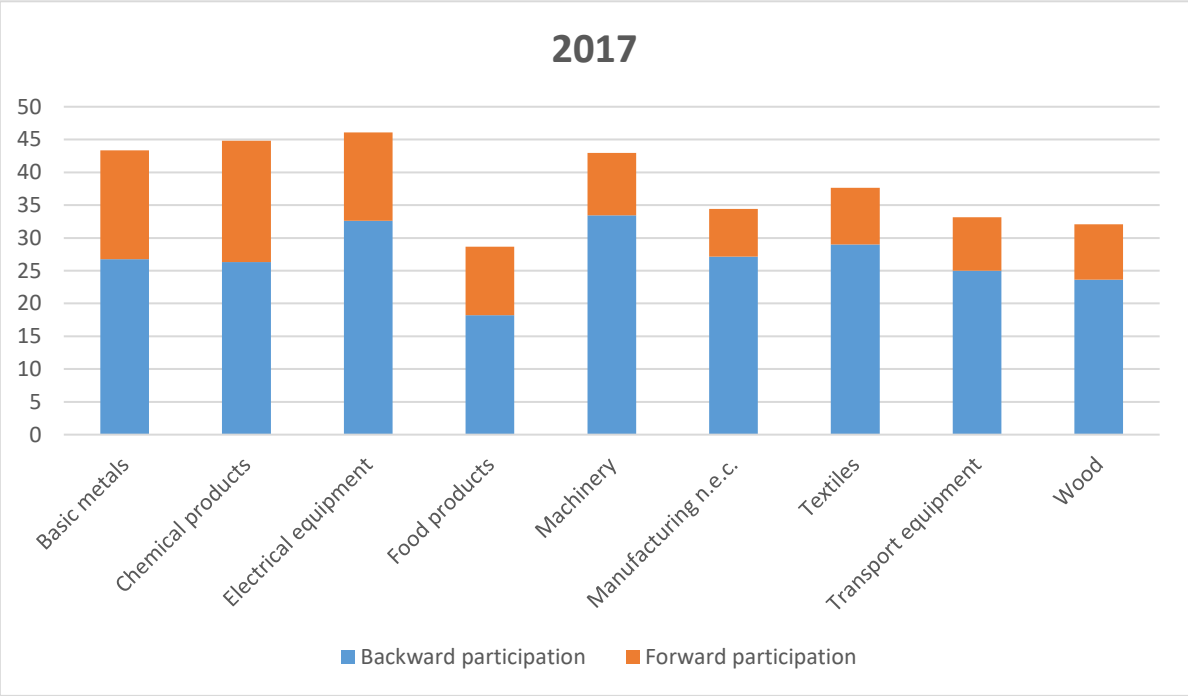




Note: See the definition of forward and backward participation in Section 2 in the main text. Also refer to figure 1.

Figure 6: The proportion of backward and forward GVC participation in gross exports, by industry, in ASEAN – 2000 and 2017





Note: See the definition of forward and backward participation in Section 2 in the main text. Also refer to figure 1.

Figures 5 and 6 tabulate the share of backward and forward participation in gross exports by broad industry categories in 2000 and 2017. The underlying technology used can be a critical factor in predicting the degree of GVC participation across

industries. Technology advancement has allowed final-goods producers to slice the production process into a finer degree of production stages and segments (the technical divisibility of the production process) (Jones, 2000). A simple rule of thumb is that the production fragmentation process can only occur and grow in industries that have the potential to vertically break up that process. For example, engineering activities such as manufacturing of automobiles and electronics can increasingly be separated into discrete production stages with different skills requirements, scales and factor inputs (Lall and others, 2004). This has allowed MNEs to locate a sequence of the production process at the most suitable locale for a wide range of activities further reductions in production costs. This process has facilitated allowed what was once trapped within domestic trade to travel across international borders in this sector (Krugman, 1995).

3.3 Global and regional linkages of value chains in East Asia

While the expansion of production networks is not limited to being regional, East Asia has a strong base of regional value chains (RVCs). This subsection examines the development of GVCs and RVCs in East Asia.

Table 1 shows the extent of GVCs and RVCs, measured in terms of the shares of gross exports, in East Asia and ASEAN. Backward participation and forward participation with their geographical associations (sourcing and selling). In addition, the contribution of each measure to GVC and RVC has been computed. For each indicator, table 1 shows three possible scopes of GVC linkages in East Asia and ASEAN – linkages with countries outside East Asia, within East Asia, and with ASEAN countries in particular.

Table 1: GVC and RVC participation by East Asia and ASEAN during 2000-2017

	Backward GVC participation (% of gross exports)				Forward GVC participation (% of gross exports)				Value chain participation (%)		
	Total	Outside East Asia	In East Asia	In ASEAN	Total	Outside East Asia	In East Asia	In ASEAN	GVC	RVC	Contribution
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	A =B+C1	B	C1	C2	D=E+F1	E	F1	F2	G=A+D	H=C+F	H/G
East Asia											
2000	17.0	12.0	5.0	1.4	12.3	7.7	4.6	3.2	29.3	9.6	32.8
2010	18.0	12.4	5.6	1.7	12.4	7.4	5.0	2.0	30.4	10.6	34.9
2011	18.8	12.7	6.1	1.8	12.4	7.5	4.9	2.0	31.2	11.0	35.3
2013	17.9	12.1	5.8	1.9	11.9	7.4	4.5	2.0	29.8	10.3	34.6
2014	17.0	11.7	5.3	1.8	12.0	7.5	4.5	2.1	29.0	9.8	33.8
2015	16.2	11.2	5.0	1.8	11.9	7.5	4.4	2.1	28.1	9.4	33.5
2016	15.4	10.7	4.7	1.7	12.3	7.6	4.7	2.2	27.7	9.4	33.9
2017	15.9	10.8	5.1	1.8	12.3	7.7	4.6	2.3	28.2	9.7	34.4
ASEAN											
2000	26.7	19.4	7.3	2.9	9.8	6.3	3.5	3.8	36.5	10.8	29.6
2010	23.5	16.7	6.8	3.2	11.6	7.0	4.6	3.1	35.1	11.4	32.5
2011	24.7	17.6	7.1	3.3	11.5	7.1	4.4	2.9	36.2	11.5	31.8
2013	24.2	17.1	7.1	3.6	11.0	6.5	4.5	2.9	35.2	11.6	33.0
2014	24.2	17.6	6.6	3.5	10.8	6.6	4.2	3.0	35.0	10.8	30.9
2015	23.4	17.3	6.1	3.5	10.7	6.6	4.1	3.0	34.1	10.2	29.9
2016	22.2	16.4	5.8	3.5	10.8	6.7	4.1	2.8	33.0	9.9	30.0
2017	23.3	16.8	6.5	3.6	10.7	6.6	4.1	3.1	34.0	10.6	31.2

Source: ADB-MRIO database.

With regard to backward linkages, both East Asia and ASEAN rely on sourcing FVA mostly outside the East Asian region. For example, in 2017 East Asia sourced about 10.8 per cent of FVA in gross exports, compared with 16.8 per cent for ASEAN. Perhaps, the dependence of external partners for FVA is relatively lower for East Asia because it includes large economies (Japan and China) and covers more countries. These observations point out the importance of outside the region for the ongoing dynamism of GVCs for East Asia. Hence, the spread of GVCs has strengthened the case of the global approach to trade policymaking rather than having a sole focus on regional expansion (Athukorala and Yamashita, 2006).

