Research on Global Value Chains: Empirical Studies on Asian Countries

by

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A dissertation submitted to the Graduate School
in partial fulfillment of the requirements
for the degree of the Doctor of Philosophy

Saitama University, Japan
January 2023

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Contents

List of Abbreviations

GVC	Global Value Chain
FDI	Foreign Direct Invesment
ICT	Information and Communications Technology
FVA	Foreign Value Added
DVA	Domestic Value Added
VS	Total Value Added
NEMs	Non-Equity Modes
MNCs	Multinational Corporations
LPI	Logistics Performance Index
PPML	Poisson Pseudo Maximum Likelihood
BRI	Belt and Road Initiative
ASEAN	Association of Southeast Asian Nations

Acknowledgement

Completing this Ph.D. dissertation was achieved due to the help and guidance of many people.

First and foremost, I would like to express my deep gratitude to my academic supervisor, Prof. Sovannroeun Samreth, for his guidance, encouragement, patience, and persistent help during my study and reasearch activities. My grateful thanks are also extended to Prof. Hiroyuki Taguchi for his guidance, encouragement, and support as I finished this dissertation. His guidance and contribution to Chapters 3 and 4 of this dissertation are highly appreciated. I also would like to thank Prof. Hisahiro Kondo, who provided me valuable advice to improve various parts of this dissertation. My appreciation is extended to faculty and staff members of the Graduate School of Humanities and Social Sciences, Saitama University, for their kind support. I am also thankful to all my university and other friends for their encouragement and mental support throughout this study process.

My special gratitude goes to the Rotary Yoneyama Memorial Foundation, whose scholarship enabled me to focus all of my time on my research activities over the last two years.

Finally, I am indebted to my family, especially my mother, who has always provided me with spiritual and mental support and encouraged me to pursue my studies to this stage. I also want to include my puppy here as her companionship throughout my Ph.D. journey and research activities has kept me grounded while giving me strength.

Chapter 1

Introduction

1.1 Research background

Since the 1990s, the production of goods and services has become more globalized, meaning not only a quantitative expansion but also a qualitative shift in international economic activity (Milberg and Winkler, 2013). With the continued reduction in transport costs, the revolution in information and communication technology (ICT), the deepening of trade liberalization is expanding the scope of globalization through the gradual fragmentation and distribution of production processes among countries (Antràs 2016). Nowadays, most products are designed in one country, their components are sourced from multiple countries, and the final product is assembled in another; this is called a global value chain (GVC). Unlike traditional international trade, in which transactions involved only two countries (i.e., an exporter and an importer), GVC trade crosses national borders multiple times.

The concept of a value chain describes the sequence of production activities that a firm undertakes to bring a good or service from concept to final use and beyond (Porter, 1985; Sturgeon, 2001). These chains, in turn, are driven by several factors, such as the information and communications technology revolution, more reliable telecommunications, and powerful personal computers. Because of these drivers, manufacturing companies can easily outsource and coordinate complex activities across distances and still ensure input quality. In addition, because of lower transportation costs, companies can disperse production worldwide and relocate internationally to where it is most economic. Simultaneously, by participating in GVCs, developing countries can take advantage of the industrial base of developed countries without

having to build an entire industry from scratch. Given these characteristics, GVCs are becoming increasingly attractive to policymakers in developing countries.

Jones and Kierzkowski (2001) introduced a theoretical framework of fragmented productive activities to determine the influencing factors of the degree and form of such activities. Their framework posits that the production process will be more prone to international fragmentation if the target market is large enough to absorb the increased supply of goods stemming from a more efficient transnational organization of the division of labor. In addition, another phenomenon that can promote global production is providing more options for offshore companies to make appropriate use of their comparative advantages, including reducing the cost of product links across different countries and diversifying the cost of production factors from countries in the production network.

Although the total share of GVC trade, including both forward and backward linkages, has stagnated over the past decade following a marked increase in total world trade in the 1990s and early 2000s, about half of the world trade apparently remains relevant to GVCs. In fact, globalization has created huge markets for new products and labor, so companies can sell the same goods to more people and take advantage of economies of scale to further deepen the GVCs. The new supply of cheap labor related to this process also encourages profit-seeking companies to relocate their production facilities or find local suppliers in low-wage countries.

Conceptually speaking, GVCs are complex, multifaceted networks that encompass the flow of people, capital, goods, services, information, and ideas, and the form of participation varies by country (World Bank, 2020), as follows: some countries export raw materials for further processing; others import inputs for assembly and export; others produce complex goods and services. To capture the distinct features of these different forms of participation, the World Bank (2020) divides countries into four broad categories based on the products they export and their participation in GVCs, as described herein: commodities, limited manufacturing,

advanced manufacturing and services, and innovative activities. This classification reveals clear distinctions between regions, as while East Asia, Europe, and North America are engaged in advanced manufacturing and services GVCs and innovation GVCs activities, Africa, Central Asia, and Latin America are mainly engaged in commodities and limited manufacturing GVCs. Industrial transformation is particularly prevalent in East Asia, where countries are heavily engaged in industries best suited to GVCs, such as electronics and machinery. For example, emerging economies like China experienced rapid growth in GVC participation between 1990 and 2015, thereby moving up on this GVC classification.

Furthermore, the sectoral specialization of countries determines the degree of their backward and forward participation in GVCs. Specifically, backward participation is the lowest for countries specializing in commodities, begins to expand for countries with limited manufacturing, and is the highest for countries specializing in advanced manufacturing and services because their exports are highly dependent on imported inputs. Still, the backward participation rates are slightly lower for countries specializing in innovation because their activities are less dependent on imported inputs. Regarding forward participation, it is highly associated with countries abundant in natural resources or agriculture because their commodities are used in various downstream production processes that often span multiple borders. Meanwhile, it diminishes for countries specializing in limited manufacturing as commodities are less important in their trade and manufacturing output (e.g., clothing) and are less likely to be used as inputs in the destination country. Then, for countries specializing in advanced manufacturing and services and (especially) innovation activities, forward participation increases again.

1.2 The effects of GVCs

Since countries have different comparative advantages not only in different sectors but also in different production stages in a sector, GVCs make use of these advantages by breaking down the production of complex products and allowing countries to specialize in specific sectors or production tasks. This makes countries experience greater freedom from the constraints of domestic supply and demand. Therefore, countries can benefit from the efficiencies brought about by participation GVCs as they create a finer international division of labor. In addition, GVC participation enables countries to obtain intermediate inputs at a greater variety and higher quality, or sometimes even inputs at lower costs. In traditional trade, where only manufactured goods cross borders, greater openness to imports means greater competition for domestic producers; in GVC trade, such openness increases the imports of intermediate inputs that can be used by domestic firms for benefitting their productivity.

In addition to productivity and income growth, GVCs also provide more and better jobs. Although GVC exports require less human labor per unit of production than non-GVC exports due to their greater reliance on machinery, GVC exports also strongly promote exportation, and this has had a positive impact on the employment of related enterprises and industries. Specifically, the new activities that GVCs bring to countries are pulling workers from less productive tasks into more productive manufacturing jobs. Participation in GVCs can also reduce poverty by promoting income and employment growth. Since the economic growth and employment gains brought by GVCs are greater than those of traditional trade, the poverty reduction effect of GVCs is also expected to exceed that of traditional trade.

Furthermore, in recent years, numerous studies have empirically examined the relationship between foreign direct investment (FDI) and GVC participation, showing their complementary dynamics. For example, the World Bank (2020) finds that, driven by manufacturing GVC

integration, FDI inflows play a significant role in lagging GVC participation shares and levels. In addition, countries' FDI centrality is highly correlated with their GVC centrality, and the positive correlation is still very significant (World Bank, 2020). Martínez-Galán and Fontoura (2019) also show that, in the 2000s, a country's GVC participation level positively contributes to the stock of bilateral FDI inflows. Moreover, for the case of sub-Saharan African countries and Vietnam, Amendolagine et al. (2019) show that GVC participation and upstream status encourage foreign firms to use inputs from local suppliers.

1.3 Dissertation structure

This dissertation studies the impact of GVCs and the issue of forward linkage in GVCs. The research questions are as follows: what is the impact of GVC participation on FDI inflows? What are the influencing factors of GVC forward linkage connection between countries? To answer the first question, I use the UNCTAD-EORA Global Value Chain Database to run a regression analysis on FDI and GVCs. This database provides time series data of key GVC indicators, foreign value added (FVA), domestic value added (DVA), and indirect value added (DVX), from 1990 to 2018, and covers 189 countries and the rest of the world region. In addition to GVCs, I also consider other significant factors that impact FDI inflows, such as economic environment, human capital, and institutional quality. Results show that GVC participation is conducive to attracting more FDI, while the host country's good economic environment and governance are also indispensable. To answer the second question, I quote logistics performance index, with the findings indicating that the lack of logistics performance significantly explains less GVC forward linkage with partner countries.