Despite the share of forward linkages in exports is still smaller than that of the backward linkages, forward linkages tend be more regionally oriented. For East Asia overall, in 2017, 4.6 per cent were forward-linked exports directed to countries in the same region. For ASEAN, in the same year, forward linkages with East Asia accounted 4.1 per cent of their total exports. Most of the regional forward-linked exports (3.1 out of 4.1 per cent) were intra-subregional. Possible factors for this high regional dependency in the forward participation are the infrastructure connectivity and the favourable regional policy setting.

3.4 Sectoral analysis of the textiles, electronics and automotive industries

This subsection focuses on the three major manufacturing sectors of textiles (table 2), electronics (table 3) and automotive (table 4).

Table 2: Participation in GVCs and RVCs (percentage of gross exports), East Asia and ASEAN, in textiles, textile products, leather and footwear

	Backward GVC participation (% of gross exports)				Forward GVC participation (% of gross exports)				Value chain participation		
	Total	Outside East Asia	In East Asia	In ASEAN	Total	Outside East Asia	In East Asia	In ASEAN	GVC	RVC	Contribution
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	A =B+C1	B	C1	C2	D=E+F1	E	F1	F2	G=A+D	H=C+F	H/G
East Asia											
2000	15.9	12.2	3.7	0.6	12.8	9.6	3.2	1.3	28.7	6.9	24.0
2010	12.6	10.2	2.4	0.6	8.3	6.7	1.6	1.3	20.9	4.0	19.1
2011	13.1	10.3	2.8	0.6	8.8	7.1	1.7	1.4	21.9	4.5	20.5
2013	11.9	9.4	2.5	0.6	8.6	7	1.6	1.5	20.5	4.1	20.0
2014	11.2	8.9	2.3	0.6	8.4	6.9	1.5	1.8	19.6	3.8	19.4
2015	10.4	8.4	2	0.6	7.9	6.5	1.4	1.9	18.3	3.4	18.6
2016	10.3	8.4	1.9	0.6	7.9	6.6	1.3	2.1	18.2	3.2	17.6
2017	10.6	8.5	2.1	0.7	8.4	7	1.4	2.3	19.0	3.5	18.4
ASEAN											
2000	23.1	20.1	3	1.4	7.1	5.3	1.8	1.4	30.2	4.8	15.9
2010	23.4	20.6	2.8	1.3	6.5	4.7	1.8	1.2	29.9	4.6	15.4
2011	26.5	22.7	3.8	1.2	6.7	4.9	1.8	1.3	33.2	5.6	16.9
2013	26.0	22	4	1.7	7.0	5.3	1.7	1.4	33.0	5.7	17.3
2014	26.5	22.4	4.1	1.8	7.1	5.7	1.4	1.6	33.6	5.5	16.4
2015	26.3	22.7	3.6	1.8	6.8	5.6	1.2	1.7	33.1	4.8	14.5
2016	24.7	21.6	3.1	1.6	7.0	5.8	1.2	1.9	31.7	4.3	13.6
2017	27.2	23.1	4.1	1.8	6.7	5.5	1.2	1.9	33.9	5.3	15.6

Source: ADB-MRIO database.

GVCs in clothing and textiles are usually governed by the major global brand retailers and their strategies. In simple terms of GVCs, the upstream process begins with the preparation of fibres, which are then used to manufacture textiles. Textiles are then integrated by another layer of firms for manufacturing garments. This process also includes the following activities: fabric scanning; design; cutting; stitching; pressing; and packaging. Each step requires a different skill mix of technology, labour and capital. Nowadays, manufacturing in the clothing industry has become technology-intensive with the use of information and communications technology and computer-aided manufacturing.

GVC-participation indicators indicate that both backward and forward participation in East Asia, including ASEAN, have declined since 2000. Backward participation in East Asia stood at 10.6 per cent of gross exports, down from 15.9 per cent in 2000 and 12.6 per cent in 2010. This drop is mostly attributed to the decline in relying on imported inputs from outside the East Asian region. It declined from 12.2 per cent in 2000 to 8.5 per cent in 2017. A similar observation can be made in regard to forward GVC participation. On the other hand, the backward participation of ASEAN has grown since 2000 and 2010. It was 23.1 per cent in 2000, 23.4 per cent in 2010 and 27.2 per cent in 2017. This intraregional concentration of foreign value-added creation is perhaps driven by the active role of major MNEs operating within ASEAN. Especially countries like Cambodia and Viet Nam have developed into major players in GVCs for textile and clothing industries. Their rise in GVCs is partly explained by the migration of textile and clothing manufacturing from China since that country started to climb up the technological ladder in the export bundle, away from labour-intensive industries to more capital-intensive industries (Schott, 2008).

Table 3: Participation in GVCs and RVCs (percentage of gross exports), East Asia and ASEAN, in electrical and optical equipment

	Backward GVC participation (% of gross exports)				Forward GVC participation (% of gross exports)				Value chain participation		
	Total	Outside East Asia	In East Asia	In ASEAN	Total	Outside East Asia	In East Asia	In ASEAN	GVC	RVC	Contribution
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	A =B+C1	B	C1	C2	D=E+F1	E	F1	F2	G=A+D	H=C+F	H/G
East Asia											
2000	18.6	14.1	4.5	1.1	11.6	7.7	3.9	3.2	30.2	8.4	27.8
2010	19.9	14.5	5.4	1.2	12.3	7.7	4.6	1.4	32.2	10.0	31.1
2011	20.8	14.9	5.9	1.3	12.3	7.7	4.6	1.5	33.1	10.5	31.7
2013	19.7	14.2	5.5	1.3	12.0	7.5	4.5	1.4	31.7	10.0	31.5
2014	18.9	13.6	5.3	1.2	12.2	7.4	4.8	1.4	31.1	10.1	32.5
2015	17.8	12.9	4.9	1.2	12.2	7.5	4.7	1.4	30.0	9.6	32.0
2016	16.9	12.2	4.7	1.2	12.6	7.7	4.9	1.4	29.5	9.6	32.5
2017	17.3	12.2	5.1	1.2	12.9	7.9	5	1.4	30.2	10.1	33.4
ASEAN											
2000	32.6	23.9	8.7	2.8	9.1	5.9	3.2	4.7	41.7	11.9	28.5
2010	28.2	18.7	9.5	4.8	11.0	5.4	5.6	3.7	39.2	15.1	38.5
2011	29.3	19.2	10.1	4.8	10.9	5.4	5.5	3.3	40.2	15.6	38.8
2013	28.9	19.6	9.3	4.8	10.7	5.1	5.6	3.2	39.6	14.9	37.6
2014	28.7	19.7	9	4.6	10.4	5	5.4	3.3	39.1	14.4	36.8
2015	28.2	19.6	8.6	4.6	10.2	5	5.2	3.3	38.4	13.8	35.9
2016	26.2	18.1	8.1	4.7	10.7	5.1	5.6	3.3	36.9	13.7	37.1
2017	28.0	19	9	4.7	10.4	5	5.4	3.1	38.4	14.4	37.5

Source: ADB-MRIO database.

Table 3 shows the patterns of GVC participation in the electrical and optical equipment (electronics) industry. Again, the consistent pattern of relatively higher reliance on extra-regional for backward participation can be observed compared to forward participation. For example, in 2017, 12 per cent of gross exports were linked to backward participation from outside the region for East Asia, and 19 per cent for ASEAN. In the same year, forward participation was recorded at 8 per cent of gross exports for East Asia and 5 per cent for ASEAN. One possible explanation is the nature of technological development in this industry; since many countries in East Asia are still at the developmental stage, they tend to rely on external backward participation. ASEAN is integrated more globally than in East Asia.

The key feature of development in GVCs for the electronics industry is the emergence of modular technology, which has had the effect of significantly expanding the possibility of global-scale GVC in East Asia, creating the so-called “modular production network”. In general, modular technology has allowed some components to be standardized for use in multiple final products across different sectors; examples include computer chips and long-lasting batteries. Computer chips are now used in a wide range of manufacturing processes, from computers to toasters, while long-lasting batteries, originally designed for use in mobile phones, are now widely used in electronic organizers, transmitters, radios, lap-top computers and missiles. These manufacturers provide “standardized” components and services on a contract basis to leading firms including, for example, the purchasing of parts, testing and packaging, the supply of chain management and services.

This has also had an impact on the way production networks are organized within this industry’s multinational production. The key development is the emergence of contract manufacturers who provide traditional and standardized manufacturing functions,

product (re)designing, component processing and purchasing, inventory management, routine tests as well as after-sales services and repairs. These functions of contract manufacturers are highly modular in nature, being accessed and shared by a wide array of lead firms. The use of contract manufacturers may bring cost and flexibility advantages to 'lead firms' (Borrus and others, 2000; Sturgeon, 2003). As a result of the widespread use of modular technology in the electronics industry, major firms such as Hewlett Packard and Ericsson have been able to sell most of their worldwide manufacturing infrastructure to contract manufacturers Solectron and Flextronics.[8]

[8] The modular production network has also spread into the semiconductor and other heavy industries in the United States. In the automotive industry of the United States, Ford and General Motors have retained vehicle design and final assembly and rely on an increasing volume of components ,such as entire automotive interior systems, headlights, carpets, cockpits, and interior panels and module design from Leair, Johnson Contrils, Magna and TRW.

Table 4: Participation in GVCs and RVCs (percentage of gross exports), East Asia and ASEAN, in transport equipment

	Backward GVC participation (% of gross exports)				Forward GVC participation (% of gross exports)				Value chain participation		
	Total	Outside East Asia	In East Asia	In ASEAN	Total	Outside East Asia	In East Asia	In ASEAN	GVC	RVC	Contribution
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	A =B+C1	B	C1	C2	D=E+F1	E	F1	F2	G=A+D	H=C+F	H/G
East Asia											
2000	13.8	11.4	2.4	0.8	3.9	2.9	1	0.6	17.7	3.4	19.2
2010	14.1	11.8	2.3	0.7	5.6	3.2	2.4	0.5	19.7	4.7	23.9
2011	14.2	11.8	2.4	1	5.7	3.3	2.4	0.7	19.9	4.8	24.1
2013	13.0	11	2	0.9	5.5	3.5	2	0.6	18.5	4.0	21.6
2014	12.5	10.4	2.1	1	6.0	3.8	2.2	0.6	18.5	4.3	23.2
2015	11.5	9.6	1.9	1	5.9	3.8	2.1	0.6	17.4	4.0	23.0
2016	11.3	9.4	1.9	0.9	6.1	4	2.1	0.7	17.4	4.0	23.0
2017	11.4	9.3	2.1	1	6.2	4	2.2	0.7	17.6	4.3	24.4
ASEAN											
2000	22.4	18.1	4.3	2.4	4.3	3.5	0.8	0.9	26.7	5.1	19.1
2010	23.4	19.5	3.9	1.8	7.0	5.6	1.4	0.7	30.4	5.3	17.4
2011	23.1	18.7	4.4	2.7	6.8	4.8	2	1.2	29.9	6.4	21.4
2013	22.8	18.5	4.3	3.5	6.6	4.9	1.7	1.2	29.4	6.0	20.4
2014	22.6	18.5	4.1	3.3	6.3	4.6	1.7	1.2	28.9	5.8	20.1
2015	21.9	18.2	3.7	3.2	6.4	4.8	1.6	1.1	28.3	5.3	18.7
2016	21.1	17.5	3.6	2.8	6.8	5.2	1.6	1.2	27.9	5.2	18.6
2017	21.6	17.5	4.1	3.4	6.9	5.2	1.7	1.2	28.5	5.8	20.4

Source: ADB-MRIO database.

Backward participation in the transport equipment industry also shows predominant linkages outside the region. For example, in 2017 backward linkages for East Asia outside the region were recorded as 9.3 per cent in gross exports (compared with 2.1 per cent for backward participation by intra-East Asia). Again, this could be due to the availability of technology-intensive parts and components within the region. Thus, extra-region reliance naturally increases. In terms of forward linkages, the extra-region reliance gets smaller (e.g., 4 per cent of forward participation was directed to outside the region in 2017 and 2.2 per cent was recorded within the region).

One of the key differences in GVC participation in this industry compared to others is the lower level of GVC participation. In 2017, 17.6 per cent of gross exports was attributed to the GVC of the transport equipment industry. In the same year, GVC participation in the electronics industry was 30.2 per cent. Importantly, despite its smaller share, the contribution of RVC in East Asia has increased during the period from 2000 to 2017. The key driver is the increases of forward linkages among East-Asian economies, which grew from 3.9 per cent to 6.2 per cent of gross exports in 2000 and 2017, respectively. The indicator indicates that RVC of electronics in East Asia have been growing over time for transport equipment.

One possible explanation for this lower GVC participation is the value-to-weight ratio. In the electronics and semiconductors industry, fragmentation of production is relatively easier in terms of the logistics, because each part or component is relatively light with lower transportation costs, but high-value contents. Whereas in the automotive industry the option of GVCs is a more constrained option because moving each component is relatively expensive (e.g., body parts, bumpers and interiors). Therefore, the locations might have to be very proximate in order to minimize transportation costs of this industry. This value-to-weight ratio of the product in the

automobile sector might explain the relatively lower GVC process in this industry. This does not mean that the GVC in this industry has been a slow process. While the extent of agglomeration and industry clustering are not covered in this study, there have been strong indications that MNEs tend to form the industrial cluster by forging strong linkages to local economies. The prime example Thailand's automotive industry, which achieving nearly 100 per cent of local sourcing in parts and materials (Athukorala andKohpaiboon, 2010).

Another key factor could be technology. The automotive industry tends to rely on integral technology, rather than modular technology, for making parts and components firm-specific or product-specific (or even brand-specific). Unlike modular technology, it involves confidential technological and knowledge assets. For this reason, firms have greater incentive to keep the production of components with integral technology within their own boundaries (intra-firm trade) or to manage production networks within close proximity to the firms. This could naturally result in a lower level of forward GVC participation.