Chapter 2 is the revised version of the study by Zhao (2021), which is entitled "Impacts of Global Value Chains on Foreign Direct Investment: The Case of Asian Developing Countries." I adopted the GVC decomposition techniques proposed by Koopman et al. (2011) to analyze

the importance of a country in terms of involvement in GVCs (i.e., both GVC participation and position) as a location determinant of FDI inflows for 21 Asian developing countries; this served to analyze whether and how GVC involvement impacts FDI. The results of the fixed effect approach show that countries with greater participation in GVCs are those which generally report higher FDI inflows, and that as the level of GVC participation in a country improves by 1 unit, its inward FDI increases by 15 percentage points. The study also demonstrated that countries and industries with upstream specialization in stages of the production process that are far from the final demand (e.g., production of intermediate goods used in exports by foreign countries) reported a higher level of FDI inflows. Further, it depicted that the FDI inflows are mediated by the host countries' economic development and economic environment, wherein a higher level of trade openness and better economic growth are related positively to FDI inflow. The positive relation between the GVC indicators and local FDI inflow was also stronger in countries reporting better control of corruption and stronger rule of law.

To further assess the relationship between GVCs and FDI at the sector level and improve the results of Chapter 2, Chapter 3, titled "Impact of GVC Integration on FDI Attraction: The Case of Asian Developing Countries and Japan at the Sector Level," investigated the case of Japan and Asian developing countries in the machinery and non-machinery sectors of the manufacturing industry. Analyzing emerging Asian countries allows me to research a region that recently has assumed a central position in the rapidly expanding process of global fragmentation of production. Particularly, Asia has not only bucked the global trend in manufacturing employment but has also managed to maintain a strong manufacturing performance (Dani Rodrik, 2015).

The largest contributor to GVC strengthening in Asia is Japan, which uses many imported inputs in its exports. Japanese companies have been transferring the production of low value-

added products and multi-purpose parts to production bases in Southeast Asia ever since the 1980s. Accordingly, the production bases of Japanese companies in Asia have become "re-export" and "parts supply" bases, further prompting many of these Japanese companies to invest in Asian countries. As a result, emerging Asian economies have become closely integrated with Japan's industrial production in the production chain. Nowadays, Japan remains an important supplier and buyer in the GVCs, especially for ASEAN countries, and it also is very influential in determining the provision of ASEAN products through its purchase behavior. Specifically, while Japanese buyers of ASEAN products are particularly concentrated in the primary sector and manufacturing industries, Japanese suppliers for ASEAN exports concentrate in the electrical and general machinery, precision instruments, and motor vehicles industries. Concomitantly, the investment of Japanese companies is an important source of FDI in these countries.

Thus, by analyzing the level of GVC integration and FDI inflows in nine Asian developing countries using the same analytical approach as in Chapter 1, this study shows that the level of GVC integration with Japanese industries is positively correlated with FDI inflows from Japanese investors. Countries with high GVC backward linkages to Japanese companies in the GVC (i.e., importing most of the intermediate products from Japan to produce their final products for export) can attract more foreign capital from Japan in the two industry sectors of machinery and non-machinery. Furthermore, in the machinery sector, the relationship between GVC backward linkages and FDI is stronger in countries with better institutional quality. Higher levels of GVC forward specialization in the stages of the production process are also important in the machinery industry, such as the production of intermediate goods for export by Japanese electronics or automotive industry companies. These findings emphasize the benefits of participating in GVCs, especially for developing Asian countries, and enrich the literature by providing such emphasis.

Meanwhile, although developing countries in Asia have a high level of GVC participation, the GVC position of most emerging countries lies in GVC backward linkage, particularly emerging ASEAN countries, which rely heavily on imports of components of knowledge-intensive manufacturing. Nonetheless, since the mid-2000s, China's GVC participation has shown a different pattern of forward linkage. Furthermore, the rise of China in the global production networks can perhaps be the most striking GVC trend of the past three years. Specifically, in 2019, China replaced Japan as the central node in Asia and replaced the United States of America as the world's second largest GVC center. The textile and apparel GVC is mainly centered on China, where Chinese fabrics are produced through highly automated processes and then shipped to Bangladesh, Vietnam, and other countries for labor-intensive cutting and sewing. Additionally, China is now the most important supplier to many industries in ASEAN countries, capturing the market share of FVA and enhancing its market power enough to attract competitive attention in most industries. According to the ASEAN-JAPAN Centre (2022), in the market of foreign suppliers in the textile, clothing and leather, automotive, electrical, general machinery, and other industries, China alone has a market share of more than 32 percent when considering all ASEAN countries.

Chapter 4 is the revised version of the study by Taguchi and Zhao (2022), which is entitled "China's global value chain linkage and logistics performances in emerging ASEAN economies." In this last essay, we applied a structural gravity trade model for analyzing the extent of China's GVC forward linkage with emerging ASEAN economies compared to the extent of its GVC forward linkage with the United States of America and Japan. We hypothesized that there would be much more room to deepen China's GVC forward linkage with emerging ASEAN economies, so we examined the nexus of China's GVC forward linkage with logistics performances in emerging ASEAN economies. The results demonstrate the major position of China's GVC, which transformed from a backward to a forward participation

since the mid-2000s. Furthermore, the estimation indicated less GVC forward linkage of China with emerging ASEAN economies than with the United States of America and Japan, and that the lack of logistics performances of emerging ASEAN countries significantly explains the lower GVC forward linkage between these countries and China.

Chapter 5 provides the concluding remarks, summarizes the findings, and discusses the implications of the dissertation.

Chapter 2

Impacts of Global Value Chains on Foreign Direct Investment: The Case of Asian Developing Countries

2.1 Introduction

In recent years, two phenomena, along with the progress of globalization, have emerged in developing countries: the upsurge of foreign investment inflows and the increasing participation in the fragmentation of production (Amendolagine et al., 2019). Based on the report of UNCTAD in 2017, FDI in developing countries grew by 16.4 percent per year between 2001 and 2016, on average more than twice the level of investment in developed economies. Developing economies are considered to be the main beneficiaries of the global rise in foreign direct investment. For developing countries, FDI allows the transfer of technology, particularly in the form of new varieties of capital inputs, that cannot be achieved through financial investments or trade in goods and services. As such, recipients of FDI often gain employee training during the course of operating new businesses, which contributes to human capital development in the host country. Through FDI, host countries can also achieve economic growth due to the influx of capital and increased tax revenues.

Global value chains are defined as the fragmentation of production processes in several stages being performed in different countries, which are typically coordinated by multinational corporations (MNCs) (Martínez-Galán and Fontoura, 2017). By participating in global value chains, companies in developing countries have become full and qualified participants in the global market, specializing in specific stages of the production process, and exploiting their comparative advantages without developing all the capabilities covered by the entire

production chain (e.g., IMF, 2013; Kowalski et al., 2015; Taglioni and Winkler, 2016). As a result of the rise of GVC involvement, combined with intensifying global competition due to the entry of major new producers and exporters, companies face significant pressures to reduce costs and increase productivity in their GVCs.

UNCTAD (2013) estimates that around 80% of global trade, in terms of gross export, is linked to the international production networks of multinational corporations, either as intrafirm trade, or through the non-equity modes (NEMs) of international production, such as contract manufacturing, licensing and franchising, and arm's-length transactions involving at least one MNCs. As a result, the MNCs must decide where to locate their activities, taking into consideration the segments or value-added activities comprised in GVCs (UNCTAD, 2013) and the specific mode adopted by the GVCs to internationally fragment production as indicated by Martínez-Galán and Fontoura (2017). FDI has been identified as the most common way to link developing countries to GVCs (Taglioni and Winkler, 2016), because MNCs are responsible directly or indirectly for a large share of trade in value added (UNCTAD, 2013).

With globalization of firms, various forms of their cross-border activities have been facilitated. As a result, multinational corporations have been perceived in a different way, from a centralized vertical organization to a decentralized more flexible structure as discussed in Franco et al. (2008). Recent empirical literature has shown that firms which are active in a form of globalization are likely to engage in other forms of globalization as an attempt to reduce production costs and expand market (Tomiura, 2007). Among others, Antras and Chor (2003) examine the firm's choice of an organizational form, based on the property-right approach. Amendolagine et al. (2019) on the relationship between GVC involvement and local sourcing of intermediate products by foreign investors.