4. Roles of policies to enhance value chain integration: The East Asian experience

One of the enlightening features of GVCs is that even small companies have the potential for integration into global production networks without having full production and managerial capacity. In this case, the policy becomes a critical factor in enabling these small enterprises to tap into the global bases. As tariffs in general have declined because of unilateral trade liberalization, to a large extent trade policy now focuses on NTMs. In addition, the stall of multilateral trade negotiations has increased incentives to seek preferential market access through FTAs. This section reviews how these two

major trade policies have affected the development of GVCs in East Asia. The next section touches upon other policies that can be crucial to building a conducive environment for further expansion of GVCs in the region.

4.1 The role of Free Trade Agreements

In theory, further reductions in tariffs can have so-called “magnified” positive effects on trade flows in GVCs because this type of trade crosses international borders several times (Yi, 2003). Therefore, any marginal reduction in the protection scheme can significantly lower trade costs for trade in parts and components. This has possibly been supported by the parallel development of the spread of production networks in East Asia since the 1990s with the proliferation of FTA deals during the same period. Hence, any reduction of tariff barriers in South Asia should be welcomed. However, relevant empirical findings and the actual policy contexts suggest that the growth of production networks in East Asia has been growing as a phenomenon that is independent of FTAs in the region (Menon, 2013). It should also be noted that FTAs are not the right policy instruments for promoting growth and the spread of production networks in the region.

In practice, the net effects of FTAs on trade in GVCs are complicated by the following factors. First, FTAs may not have any actual impacts on trade in parts and components, since these types of products are usually duty-free owing to the “tariff escalation”structure, which makes MFN tariff rates almost negligible or significantly lower for parts and components. In other words, the margins of preference are practically worthless for this product category. In addition, as pointed out by Menon (2013), most of the key components – telecommunications equipment, semiconductor and printed circuit assemblies – are already covered by information technology

agreements (ITAs), which permit these products to travel duty-free across almost all international borders.[9]

Second, trade flows in final assembled goods consisting of a larger number of imported parts and components may not be facilitated well due to the presence of complex Rules of Origin (RoO) in existing overlapping FTAs. Under an FTA, countries can maintain their own external tariffs while offering preferential (mostly zero) tariffs to the member countries.[10] In this setting, RoOareplaced to prevent imports of any products into member countries through a country with the lowest tariff on the item in question, and then re-exported to other member countries (the final destinations). However, if the RoO impose the stringent criteria for identifying the "true" origins of parts and components used in assembled products entailing cumbersome administrative compliance procedures, FTAs would not be used at all by firms involved with global production networks (Demidova and Krishna, 2008).[11] The related administrative costs for satisfying RoO arise from the need for exporting firms to prepare all the documentation required to obtain Certificates of Origin (CoO), which certify that export goods are locally produced. The costs also include the different schedules for phasing out tariffs, conforming to different RoO of overlapping FTAs, exclusions, conflicting standards and differences in the rules as well as other regulations and policies inherited with the agreements. Indeed, these costs easily outweigh the preferential tax

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[9]One additional point put forward by Menon (2013) is the existence of export processing or free trade zones (FTZs). Normally, multinational firms involved in global production networks are located in these privileged areas by benefiting from the duty-free treatment of these products.

[10] More precisely, under FTAs except for the customs unions where member countries also offer uniform external tariff rates.

[11] There are four types of criteria fordetermining the origins of goods: (a) the value-added content criterion; (b) change in tariff classification criterion; (c) the optional criterion of allowing a choice of either (a) or (b); and (d) the dual criterion requiring satisfaction of both (a) and (b) (Cadot and others, 2006).

reductions for a larger number of imported parts and components from a wide array of countries. Two additional points that emphasis the complicated nature of RoO (Menon, 2013) are that:

(a) The conventional value-added content criterion may not be a binding constraint since the value-added is extremely low for parts and components;[12] and

(b) A change in the tariff classification criterion may disqualify many parts and components, both inside and outside the region, since they virtually fall under the same HS 6-digit code.

The following example cited illustrates the second point (Athukorala and Kohpaiboon, 2011). Printed circuit board assembly (PCBA) in Thailand using imported bare printed circuit boards (BPCB), together with other locally sourced electronic components such as integrated circuits and semiconductors, are not eligible for FTA concessions because both PCBA and BPCB fall under the same HS code (853690). In fact, available evidence suggests a lower than the expected utilization rate of the FTA scheme for exporting firms in Asia (Hayakawa and others, 2009). For example, only 3.6 per cent of exporting firms are reported to be using the Japan-Singapore agreement and 5.5 per cent for the Japan-Malaysia agreement.

All in all, the creation of FTAs in the context of GVCs may not exert the expected trade enhancement effects, despite significant resources invested in preparation, negotiations and maintenance. The most fundamental problem in using FTAs as policy instruments is that these agreements need to protect the provision of preferences by excluding non-member countries. However, as Athukorala and Yamashita (2006) pointed out, the expansion of regional trade in parts and components in East Asia has been sustained only because of the growing extraregional demand for final assembled goods in this region. At the same time, this facilitates the expansion of intraregional exchanges of trade in parts and components. Hence, to promote the natural expansion

[12]See the detailed breakdown of value-added in iPad –the valued-added in the assembly country, which is China, is a very tiny margin.

of global production networks, FTAs should be designed in a manner consistent with the multilateral MFN basis, rather than for excluside use by regional member countries only.

4.2 The effects of Non-Tariff Measures

The term NTM refers to a variety of trade measures other than tariffs and include technical barriers to trade (TBT), and sanitary and phytosanitary (SPS) measures that aim to protect human, animal and plant life as well as the environment. Such measures have become more significant deterrents to trade than tariffs. Unlike tariffs, however, NTMs are less transparent and more difficult to comply with, especially for small producers and traders. The increased presence of NTMs may partly explain the limited role of FTAs in the progress of GVCs, as noted in the previous section.

The crucial point is that tariffs on goods are already low, especially intermediate goods in East Asia. However, in recent years policymakers have started to turn to the alternative form of trade protection, i.e., NTMs, even in East Asia. For example, it has been observed that while tariffs are rapidly declining, the number of NTMs is increasing in Viet Nam. The average preferential tariffs of Viet Nam fell from 13.1 per cent in 2003 to 6.3 per cent in 2015. In contrast, the number of NTMs increased by more than 20-fold during the same period.[13] International experience also shows that poorly designed and implemented NTMs could restrict trade, distort prices and erode national competitiveness. According to the World Bank's assessment, the NTM system in Viet Nam remains complicated, opaque and costly, resulting in a high cost of compliance. One study has estimated that the equivalent tariff rate that SPS measures of Viet Nam

[13] Information is sourced from, https://www.worldbank.org/en/news/press-release/2018/12/12/vietnams-economy-grows-robustly-but-risks-intensify

are imposing on imported goods is 16.6 per cent compared with the average level of 8.3 per cent for ASEAN countries.

To understand the role of NTMs in trade that is related to GVCs in East Asia, this study undertook an empirical analysis using the gravity model of bilateral trade flows. The gravity model has been the workhorse for empirical research of international trade for many years (see the Technical Appendix to this report for a general discussion on the gravity equation). The specification presented in De Melo and Nicita (2018) was used to estimate the effects of NTMs on GVCs. The benchmark estimate is expressed as:

$$\ln M_{ijt}^{k} = \alpha + \beta_1 NTM_{it}^{k} + \beta_2 \ln D_{ij} + G_{ijt}\beta_3 + \varepsilon_{ijt}^{k}$$

where *M* denotes imports to industry *k* by country *i* from country *j*, *NTM* is a key variable capturing the NTMs (a dummy variable was used to capture the coverage of NTMs in a given industry *k* for country *i*), *D* is the bilateral distance between *i* and *j*, and *G* is a vector of bilateral controls (GDP, common border, common language). Because the focus is on trade flows linking GVCs, the three indicators of *M*: total imports by country *i*from country *j*; intermediate imports by country *i* from country *j* to be used in country *i*'s exports to a third country (the term DVA_INTrex used in Technical Annex figure A1); and direct importers' value-added in the exporting country's final goods and intermediate exports (FVA=FVA_FIN+FVA_INT in Technical Annex figure A1).

This framework identifies the distortionary effects of NTMs on trade flows representing GVCs. NTMs often increase fixed costs for exporters (as well as importers) such as the administrative costs of obtaining an import license or new machinery to comply with hygienic requirements). The estimated coefficient on NTM provides an indication of the impact of NTMs on the types of imports. Because they may be many sets of unobservable in the bilateral exchange of goods, we include country and year fixed effects to better capture country-specific differences in origin and destination countries.

4.3 Data

The following data sets were combined to conduct the analysis. First, the bilateral trade flows were obtained from the ADB-MRIO dataset for 62 countries including the East Asia region (see Technical Annex table A2 for a full list of the countries) for 2000 and 2010-2017. Second, NTM data were collected from the UNCTAD online database.[14] Third, the standard variables (distance, common border, language, ethnicity and colonial links) used in the gravity equation were collected from CEPII[15] and data for GDP were sourced from the World Bank Development Indicators.[16]

These variables represent different disaggregation, hence the following procedure was used to merge the three datasets. First, NTM data were originally organized at the HS 6-digit level, which can usually be matched to trade flows at the level of the same disaggregation. However, the data from ADB-MRIO is only available for the broad 34 industries. In order to match at this level of aggregation, the HS6 digit NTMs data were collapsed to the broad industry categories (similar to HS 1 digit). Once the data for trade and NTMs were organized for the bilateral sets of countries across 2000-2017, they were merged into other gravity variables at the country level. To measure the extent of NTMs, a simple dummy variable was used that specified the value of 1 if NTMs are recorded at the HS 6-digit level under HS 1-digit heading, otherwise zero. A dummy variable is the simplest way to measure the prevalence of NTMs, but it may be narrow in focus. In the literature, frequency and coverage indexes use NTMs data (UNCTAD, 2012). However, the restriction in setting is that trade data for GVCs are only available for the broad industry categories. This precludes computation of alternative ways of capturing the prevalence of NTMs across industries.Based on the

[14]See https://trains.unctad.org/.

[15]See http://www.cepii.fr/cepii/en/bdd_modele/bdd.asp.

[16]See http://datatopics.worldbank.org/world-development-indicators/.

constructed dataset, the focus was on three broad industries – food, electronics and transport equipment.

5. Results

Table 5 shows the main estimation results. Since the extent of NTMs can vary across industries, the estimation is performed at the selected broad industry level for each industry (food, electronics and transport equipment). A dummy was created for NTMs if at least one NTM measure registered at the HS 6-digit level (the study aggregates up to the broad industries). All explanatory variables in the specification vary only at the country level. For columns (1)-(3), the dependent variable is the log of gross exports, (4)-(6) for domestic value-added in the direct use of importers (to produce for exports to a third country), and (7)-(9) for importers' value-added in the exporting country's final or intermediate goods.

Table 5: Influence of NTMs on GVCs and RVCs (percentage of gross exports) in the gravity model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Log of total exports			Log of domestic value-added in intermediate exports used by importers			Log of importer's value-added in exporting country's exports		
Importers - All	Food	Electronics	Transport	Food	Electronics	Transport	Food	Electronics	Transport
ln GDP exporter	0.492***	0.485***	0.243***	0.188***	0.262***	0.111***	0.274***	0.307***	0.128***
	(0.019)	(0.023)	(0.016)	(0.011)	(0.018)	(0.009)	(0.013)	(0.019)	(0.012)
ln GDP importer	0.403***	0.520***	0.310***	0.129***	0.277***	0.104***	0.241***	0.404***	0.190***
	(0.023)	(0.030)	(0.018)	(0.011)	(0.022)	(0.010)	(0.015)	(0.024)	(0.012)
ln distance	-0.847***	-0.903***	-0.721***	-0.419***	-0.665***	-0.436***	-0.642***	-0.769***	-0.521***
	(0.034)	(0.033)	(0.027)	(0.031)	(0.034)	(0.022)	(0.027)	(0.030)	(0.023)
Common border	0.862***	0.152	0.486***	0.603***	0.193	0.497***	0.819***	0.185	0.497***
	(0.142)	(0.142)	(0.130)	(0.122)	(0.152)	(0.110)	(0.123)	(0.136)	(0.116)
Common language	-0.048	-0.086	0.152	-0.087	-0.118	0.271*	0.029	-0.018	0.134
	(0.199)	(0.201)	(0.178)	(0.159)	(0.233)	(0.145)	(0.176)	(0.196)	(0.161)
Common ethnicity	0.399**	0.439**	0.136	0.332**	0.492**	-0.003	0.289*	0.379**	0.124
	(0.188)	(0.190)	(0.154)	(0.145)	(0.222)	(0.130)	(0.169)	(0.185)	(0.140)
Colonial link (prior 1945)	0.634***	0.882***	0.588***	0.112	0.465***	0.189**	0.447***	0.714***	0.388***
	(0.129)	(0.147)	(0.116)	(0.087)	(0.139)	(0.073)	(0.102)	(0.126)	(0.088)
Colonial link (post 1945)	0.474***	0.472*	0.306	0.139	-0.057	-0.028	0.125	0.257	0.030
	(0.184)	(0.259)	(0.221)	(0.162)	(0.251)	(0.143)	(0.150)	(0.230)	(0.165)
NTM_dummy	**0.199**	**0.007**	**-0.283****	**0.203****	**-0.248***	**-0.395*****	**0.128**	**-0.010**	**-0.233****
	(0.126)	**(0.152)**	**(0.124)**	**(0.094)**	**(0.132)**	**(0.099)**	**(0.093)**	**(0.148)**	**(0.110)**
R-sq	0.808	0.862	0.799	0.678	0.797	0.712	0.771	0.830	0.748
N. of country pairs	1 755	1 755	1 755	1 755	1 755	1 755	1 755	1 755	1 755
Obs.	29 280	29 280	29 280	29 280	29 280	29 280	29 280	292 80	29 280

. Note: All regressions include exporter, importer and year fixed effects. Standard errors are clustered by country pairs,

***denotes1%significance;**denotes5%significance;*denotes10%significance. NTM dummy = 1 if at least one NTM identified at the HS6 level

Starting from columns (1)-(3), the estimated NTM dummy indicates that it may impose no further costs in bilateral trade in food (column 1) and electronics (column 2), while negative impacts are shown in transport equipment (column 3). This means that gross exports in the transport equipment industry are discouraged by the requirements and the administrative constraints imposed by NTMs.