As documented and indicated by Dunning (1998) and Martínez-Galán and Fontoura (2017), despite the recognition that the determination of the location of multinational corporation

activities is increasingly specific to GVC segments and GVC modes, the empirical research on the role of a country's degree of GVC involvement as an inward FDI driver is still scarce. Some studies have focused on the expansion of GVCs as a consequence of the inflows of FDI (e.g., Lopez Gonzalez, 2016; UNCTAD, 2013). However, Amador and Cabral (2014) point out that although it is difficult to set clear borderlines, the flows of FDI are mostly a consequence of the expansion of GVCs and not exactly drivers for its expansion. The existing evidence indicated that GVC participation increases inward FDI stock (Martínez-Galán and Fontoura, 2017). Furthermore, Amendolagine et al. (2019) report that GVC participation and upstream position encourage foreign investors to use local inputs. Carril-Caccia and Pavlova (2019) demonstrate that a country' trade policy and GVC involvement affect its capacity of attracting foreign investment.

As an attempt to make a new contribution to the literature, this paper tries to analyze the role of a country's involvement in GVCs as a driver of FDI inflows. In addition, this study towards an improved knowledge of GVCs is twofold. First, to present the results obtained with a GVC involvement index for the 21 developing Asian countries. Intensive participation in GVCs exposes local companies to the requirements of international markets, more complex demands, and learning opportunities (Amendolagine et al., 2019). In addition, upstream position in GVCs indicates specialization in the local production of intermediate inputs, which are available for foreign investors to buy (Amendolagine et al., 2019). In developing countries, downstream specialization usually corresponds to the assembly stages of imported inputs, mainly using low-cost local labor. Although it has no direct impact on the local supply of intermediate inputs, it may well attract efficiency-seeking motivations. Second, to analyze whether or not the degree of GVC involvement in a country is positively associated with FDI inflows in developing Asian countries.

The results indicate that the degree and position of GVC involvement matter for the FDI inflows. The higher degree of involvement in GVCs, the higher a country might expect the FDI inflows to be. This applies also to countries that specialize in more upstream stages of GVCs, where more raw materials and/or intermediate goods can be provided to foreign buyers, thus attracting more foreign capital. Furthermore, the relationship between GVC involvement and inward FDI is stronger in countries with stronger rule of law and better control of corruption.

The next section reviews the theoretical framework. Section 3 provides the measurement of the GVC indicators. Section 4 presents. Section 5, and Section 6. Section 7 is the conclusion.

2.2 Framework regarding FDI and GVC involvement

The impact of GVCs on MNCs' activities extends to all types of FDI motives (Martínez-Galán and Fontoura, 2017). For instance, when efficiency-seeking FDI comes to a firm seeking to locate discrete parts of the production in low-cost countries, it is particularly relevant to GVCs (Martínez-Galán and Fontoura, 2017). Besides, plenty of the foreign investment in natural resources is increasingly driven by MNCs that operate globally, such as Mongolia, which has demonstrated high performance in attracting FDI from different multinational corporations during the 1990s, and whose FDIs have been concentrated in the mining industries. Even in market-seeking purposes, FDI by MNCs usually correspond to the shift from arm's-length transaction to intra-firm transaction (UNCTAD, 2013), partly due to the increased role of agglomerative space economies and local service support facilities (Dunning, 1998), and may belong to a GVC network. Strategic alliances may also prevail in a firm's decision to internationalize operations through FDI, depending on the power relationships and coordination of potential partners in its international production network (Martínez-Galán and Fontoura, 2017).

Involvement in GVCs is one of the dimensions that can affect the local sourcing decision (Taglioni and Winkler, 2016). In the early 1980s, many Southeast Asian countries implemented aggressive policies in order to attract FDI, thereby taking advantage of potential spillover effects to promote industrial development. During the process, most countries faced the problem of high domestic production costs. One of the reasons was insufficient local supply, as well as the increased cost involved in the transportation of intermediate goods.

The implications of GVC involvement are multifold, particularly for some developing countries. GVCs can provide local companies with access to global markets and integration in the global economy. They no longer have to develop an entire industry to generate exports but can instead focus on fewer tasks within industry value chains. Since participating in GVCs implies compliance with international quality standards in order to conduct customized inputs, it exposes local firms to stronger competition, more intense information flows, and greater production complexity (Amendolagine et al., 2019). This can be one of the important ways for companies in developing countries to build productive capacity, as well as technology dissemination and skill-building to create opportunities for longer-term industrial upgrading (UNCTAD, 2013). A higher productive capacity can increase incentive for foreign investors to establish manufacturing facilities in the country especially, in terms of vertical FDI, which is associated with the GVC specialization in order to benefit from the competitive advantage of each country (Beugelsdijk et al., 2009). Through vertical FDI, MNCs set production networks to fragment the value chain by taking advantage of the skilled and unskilled labor endowment differences across countries (e.g., Hanson et al., 2005; Braconier et al.,2005). In this case, the trade often takes the form of intra-company transactions, with production stages located in different countries.

Meanwhile, participation in GVCs enables countries to produce inputs for other countries by providing raw materials and/or intermediate products (Koopman et al. 2011). This

participation can attract foreign investors to establish alternative local sources of supply for key intermediate inputs in order to diversify risks and to overcome trade costs like transportation, tariffs or anti-dumping measures (e.g., Buckley and Casson, 1981; Horstman and Markusen, 1987).

Furthermore, greater involvement in GVCs can improve the business ecosystem in which foreign investors decide to produce and enhance local capabilities, and an improved business ecosystem can encourage foreign investors to rely more on local inputs (Amendolagine et al., 2019).

Overall, it is possible that MNCs opt for countries with a high level of GVC involvement, as this can facilitate access to favorable factors, global market, and global economic integration.

2.3 Data and descriptive analysis

2.3.1 Foreign investment in developing Asia

This paper use FDI net inflow data from World Bank Database. The tendency of FDI inflows (% of GDP) represented in Figure 2.1. refers to the full sample (Developing Asia) that is used in this research.

The world investment report (UNCTAD, 2018) reports that East Asia has experienced a continued decline in FDI inflows since 2011, despite the steady and high level FDI inflows to China. This contraction related to the changes in commodity price and concerns about the regulatory and legal environment for FDI projects in Mongolia. In 2016, Mongolia registered a negative $4 billion in FDI inflows, due to funds transfers through intracompany loans by foreign MNEs in the mining industry.

FDI flows to West Asia increased by 12% in 2007, the fifth consecutive year of growth. However, as domestic investment grew faster than foreign direct investment, the ratio of

foreign direct investment to total fixed capital formation fell slightly from 22% in 2006 to 20% in 2007(UNCTAD, 2008).

Although the global financial and economic crisis has affected the economies of host countries in South, East and Southeast Asia, as well as the main home countries of multinational companies investing in the region, total foreign direct investment inflows into the region increased by 17% in 2008. In 2009, FDI inflows to all major host countries, including China and India, started to decline. However, the decline is smaller than in many other regions of the world. In addition, the region has become the first to benefit from a rebound in global consumer and business confidence, which has been translated into increased FDI flows in several major economies since mid-to-late 2009 (UNCTAD, 2010).

Figure 2.1. FDI inflows (% of GDP), 1996-2017

Source: Author, based on the World Bank database

FDI inflows to developing Asia shared 33 per cent of the world total in 2017. The region regained its position as the largest FDI recipient worldwide, are expected to remain at the same level in the future.

In East Asia, FDI inflows remain stable with an all-time high in China. The rise in China was supported by a 28 per cent in the number of foreign subsidiaries. Besides, reversing a continuous decline since 2011, FDI flows to Mongolia improved in 2017 and turned positive. FDI flows to South-East Asia rose by 11 roughly, due to an increase in most ASEAN countries and a strong rebound in Indonesia.