Column (4) onwards shows the estimation results of NTMs on GVC trade flows. In the food industry, the NTM dummy is positive with statistical significance. A plausible explanation for the trade-enhancing effects of NTMs in the food industry is that the food exports can possibly be hazardous to humans in the importing economy; the existence of NTMs signals information and confidence in the quality standards met by the imported food products. Hence, this can favour exports of food products integrated into GVCs from exporting countries with NTMs. On the other hand, in electronics (column 5) and transport equipment (column 6), the effects of NTMs were assessed as discouraging domestic value-added exports in GVCs. This suggests that on top of other trade costs (including georgical distance), the existence of NTMs can create additional costs for GVC trade flows.

Column (7)-(9), the dependent variables take the form of value-added contributed by the importing country, thus acting as a proxy for backward GVC participation. In column (9), NTMs is found to impede value-added imports to be integrated in one's exports of the reporting country in transport equipment.

In table 6, the sample of importing countries is restricted to East Asian economies. As before, in columns (1)-(3) the dependent variable takes the form of the log of gross exports in each industry to East Asian economies. In the electronics and transport equipment industries, a dummy NTM is found to impede gross imports in East Asia. In value-added exports from East Asian economies, column (4)-(9), NTMs in the electronics and transport industries impose additional trade resistance by costs of

imports to East Asian economies. The same negative impacts of NTMs are also observed in the backward GVC participation in these two industries. These findings clearly suggest that the removal of NTMs can further enhance GVC trade flows for East Asian economies.

Table 6: Influence of NTMs on GVCs and RVCs (percentage of gross exports), importers as East Asia only

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Log of total exports			Log of domestic value-added in intermediate exports used by importers			Log of importer's value-added in exporting country's exports		
Importers - East Asia	Food	Electronics	Transport	Food	Electronics	Transport	Food	Electronics	Transport
ln GDP exporter	0.653***	0.627***	0.357***	0.326***	0.377***	0.169***	0.400***	0.420***	0.192***
	(0.040)	(0.049)	(0.024)	(0.022)	(0.040)	(0.020)	(0.027)	(0.037)	(0.020)
ln GDP importer	0.455***	0.635***	0.420***	0.116***	0.329***	0.127***	0.273***	0.504***	0.264***
	(0.040)	(0.049)	(0.031)	(0.024)	(0.045)	(0.022)	(0.027)	(0.040)	(0.021)
ln distance	-0.675***	-0.935***	-0.830***	-0.163	-0.604***	-0.376***	-0.548***	-0.850***	-0.689***
	(0.155)	(0.174)	(0.129)	(0.112)	(0.196)	(0.135)	(0.125)	(0.158)	(0.109)
Common border	-0.048	-0.471	-0.484*	-0.099	-0.449	-0.153	-0.288	-0.563*	-0.627***
	(0.273)	(0.319)	(0.254)	(0.193)	(0.333)	(0.219)	(0.226)	(0.306)	(0.205)
Common language	0.198	0.351	0.443*	0.171	0.360	0.199	0.149	0.365	0.327*
	(0.234)	(0.315)	(0.234)	(0.189)	(0.403)	(0.226)	(0.216)	(0.290)	(0.176)
Common ethnicity	0.177	0.118	-0.198	0.229	0.192	-0.152	0.163	0.082	-0.175
	(0.212)	(0.257)	(0.207)	(0.180)	(0.341)	(0.215)	(0.199)	(0.243)	(0.153)
Colonial link (prior to 1945)	0.139	0.402*	0.357*	-0.204	0.050	0.057	0.183	0.363*	0.391***
	(0.198)	(0.240)	(0.184)	(0.137)	(0.228)	(0.108)	(0.161)	(0.207)	(0.146)
Colonial link (post-1945)	0.472*	-0.015	0.140	0.388	0.142	0.357	0.323	-0.115	-0.009
	(0.246)	(0.280)	(0.234)	(0.308)	(0.363)	(0.267)	(0.256)	(0.305)	(0.188)
NTM_dummy	**0.141**	**-0.677*** **	**-0.804** **	**0.148**	**-0.682*** **	**-0.631** **	**0.154**	**-0.683*** **	**-0.687** **
	(0.237)	**(0.237)**	**(0.326)**	**(0.190)**	**(0.230)**	**(0.321)**	**(0.177)**	**(0.223)**	**(0.316)**
R-sq	0.824	0.863	0.773	0.746	0.787	0.647	0.780	0.834	0.715
No. of country pairs	736	736	736	736	736	736	736	736	736
Obs.	7 200	7 200	7 200	7 200	7 200	7 200	7 200	7 200	7 200

Note: All regressions include exporter, importer and year fixed effects. Standard errors are clustered by country pairs,

***denotes1%significance;**denotes5%significance;*denotes10%significance. NTM dummy = 1 if at least one NTM is identified at the HS6 level.

Towards further development of GVCs in East Asia

In the East Asia region, deeper regional integration and growing intraregional trade linkages have been strong and have become the key driving force for countries, even small ones, to develop specialization for tapping into networks. The policy side has, in general, created favourable conditions for trade-related GVCs to further expand. This section touches on several GVC-oriented policies and discusses the future development of GVCs in this region.

It is crucial to realize that the major driving force in the evolution of GVCs is still centred around the operations of MNEs from industrial economies. Their operations are already widespread across East Asian countries, creating good connections in the cross-border exchange of trade in GVCs and related services. However, it is not often realized that the operational decisions of MNEs are usually governed by a combination of trade and FDI factors with the policy supporting them. At this point, there is still considerable scope for East Asian countries to strengthen foreign investment-cum-trade policies. In particular, as found in the above analysis, further removal of NTMs among East Asian economies can be another booster to trade in GVCs. At the same time, further liberalization should be undertaken in the investment-cum-trade policy to further broaden the prospect of inward FDI with the objective of GVC participation.

To this end, an improvement in the level of physical infrastructure (e.g., local distribution networks) is one of the crucial elements involved in building the productive capacity of a nation with regard to participating in GVCs. Building better infrastructure is closely linked to service link costs (Jones and Kierzkowski, 2000). When MNEs are selecting new production sites, a country with better infrastructure tends to be a preferred location for certain types of production. In some cases, MNEs may indeed

select a location with better connectivity to other countries in GVCs, even though other value-added aspects such as labour costs remain uncompetitive.

The quality of legal and institutional arrangements of countries are also inextricably related to service link costs, especially in the case of technology-intensive parts and components. Institutional quality is relevant to the process of GVCs, as it involves establishing complex contracts between parties engaged in specific long-term investment relationships, compared to spot market transactions and arms-length trade. In this sphere, strengthening the rulemaking in intellectual property (IP) protection is a priority. This goes a long way to improving the business climate, further contributing to national competitiveness. Naturally, a poor institution can be a limiting factor in the further expansion of GVCs.

Penang, Malaysia provides an enlightening point of reference. The Penang export hub has consolidated its position within global production networks over the past four decades, starting with success in hosting major United States semiconductor firms in the early 1970s. Penang has since emerged as a hub in GVC linkages, not only in the semiconductor industry but also in medical devices, light-emitting diodes (LED), and photovoltaic design and development. Following the initial FDI stage, the Government of Malaysia has offered well-designed FDI promotion strategies, including Free Trade Zones (FTZs), infrastructure development, skills development and vocational training, and human capital investment. These policy sets have matched well with the Penang's innate comparative advantages, geography and its legacy from the colonial era. Inter alia, the key strategy was to foster linkages with domestic supplier networks in the upstream industries. Indeed, this has helped MNE operations to bolster their production, yielding positive spillovers, and has led to the emergence of supplier networks.