While FDI to South and West Asia slid, particularly in West Asia, inflows have been continuously declining since 2008. Saudi Arabia, traditionally the largest FDI recipient in West Asia, inflows contracted by four-fifth as a result of significant divestment and negative intracompany loans by foreign MNEs. And Turkey, the other larger FDI recipient in the region, due to the instability political environment, FDI inflows continued to decline in 2017, follow the drop in 2016. (UNCTAD, 2018)

2.3.2 Measuring the participation and the position in the GVCs

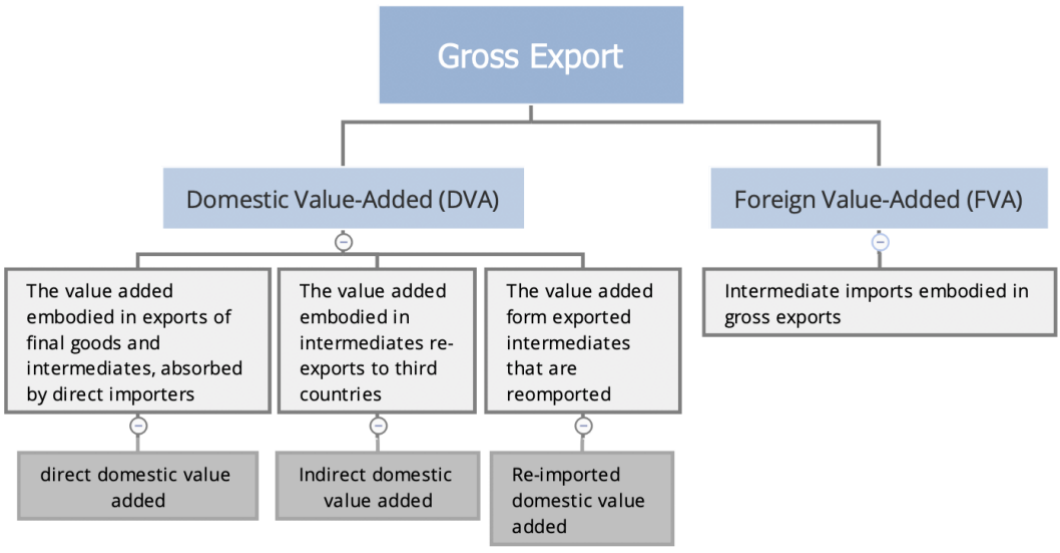
This research calculates two indicators of GVC involvement based of the UNCTAD-Eora Global Value Chain Database, which provides information on key GVC indicators for 189 countries from 1990 to 2017 (Casella et al., 2019).

Gross exports in a given economy can be decomposed into *domestic value added* (DVA) component and *foreign value added* (FVA) component generally. This paper reproduces in Figure 2.2. a consolidated decomposition of gross exports that clearly identifies the value-added components included in the indicators of Koopman et al. (2011). The first level of Figure

2.2. decompose the gross export: (1) DVA, the real value added exchanged in trade, all countries participating in GVCs contribute to its creation through their domestic factors of production; and (2) FVA component, the value added traded as part of imported inputs in multi-stage, multi-country production processes. In valve added term, it is thus double counting rather than the creation of fresh value. The more ingrained the GVCs in the global economy, and the more fragmented the global production process, the higher is the foreign value added. (UNCTAD, 2018)

The second level of Figure 2.2. decompose the DVA of gross exports into three other types: (1) *direct value added*---that is, exports in final goods and intermediates absorbed by direct importers; (2) *indirect value added*---that is, exported in intermediates re-exports to third countries; and (3) *re-imported domestic value added*---that is, exported in intermediates that return home. These three components represent the share of domestic content in a given country's exports.

Figure 2.2. Gross export decomposition



Source: Author, based on Koopman et al. (2011).

Based on the decomposition of gross above described, Koopman et al. (2011) built an index to measure the degree of GVC participation of a given country considers both the FVA and part of DVA in gross exports, basically adding the DVA traded with the FVA traded. Because direct domestic valued and re-imported domestic value added, those two GVC types cannot be disentangled with available data, this paper aimed at measuring the indirect value added with regard to the DVA exported in intermediates based on previous research.

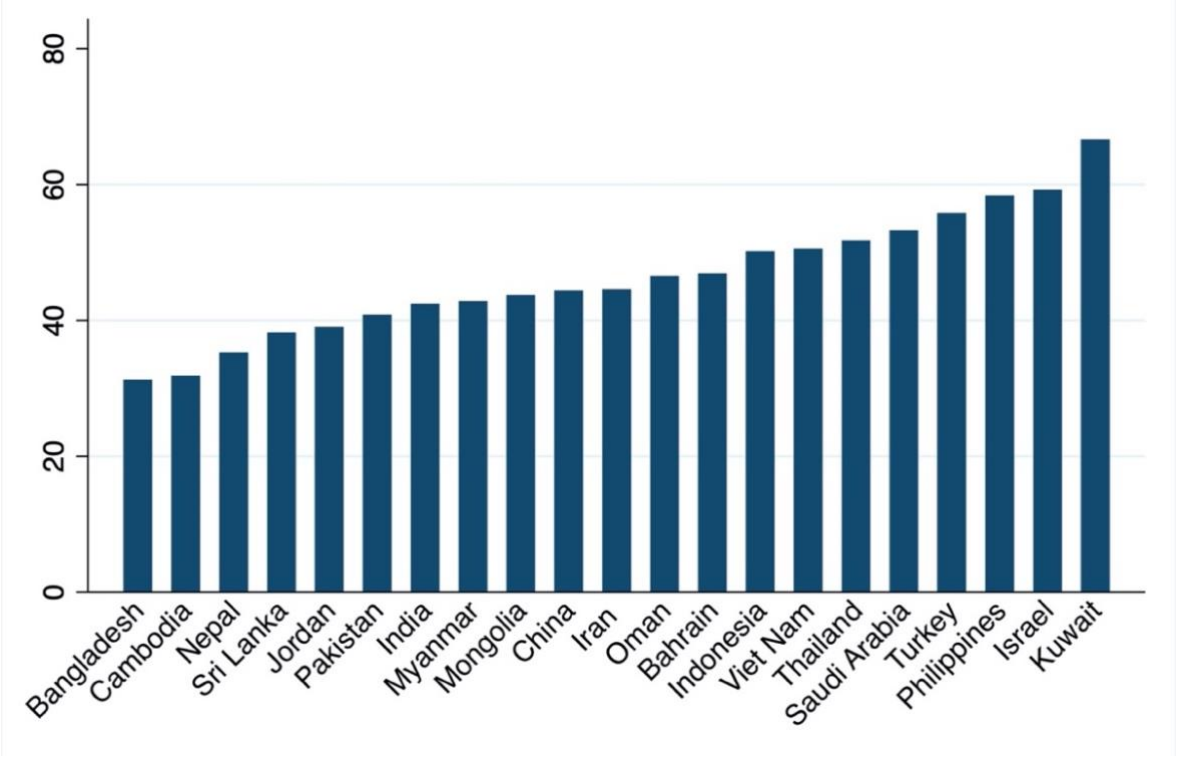
The GVC indicator measuring the participation of each year *t* in a given country *i* in the cross-national trade of intermediate goods is defined as:

$$GVC\ Participation = FVA_{it} + DVX_{it} \quad (1)$$

where FVA_{it} is the foreign value added and DVX_{it} is the indirect domestic value added in country *i*, divided by gross exports VS_{it}.

Figure 2.3. depicts the level of GVC participation in the countries in our sample. Countries from Indonesia to Kuwait have the highest participation, with at least 50 per cent of the exported value-added including intermediates imported by other countries or intermediates used by foreign countries in their exports. The low level of GVC participation are much smaller in Bangladesh and Cambodia compare to Philippines, suggesting that the former is generally still at the beginning of their process of integration in to GVCs.