The example of Penang as an export hub illustrates that even a small island can have the potential to play a major role in the development of GVCs in East Asia. Going forward, GVCs continue to shape East Asia's regional and global trade and investment. As observed in the main analysis above, the state of GVCs in the East Asia region has not only been maturing but has also developed in tandem with the expansion to other parts of the region. In this sense, it is important to stay focused on the development path to becoming global rather than placing policy weight on the regional economies. At the same time, the benefits of participating in GVCs would become greater if local industrialization is developed by offering an attractive FDI ecosystem. However, the need still looms for improvement in policy (e.g., non-tariff measures), institutions logistics and infrastructure, and human capital.

The emerging trend towards protectionism, in particular the growing unilateral protectionist measures and retaliation between the United States and China, may affect the landscape of GVCs. It is still too early to assess the impacts of the recent escalated United States-China trade dispute and its ramifications for GVC development in the region. However, an expectation exists that if the trade war escalates and remains persistent, GVCs will be readjusted towards regional orientation. The reshoring of production back from developing to developed countries could result in GVCs becoming adversely affected by lower availability of jobs due to some, if not all, of the reshored tasks in developed countries will be handled through automation. At the global level, these adjustments will come with decreased GVC efficiency, which will eventually result in consumers having to bear higher costs. However, for East Asia, such bilateral disputes could create opportunities for some countries that can attract redirected GVC-related investment that is moving away from China (Anukoonwattaka and Lobo, 2019).

Conclusion

This paper examines the prospect of further East Asian trade integration in GVCs. The role of GVCs in trade flows has important policy implications for countries that already are involved as well as countries that are keen to join the evolving trade networks. Using intercounty input-output data, the evolution of GVCs since 2000 is discussed by focusing on the degree of backward and forward GVC participation, followed by reviewing the policy instruments needed for further strengthening GVCs in this region. The analysis detailed in this paper confirms the fact that reliance on backward GVC participation outside of the region still looms large in East Asia. This presents the case for creating policies that would enable the creation of greater global links in addition to deepening intraregional trade linkages remain important. Sectoral comparisons reveal that Regional Value Chains (RVCs) among East-Asian economies have been increasing its role in East Asian's exports of transport equipment sector while decreasing the role in its exports of textile and apparel sector. Such trend seems to suggest RVC opportunities are available to East Asian economies in sectors that require production to locate close to large and growing markets and suppliers' ability to absorb new technology. Moreover, the study finds enabling policy environment is an important factor to strengthen intraregional value chain linkages. For example, non-tariff measures (NTMs), have become an important part of trade-policy measures and have significantly affected trade flows in RVCs. It is found that NTMs are generally associated with reduced trade in value-added flows, except in the case that NTMs may help ensuring quality standards, such as technical NTMs in the food industry.

Therefore, policies to support strengthening intraregional value chain should focus on removing barriers to trade within and beyond East Asia, at the same time, be

formulated together with other policies for enhancing domestic production capacity, such as an improvement in human capital, infrastructure and logistics, and institutions.

Going forward, East Asian economies may see geopolitics play both negative and positive roles to RVCs. On one hand, the United States-China trade dispute and its ramifications for the development of GVCs for East Asia is worrying, because China has been at the centre of many GVCs in which many other countries are involved. On the other hand, the rest of East Asia is in a relatively better position. It, generally, has a high absorption capacity, given its diverse set of countries with its multi-layers of income groups, human capital development, its unique geography and overall macroeconomic stability. These regional characteristics can help East Asia as a group to remain in a relatively good position for securing their strong position in the global and regional production networks, despite the increasing risks facing global trade.

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Technical appendix

Gravity framework

Tinbergen (1962) and Pöyhönen (1963) performed the first econometric analyses of trade flows by employing the gravity equation. Since then, the equation has been widely used as an analytical tool in the empirical investigation of international trade. One of the desirable features of the gravity equation is that the model fits the data remarkably well, typically explaining the variation of trade flows in a range of 65 to 95 per cent in terms of R2. Indeed, this high explanatory power has led many researchers to employ the gravity equation to trade flow analysis. It is frequently used to evaluate economic policy issues such as the effects of protection (Harrigan, 1993), openness (Harrigan, 1996) the evaluation on regional trade agreements (Frankel, 1997; Soloaga and Winters, 2001) and the effects of national borders (McCallum, 1985; Anderson and van Wincoop, 2004).

The fundamental premise of the gravity model is that trade flows between two countries are related positively to the size of their economies and negatively to the geographical distance between them. This is just as the force of gravity between two bodies increases with the products of their mass and decreases with distance (Tinbergen, 1962; Deardorff, 1998; Feenstra, 2004). The empirical application of the gravity model has been improved in subsequent applications by incorporating other factors in addition to the size of the economies and distance. Typically, GDP per capita (denoted as GDPP) is included to control for the stage of economic development. It is basically argued that higher income per capita countries tend to trade more (Frankel and others, 1996). This belief is supported by a high correlation between the stage of development and a superior infrastructure setting, better access to airports, ports and good roads. It is also commonly observed that higher income countries are more open to trade with

lower tariff rates. GDP per capita might also represent a measure for relative factor endowment such as the overall educational and technology levels of a country, both of which facilitate international trade (Kaldor, 1963; Egger and Egger, 2005).

Anderson (1979) and Bergstrand (1985 and 1989) introduced two key assumptions into the theoretical model – “Iceberg” transportation costs and the “Armington assumption” in the constant elasticity of substitution (CES) utility function. The Iceberg form of transportation costs explains the negative effects of distance on trade. With the Armington assumption, consumers regard goods as being differentiated by the country of origin (Armington, 1969) and essentially it implies that whatever the price, a country will consume at least some of every good from every country. Under this assumption, if all goods are traded, national income becomes the sum of equilibrium traded goods. Solving the model for imports as a function of income and trade cost gives the gravity equation for imports:where Mcd and Y are explained as above, and t and p indicate trade costs and prices, respectively. A subscript w denotes “the world”. Hence, Yw represents world incomes.

The first and second terms in the right-hand side (RHS) of the above equation imply the size of the two countries relative to world income, which positively affects the volume of imports from country c by d, and trade costs (t) reduce imports flows between two countries with an elasticity of . The third term in the RHS refers to a substitution effect. If the transport costs facing an importer c are high, so that is larger, country c will import more from d. The fourth term varies across an exporting country d and is increasing in the weighted average of d’s transportation cost. If d is, on average, a long way from trading partners, it will have low free on board (FOB) prices, so that c will import more. Despite its central importance, the empirical literature only incorporates the indirect measure of transportation costs, i.e., geographical distance between bilateral trade partners – transportation costs, language barriers, information barriers,