Figure 2.3. GVC participation at country level (2017)



Source: Author's elaboration based on the UNCTAD-Eora GVC Database

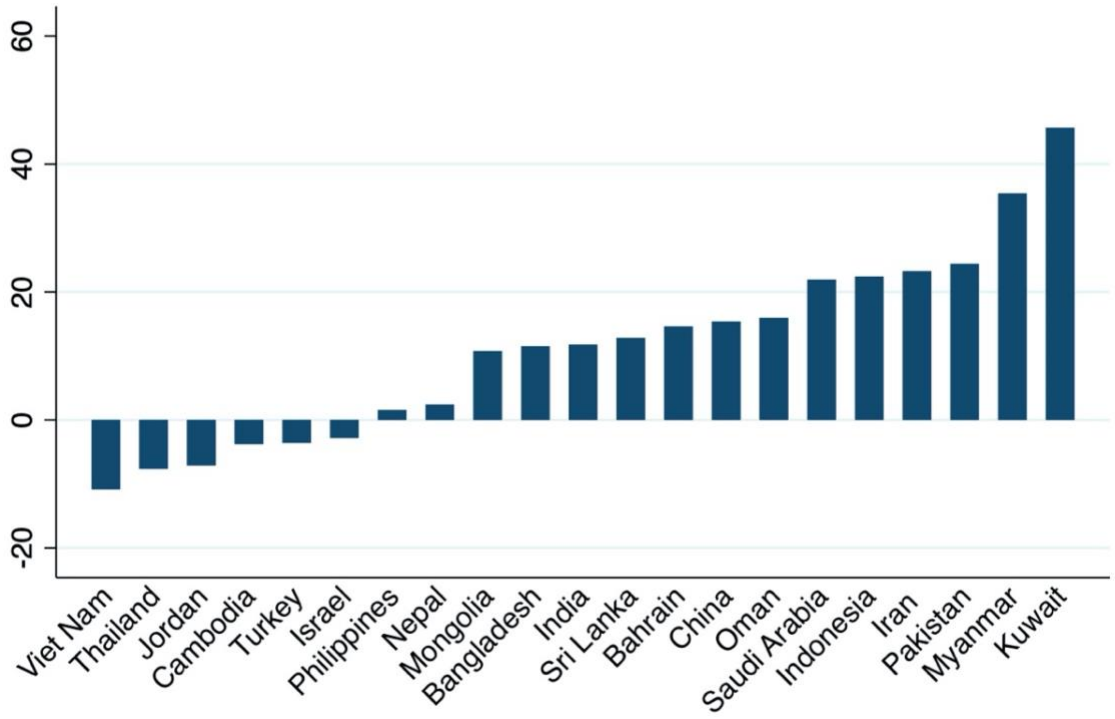
Calculating the log-difference between the DVA and the FVA components of the GVC participation index provides a proxy for the country's prevailing position (i.e. upstream or downstream) in the GVC. The second indicator measuring the relative position of county *i* in year *t* within the GVCs is defined as:

$$GVC\ position = Ln(1 + DVX_{it}) - Ln(1 + FVA_{it}) \quad (2)$$

It makes sense to captures whether a country is primarily a net exporter, or a net importer of value added, that is compare a country's export of intermediate are used by other countries, with that country's use of imported in production process (Koopman et al. 2011).

A country with positive values of position index lies upstream in the GVC of production process which are remote form final demand. The more upstream a country is the larger its forward linkage-based production is. In contrast, if a country with negative values lies downstream in the GVC, which indicate it will use a large portion of other countries intermediates to produce final goods for exports (Koopman et al. 2011). Upstream participation in GVCs indicates local specialization in the production of intermediate inputs, available for purchase by foreign investors, while in developing countries, such as Vietnam, downstream stage generally corresponds to the assembly phase of imported inputs, using mainly the low-cost local labor force, with no direct impact on the local supply of intermediate inputs (Vito et al., 2017). Figure 2.4. depicts the values of the GVC position index across countries. East and South Asia countries are concentrated in upstream activates, confirming that those countries participate to GVC mainly by producing inputs for other countries, either by supporting raw materials, or by providing intermediates products, or both (Koopman et al. 2011). Furthermore, several countries have upstream specialization and relatively low levels of GVC participation, since they undertake the initial stages of the manufacturing transformation of inputs that are exported for further processing (African case, Vito et al. 2017). The countries with both high level of GVC participation and position (e.g. Kuwait, Iran and Saudi Arabia) indicate that the country's participation in the GVC is mainly based on the supply of raw materials, such as crude oil.

Figure 2.4. GVC position at country level (2017)



Source: Author's elaboration based on the UNCTAD-Eora GVC Database

2.4 Empirical analysis

To assess the impact of the participation and position in GVC on FDI inflows, this paper augments a model widely used to investigate the determinants of inward FDI by the two measure of GVC involvement:

$$FDI_{it} = \beta_1 GVC\ participation_{it-1} + \beta_2\ GVC\ position_{it-1} + \sum \beta_3\ X_{it} + \delta_i + \lambda_t + \varepsilon_{it} \qquad (3)$$

The variables included in the model are as follows. The dependent variable FDI_{it} measures the FDI net inflows as the percentage of GDP of country *i* in year *t*, and *t* ranges from 1996 to 2017. As measured above, $GVC\ participation_i$ is the degree of GVC participation,

measured by the share of value-added contents of gross exports used for further processing through cross-border production networks, and $GVC\ position_i$ is measured by the position of one country in the GVCs. To avoid potential endogeneity and variables bias of GVC indicators, this research use the lag value *(t-1)* of GVC participation and position.

The set of control variables X_{it} includes other factors that are considered to affect inward FDI. Control variables, including openness ratio, are measured by the total trade as the share of GDP (*Openness Ratio*), which indicate the trade openness in a given country; annual percentage growth rate of GDP (*GDP growth*); *GDP per capita*; labor productivity, measured as the ratio of GDP per employees (*Labor Productivity*). Also, this research controls the impact of the financial crisis that emerged in 2008 using a dummy variable indicating the year *t*, ranging from 2008 to 2010 (*Financial Crisis*).

Rule of law and *Political stability* are the indicators of governance in a given country. Rule of Law captures perceptions of the extent to which agents have confidence in, and abide by, the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts. Political Stability is the index of Political Stability and Absence of Violence/Terrorism , which capture perceptions of the likelihood that the government will be shaken or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. The estimation of both indicators gives the country's score on the aggregate indicator in units of standard normal distribution, that is, ranging from approximately -2.5 to 2.5.

It is possible that the omitted variable bias remained and other factors affecting FDI inflows in the country *i* not included in the control variables of the investigation equation. Some of these unobserved variables can be assumed to be country-specific and year-specific, representing differences between years, but constant for the country, and representing the heterogeneity between countries, but constant over time, respectively. Therefore, this paper

uses the fixed effects model, controlling for other possible FDI determinant variables, including fixed effects for host country i (δ_i) and year t (λ_t) to absorb unobserved heterogeneity which could affect the degree of GVC participation and the FDI flows to host countries.

Country sample is shown in Table A2.1. A summary of statistics of all the variables is presented in Table A2.2.

2.5 Discussion of the main findings

The results from fixed-effect model are reported in Table 2.1 and show the presence of a positive and statistically significant relation between participation in GVCs and the FDI net inflows. The marginal effect retrieved from the estimated coefficient reported in Column 1 indicate that the level of GVC participation in a country such as Vietnam (0.51) improve by 1 unit, the inward FDI increases by 9 percentage point next year. Existing evidence discussed by Farole and Winkler (2014) confirm that GVC involvement fosters the development of a local supply base, for instance, the agro-food buyer-driven chain in Vietnam. This is roughly in line with the finding in this paper. In addition, UNCTAD (2013) report that there is a positive relationship between FDI inward growth and GVC participation growth in 187 countries over the periods of 1990-2000 and 2001-2010. Generally, this is also consistent with the result this study.

In addition to GVC participation, the result represents that the position in GVCs is also significantly positive. Countries and industries with upstream specialization in the stages of the production process that are far from the final demand (production of intermediate goods used in exports by foreign countries) report a higher level of FDI inflows. This result might be obvious. The more upstream the industry, the more it produces intermediate goods that can be bought by foreign investors (Amendolagine et al., 2019). Attracting foreign investors and other

international buyers and linking them to the domestic economy should create conditions for local firms and workers to benefit from spillovers of knowledge and technology. Although the literature on global value chains often associates more upstream specialization with lower added value and less structural transformation, this result shows that this integration model in the value chain still provides a way to attract foreign direct investment. The study conducted by Farole and Winkler (2014) indicate that the Ahafo Linkage program in Ghana contributed to local procurement surrounding the Ahafo mine. The upstream sectors' experience, such as the agricultural industry or mining, in which the FDI and recourse to higher local sourcing of inputs by foreign companies are increasing (Amendolagine et al., 2019). The evidence from these studies is basically consistent with the finding of this research. Regarding the policy enhancing local sourcing, as documented by Sutton (2014), the local content program adopted by the Government of Tanzania, following the discovery of gas can be a good example for East and South Asian countries.[1]

The estimated coefficients of the control variables confirm the importance of a country's economic development and economic environment as mediating factors in the extent of FDI inflows. Higher levels of trade openness and better economic growth are related positively to inward FDI, consistent with the view that economic growth is positively correlated with FDI in all regions, and the correlation is slightly higher in developing countries than when all countries are combined (Iamsiraroj et al., 2015).

As such, the relation between labor productivity and FDI inflows is positive, although it contradicts some previous findings (Winkler, 2013). Conversely, GDP per capita is associated negatively with FDI net inflows. GDP per capita, as a good measurement of a country's living

[1] After discovering natural gas reserves, the Tanzanian Government established a Local Content Unit to promote the participation of domestic companies as suppliers of foreign multinational corporations investing in the country (Sutton, 2014).

standards, also indicates the national wage level. The results for GDP per capita and productivity are in line with Cushman (1987) who indicates that a rise in a host country's wages or cut in its labor productivity discourages FDI into that country. The importance of the labor productivity for FDI inflows is due to the fact that foreign firms operating in developing countries usually produce more complex goods than domestic firms. Therefore, labor quality is an important factor for their investment decision (Rodriguez-Clare, 1996).

Finally, both governance indicators are significant, which suggests that political governance in the host country affect a firm's globalization decisions.

To investigate how heterogeneity in host country conditions might affect the impact of GVCs on FDI inflows, this paper interacts the two measurements of GVC involvement with macro variables (Table 2.2).

This research considers the measurement of rule of law *(Rule of law)* and political stability (*Political stability*) as proxies for local institutional quality and, as such, the results Column (1) indicates that the effect of GVC participation is higher in countries with stronger institutions. This finding supports the view that a good institutional environment is important for attracting foreign investors (Amendolagine et al., 2019). This is especially the case when the aim is to establish local linkages with domestic suppliers, since well-functioning institutions are essential for ensuring foreign investors are able to enforce contracts with local partners (Dollar and Kidder, 2017). Figure 2.5. shows the marginal effects of GVC participation by political stability.

Table 2.1. Result of a fixed-effect panel regression to estimate the determinants of FDI inward with the country's GVC involvement index in the period 1997-2017

Dependent Variable:	**Fix Effected**	**Fix Effected**
FDI net inflows	(1)	(2)
Lagged GVC participation	0.096*	0.103**
	(0.050)	(0.048)
Lagged GVC position	0.115*	0.116*
	(0.058)	(0.056)
Openness ratio	0.060**	0.060**
	(0.023)	(0.023)
GDP growth	0.251	0.250
	(0.193)	(0.194)
GDP per capita	-0.000***	-0.000***
	(0.000)	(0.000)
Labor productivity	0.000**	0.000**
	(0.000)	(0.000)
Financial crisis	0.793	0.703
	(0.554)	(0.541)
Political stability	0.590**	
	(0.276)	
Rule of law		0.834**
		(0.347)
Constant	-7.777*	-8.098*
	(4.321)	(4.286)
Year fixed effects	462	462
Country fixed effect	22	22
Observations	462	462

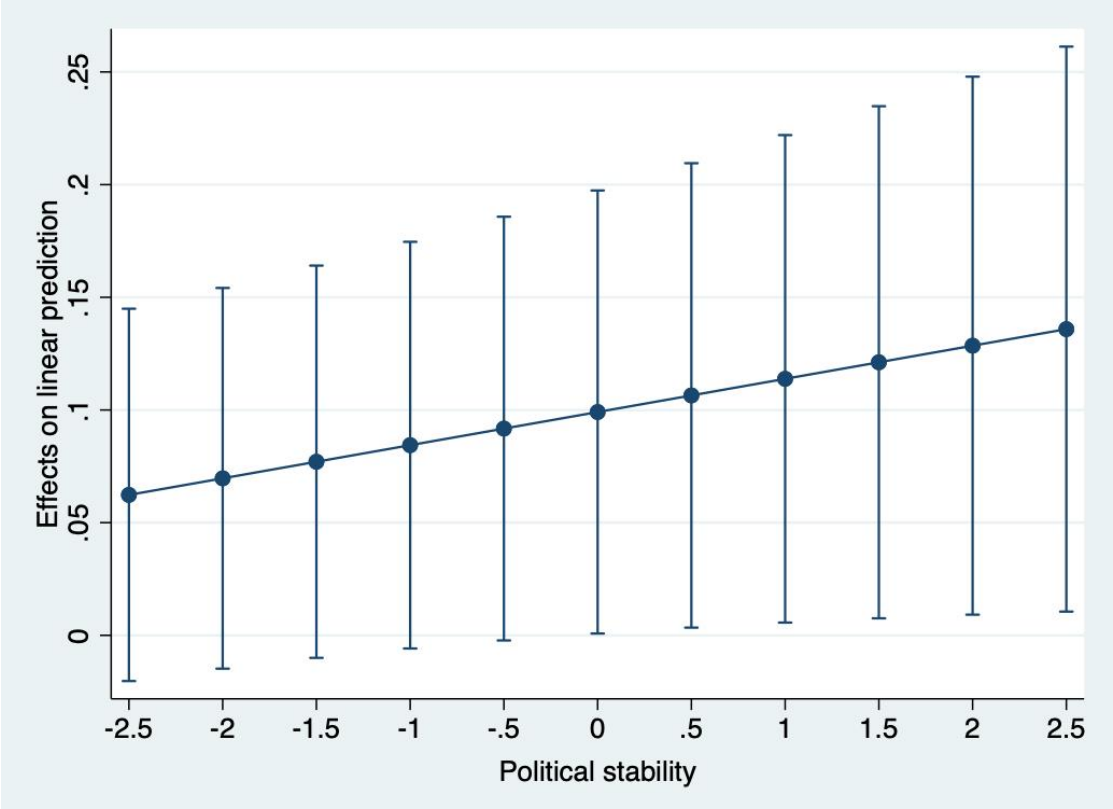
Notes: Columns 1 reports the estimate coefficients of equation (3), obtained with fixed-effect panel model. The dependent variable is the percentage of FDI net inflows divided by GDP. Columns (2) reports the coefficients of the same model but with new independent variables, CONTROL OF CORRUPTION. Standard errors are report in parentheses * p<0.1, ** p<0.05, *** p<0.01.

Table 2.2. Result of the interaction between dependent variables.

Dependent Variable:	**Fixed effect**	**Fixed effect**
FDI net inflows	(1)	(2)
Lagged GVC participation	0.099*	0.109**
	(0.050)	(0.042)
Lagged GVC position	0.109*	0.113*
	(0.060)	(0.055)
Openness ratio	0.060**	0.060**
	(0.023)	(0.023)
GDP growth	0.261	0.257
	(0.190)	(0.191)
GDP per capita	-0.000	-0.000
	(0.000)	(0.000)
Financial crisis	0.895	0.788
	(0.554)	(0.524)
Lagged GVC participation x political stability	0.015*	
	(0.008)	
Lagged GVC participation x political stability	-0.005	
	(0.015)	
Lagged GVC participation x rule of law		0.025
		(0.015)
Lagged GVC position x rule of law		-0.013
		(0.031)
Constant	-7.605	-8.138*
	(4.464)	(4.236)
Year fixed effects	Yes	Yes
Country fixed effect	Yes	Yes
Observations	462	462

Notes: Columns 1 reports the estimate coefficients of equation (3), obtained with fixed-effect panel model. The dependent variable is the percentage of FDI net inflows divided by GDP. Standard errors are report in parentheses * p<0.1, ** p<0.05, *** p<0.01.

Figure 2.5. Average marginal effects of GVC participation by political stability



Source: Author's elaboration based on the UNCTAD-Eora GVC and World Bank Database

2.6 Conclusions

The increasing involvement of developing countries in GVCs could have positive effect on local economies by enhancing FDI inflows. This research tests this hypothesis by using data on the FDI net inflows of 21 developing Asia countries from World Bank Database, with data on GVC indicators from UNCTAD-EORA Global Value Chain Database and calculated two GVC involvement index at the country level.

The results show that countries with greater participation in GVCs are those where generally report higher FDI inward. It finds that also the position in the GVC matters; countries lie in more upstream stages of production attract foreign investors a greater willingness to invest at local. These results are especially relevant for countries specialized in low value-

added phases that are positioned more upstream in the GVC (Manson, 2017). The findings in this paper support the policy effort in some Southeast Asia countries aimed at attracting foreign direct investment by accelerating industrialization processes to lowering the cost of local sourcing. This applies, for instance, to Thailand, Philippine and Indonesia, which are investing in export processing zone in order to be able to satisfy the demand from investors in global integrated industries. Besides, in order to attract more foreign investors, countries can expand GVC participation by strengthening existing links in the GVC, enhancing the absorptive capacity of a country to benefit from GVC integration, and building a world-class workforce (Taglioni and Winkler, 2016).