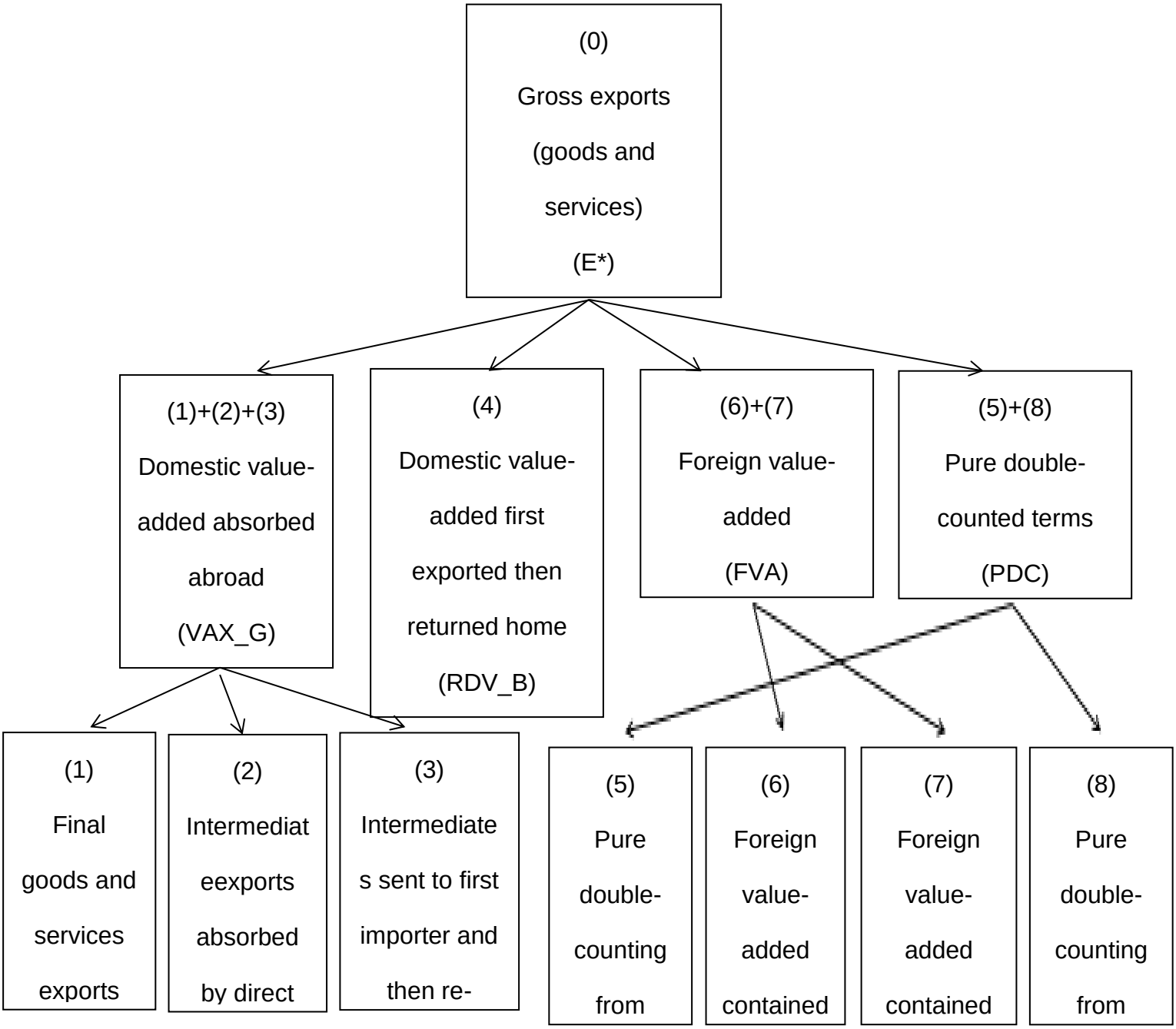
trade policy barriers (tariffs and quotas), and non-tariff barriers (Anderson and van Wincoop, 2004). In addition to the usual proxies for trade costs, a measure of NTMs has been incorporated.

Table A 1: Sixteen-term decomposition of gross exports, using the value-added approach

Term 1	DVA_FIN	Domestic value-added in final goods exports.
Term 2	DVA_INT	Domestic value-added in intermediate exports used by the direct importer to produce its domestic final goods and consumed in that country.
Term 3	DVA_INTrex (a)	Domestic value-added in intermediate exports used by the direct importer to produce intermediate exports for production of domestically used final goods in third countries.
Term 4	DVA_INTrex (b)	Domestic value-added in intermediate exports used by the direct importer to produce exports of final goods to third countries.
Term 5	DVA_INTrex (c)	Domestic value-added in intermediate exports used by the direct importer to produce intermediate exports to third countries.
Term 6	RDV_B (a)	Returned domestic value-added in imports of final goods from the direct importer.
Term 7	RDV_B (b)	Returned domestic value-added in imports of final goods via third countries.
Term 8	RDV_B (c)	Returned domestic value-added in intermediate imports used to produce final goods consumed at home.
Term 9	DDC (a)	Double-counted domestic value-added used to produce final goods for export.
Term 10	DDC (b)	Double-counted domestic value-added used to produce intermediate goods.
Term 11	FVA_FIN (a)	Direct importer's value-added in exporting a country's final goods.
Term 12	FVA_FIN (b)	Direct importer's value-added in exporting a country's intermediate goods.
Term 13	FDC (a)	Direct importer's value-added double-counted in the home country's export production.
Term 14	FVA_FIN (c)	Third countries value-added in exporting country's final goods exports.
Term 15	FVA_INT	Third countries' value-added in exporting country's intermediate goods.
Term 16	FDC (b)	Third countries' value-added double-counted in the home country's exports production

DVA = domestic value-added; RDV = returned value-added; DDC = domestic double-counted; FVA = foreign value-added; FDC = foreign double-counted.

Figure A 1: Illustration of gross trade accounting



Note: E* can be at country/sector, country aggregate, bilateral/sector or bilateral aggregate; both VAX_G and RDV_B are based on backward linkages. Adapted from Wang, Wei and Zhu2013.

Table A 2: List of countries covered by the analysis

Country	East Asia	ASEAN
Australia	1	0
Austria	0	0
Belgium	0	0
Bulgaria	0	0
Brazil	0	0
Canada	0	0
Switzerland	0	0
China	1	0
Cyprus	0	0
Czech Republic	0	0
Germany	0	0
Denmark	0	0
Spain	0	0
Estonia	0	0
Finland	0	0
France	0	0
United Kingdom	0	0
Greece	0	0
Croatia	0	0
Hungary	0	0
Indonesia	1	1
India	0	0
Ireland	0	0
Italy	0	0
Japan	1	0
Republic of Korea	1	0
Lithuania	0	0
Luxembourg	0	0
Latvia	0	0
Mexico	0	0
Malta	0	0
Netherlands	0	0
Norway	0	0
Poland	0	0

Portugal	0	0
Romania	0	0
Russia	0	0
Slovak Republic	0	0
Slovenia	0	0
Sweden	0	0
Turkey	0	0
Taiwan Province of China	1	0
United States	0	0
Bangladesh	0	0
Malaysia	1	1
Philippines	1	1
Thailand	1	1
Viet Nam	1	1
Kazakhstan	0	0
Mongolia	1	0
Sri Lanka	0	0
Pakistan	0	0
Fiji	0	0
Lao PDR	1	1
Brunei Darussalam	1	1
Bhutan	0	0
Kyrgyzstan	0	0
Cambodia	1	1
Maldives	0	0
Nepal	0	0
Singapore	1	1
Hong Kong, China	1	0

Source: ADB-MARIO Database.

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