In addition, it is important for countries to complete the firm ecosystem beyond the initial GVC enclave and ensure that GVCs are integrated into the domestic economy. Economic upgrading and densification are key to transforming GVC participation into sustainable development. The concept of former is mainly to gain competitiveness in the process of higher added value and improve domestic labor productivity and skills, while densification of GVCs means promoting spillover effects through the participation of GVCs and involving more local companies in the supply network (Taglioni and Winkler, 2016) thus to attract more foreign investors.

The FDI inflow is also mediated by host country's economic environment. The positive relation between the GVC indicators and local inward FDI is stronger in countries reporting better control of corruption and stronger rule of law.

This study contributes to the literature that emphasized the benefits of involvement in GVC (Taglioni and Winkler, 2016; Costantinescu et al., 2017), especially for Asian developing countries. It also proposing a channel through which the benefits derived from participation in GVCs can spread through the local economy, that is attracting foreign investors. The results of this paper suggest a high degree of relationship between GVCs and FDI and show that policies

to support engage in and upgrading of countries in GVCs could improve the FDI inflows. The findings also have some policy implications. Well-functioning institutions and better political governance greatly increase the positive relation between GVC involvement and FDI attraction.

Several limitations remain in this research. The major strand that is underdeveloped to use industrial-sector data to examine GVCs, micro level measurement in analysis of GVCs would meaningfully inspire the impact of GVCs. For the future plan, author will improve the result by analyzing the impact of GVC involvement on FDI in industries level, still focused on Asia developing countries. A fruitful avenue for further research is expected.

Appendix

Table A2.1. Country sample

East Asia	South Asia	Southeast Asia	Western Asia
China	Bangladesh	Cambodia	Bahrain
Mongolia	India	Indonesia	Iran
	Nepal	Malaysia	Israel
	Pakistan	Myanmar	Jordan
	Sri Lanka	Philippines	Kuwait
		Thailand	Oman
		Viet Nam	Saudi Arabia
			Turkey

Note: Country classification based on website of Central INTELLIGENCE AGENCY/ the world factboo

Table A2.2. variable description, source, and summary statistics

Variables	Definition	Source	Mean	Min	Max	Number of Obs.
FDI	FDI net inflows as the percentage of GDP	World Bank	3.03	-37.15	43.91	462
GVC Participation	GVC participation index (Koopman et al.2011)	UNCTAD-Eora	45.93	23.18	66.64	462
GVC Position	GVC position index (Koopman et al.2011)	UNCTAD-Eora	9.14	-26.13	45.66	462
Openness ratio	Total trade as the share of GDP	World Bank	65.02	18.01	190.29	462
GDP growth	Annual percentage growth rate of GDP	World Bank	5.18	-13.13	17.32	462
GDP per capita	Gross domestic product divided by midyear population	World Bank	6725.84	131.8	55572	462
labour productivity	The ratio of GDP per employees	World Bank	15068.83	271.11	104628.4	462
Rule of law	Rule of Law Index (it ranges from -2.5 to 2.5)	World Governance Indicators	-.23	-1.74	1.28	399
Political stability	Political stability (it ranges from -2.5 to 2.5)	World Governance Indicators	-.36	-1.67	1.35	399
Financial crisis	Dummy equal to one if the year ranges from 2008 to 2010, and zero otherwise	—	.16	0	1	399

Chapter 3

Impact of GVC Integration on FDI Attraction: The Case of Asian Developing Countries and Japan at the Sector Level

3.1 Introduction

Since the year 2000, many developing countries have both experienced a wave of foreign capital inflows and increasingly participated in the process of global production fragmentation. Developing economies were the main beneficiaries of the increase in global FDI between 2001 and 2016, receiving on average more than twice as much investment as developed economies (UNCTAD, 2017). Furthermore, the participation in GVCs has enabled companies in many developing countries to become fully qualified players in global markets by focusing on specific stages of the production process. These firms have exploited their comparative advantages without developing all the capabilities encompassed by the value chain (Taglioni and Winkler, 2016). These opportunities to attract foreign capital and become part of the production process by participating in one or more specific stages of GVCs is of particular importance for the development and industrialization of many developing countries.

FDI is an important source of development financing, which in turn contributes to domestic employment, capital formation, and access to key external knowledge for local economies in developing countries (Hanousek, Kocenda, and Maurel, 2011). Since the 1980s, several prominent studies have modeled the behavior of firms that give rise to GVCs, and they are generally built on the industrial organization literature. For example, Grossman and Helpman (2002) describe firms' choices between integration and outsourcing, and their model emphasizes the trade-off between the costs of running large and less specialized organizations and the costs of searching friction, relationship-specific investments, and imperfect contracts. Helpman, Melitz, and Yeaple (2004) analyzed firms' decisions about whether to serve foreign

markets through fair trade or investment. They focus on the trade-offs between trade costs, the costs of investing in foreign markets, and productivity heterogeneity within sectors. Antràs and Helpman (2004) then combined these two modeling frameworks to study the choices that firms make simultaneously between domestic and foreign markets and between consolidation and outsourcing in the context of productivity within heterogeneous sectors.

Among the many theories on FDI and GVCs, the studies by Melitz (2003) and by Helpman, Melitz, and Yeaple (2004) established a microeconomic theoretical framework from the perspective of entry costs to explore the international trade between FDI and trade factors of choice. The framework posits that the entry costs required for FDI are higher than those required for exports, meaning that only the most productive firms would absorb the previous costs and engage in FDI, while the less productive firms would export, and the least productive firms would only serve the domestic market. Bernard et al. (2018) further developed a theoretical framework that allows firms to have large market shares while simultaneously deciding where they produce, the export markets, sources of inputs, products they export, and inputs they import.

This article contributes to the literature on FDI inflows by proposing a novel determinant: the host country's GVCs integration. The author does so by assessing the position of the GVC linkage based on country (and sector) specialization in the forward (i.e., production of intermediates used by other countries) and backward (i.e., use of intermediates produced by other countries to manufacture final goods for exports) stages of the GVC. Specifically, a country's intensive GVC integration exposes local firms to the requirements of the markets of advanced nations, more sophisticated demand, and to learning opportunities through the transfer of knowledge and technology from industry leaders to local suppliers within the value chain. In addition, GVC forward linkage implies a local specialization in the production of intermediate inputs to be purchased by foreign investors. Conversely, in developing countries,

backward specialization frequently corresponds to concentration in the assembly phase of imported inputs and to the exploitation of mainly low-cost local labor force, with no direct impact on the local supply of intermediate inputs.

An analysis of emerging Asian countries is particularly pertinent in the context of our research since it allows us to investigate a region that has recently assumed a central position in the rapidly expanding process of the global fragmentation of production. Asia has bucked the global trend in manufacturing employment and maintained strong manufacturing performance compared with other middle-income regions, such as Latin America, which has been undergoing deindustrialization (Dani Rodrik, 2015). Specifically, the ASEAN countries have intensified their production networks by importing more intermediate products from abroad and integrating these products into their export products, thus establishing value chains (ASEAN-Japan Center). Furthermore, these export products have been increasingly reintegrated into exports from other countries as intermediate products.

Japan has been one of the major investors in Asian regions since the 1980s, and the related Asian economies have accrued many benefits from the inflows of Japanese FDI. The IMF (2012), for instance, found that the rest of Asia gained from Japanese FDI much more than from the increase in growth caused by FDI from other countries. The higher growth in the regions stemming from Japanese FDI partly reflects the characteristics of such investment, which is associated with efforts at promoting technology transfer and learning in the emerging Asian countries (Kojima, 1973).

Our analysis shows that the degree of GVC integration of developing countries with the Japanese industry is positively related to the amount of capital inflows by Japanese investors. This applies also to countries and sectors in the manufacturing industry that specialize in GVC backward linkage, attracting more foreign capital from Japan. Furthermore, the relationship

between GVC backward linkage and FDI inflow is stronger in countries with stronger control of corruption and a more stable political governance.

3.2 Theoretical overview of FDI and GVC integration

FDI has been the primary driver of GVC expansion for the past several decades, and recent years have seen theories and empirical studies on the relationship between FDI and GVCs gain attention, showing a mutually reinforcing dynamic between FDI and GVC involvement (Qiang et al., 2021). From the perspective of GVC involvement, integrating with foreign firms in GVCs could attract initial FDI by lessening the entry costs (Kathuria and Yatawara, 2020), which further encourages foreign investors to bring their partners in the production chain to the host country because of the high switch costs (Baldwin and Venables, 2010; World Bank, 2020). Furthermore, according to Martinez-Galan et al. (2017), GVC involvement has impacted almost all types of FDI motives within the context of multinational corporations' (MNCs) activities, namely, efficiency-seeking, market-seeking purposes investment, strategic alliances, and investment in natural resources. Carril-Caccia et al. (2019) argue that companies using FDI strategies that are positively linked with trade might be attracted by some specific involvements in trade and GVCs. For instance, the capacity of producing intermediate goods that are used later in the production process in other countries can favor vertical FDI (Beugelsdijk, Pedersen, and Perdersen, 2009; Braconier, Norback, and Urban, 2005), and economies which can export goods to a wider number of countries are more likely to attract export platform FDI (Medvedev, 2012). Braconier et al. (2005) highlight that through vertical FDI, MNCs slice up the value chain by exploiting the skilled and unskilled labor endowment differences across countries. The slice up of the value chain implies that, to produce a final good, several value-adding productive stages are realized in different countries (Krugman et

al., 1995). Following these arguments, Beugelsdijk et al. (2009) indicate that vertical FDI is associated with GVC specialization, which leads MNCs' affiliates to participate in trade in order to be able to exploit the competitive advantages of each country in the value chain. As a result, MNCs have been increasingly deciding to locate their activities while considering the segments or value-added activities within a GVC (UNCTAD, 20113) and the specific mode adopted by the GVC to tackle the internationally fragmented production (Martinez-Galan, 2017).

Japan has a long history of searching for investment opportunities in Asia's emerging markets (Wu, 2019). Japanese companies have long been transferring their low-value added products and multi-use parts to production bases in Southeast Asia and exploiting the advantage of their lower production costs; this developed the production bases in Asia, which eventually turned into a total production base for exports to the European and American markets (Tsuchiya et al., 2006; Kitagawa, 2008). As a result, the Asian regions became "re-export" and "part supply" production bases for advanced nations, which further caused many Japanese small and medium enterprises involved in the production chain to invest in Asia (Nakajima, 2000). Thorbecke and Salike (2013) indicate that the Japanese FDI pattern in many sectors can be classified into a "network FDI" (explained in footnote), which is a term used to describe the East Asian FDI coined by Baldwin and Okubo (2012), who argue that Japanese MNCs get more deeply involved in the production chain than MNCs from other advanced nations.

Along with the rise of regional production networks operated by Japanese MNCs as node, parts and components turned into the main trade in the manufacture industry between the fragmented production blocks, particularly in the machinery sector (Thorbecke and Salike, 2013; Baldwin and Okubo, 2012). Specifically, Japanese MNCs adopted fragmentation strategies to allocate their production stages in different countries according to the differences

in factor endowments and other locational advantages (Thorbecke and Salike, 2013). A survey report conducted by the JBIC shows that, for Japanese manufacturing firms, the "supply base for assembler" has long been one of the main reasons for investing in countries such as China, India, and Thailand. Furthermore, although there have already been decades since emerging Asian economies became comprehensive production bases, they have maintained a close integration with Japan's industrial production in the global production chain. Therefore, it can be assumed that a higher level of GVC integration between emerging Asian countries and the Japanese industry could be a driver for the expansion of Japanese FDI inflows.

Regarding the relationship between FDI and GVC involvement, several studies provide evidence indicating their positive association. The World Bank (2020) describes that FDI inflows play a strong role in the extent of GVC backward participation shares and levels, which is driven by the GVC integration of the manufacturing sector. Additionally, FDI not only contributes to countries' GVC participation directly by integrating local firms into global production networks but can also provide higher-quality inputs and services to local firms, generating widespread positive spillovers that indirectly expand host countries' GVC participation (World Bank, 2020). GVC participation, then, stimulates FDI flow. Martinez-Galan and Fontoura (2019) report that GVC participation increases inward FDI stock. Moreover, Beugelsdijk et al. (2009) show, for the foreign affiliates of American MNCs, that GVC specialization is driven by exports of MNCs' foreign affiliates regarding intermediate products, which are further used for production. For the case of sub-Saharan African countries and Vietnam, Amendolagine et al. (2019) demonstrated that GVC participation and upstream position encourage foreign firms to use inputs from local suppliers. In line with this growing strand of the literature, several works suggest that countries' GVC involvement may serve as a local advantage for attracting FDI (Amador and Cabral, 2016; Amendolagine et al., 2019; Martinez-Galan and Fontoura, 2019; UNCTAD, 2013).

Nevertheless, empirical literature directly addressing the connections between FDI and GVCs in emerging Asian regions remains scarce. Therefore, this research aims to extend the literature by examining whether the degree of a host country's GVCs integration into the country of investment origin is positively associated with FDI inflows. Thus, this research considers the case of Asian developing countries and Japan by adopting two GVC indexes, as follows: GVC forward participation and backward participation in the manufacturing industry. This study will specifically focus on the machinery sector, which was identified as the most internationally fragmented sector in 2011 (Martinez-Galan and Fontoura, 2019).

3.3 Data and empirical analysis

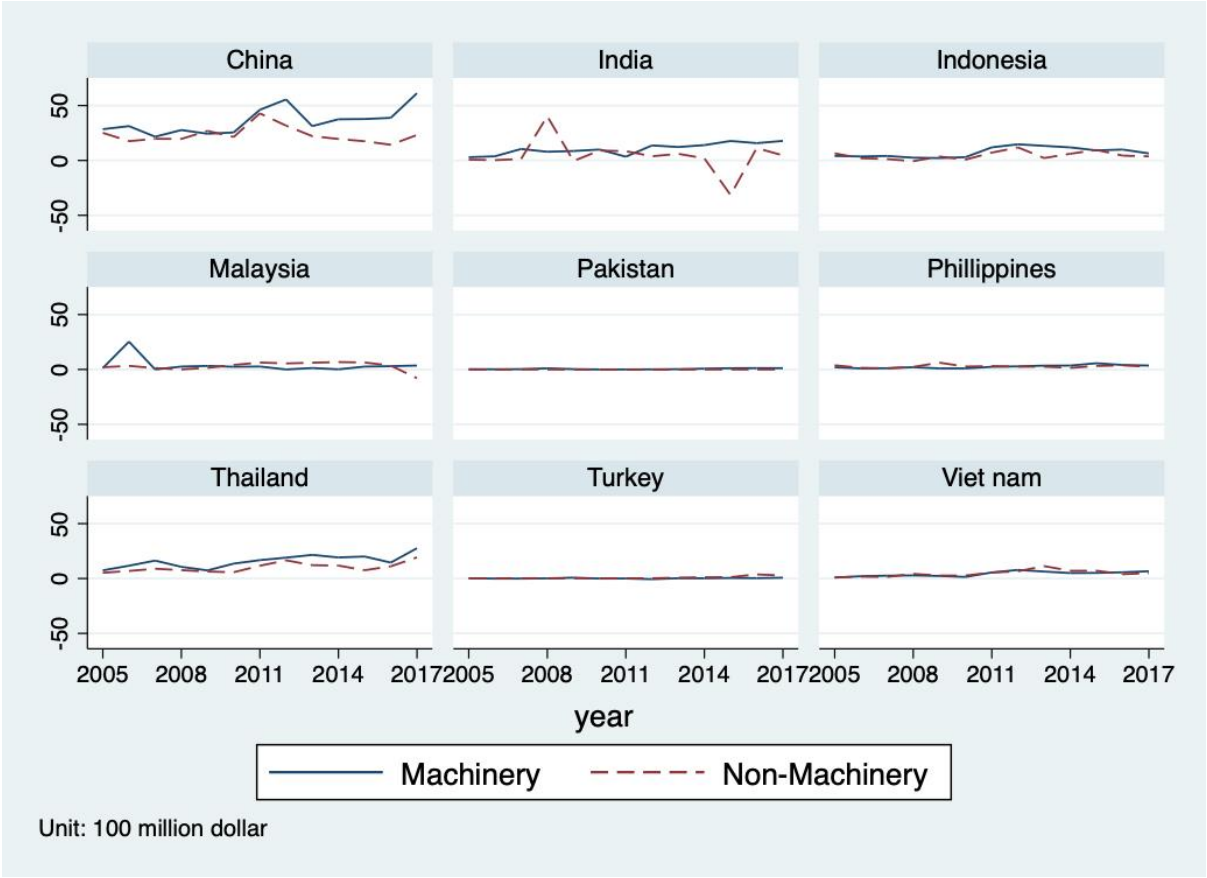
3.3.1 Foreign investment from Japan in Asian developing countries

This research uses sector-level data from the Bank of Japan, which provides detailed data on Japanese FDI outflows to partner countries in each sector. To ensure consistency with other studies on FDI and GVCs, this study focuses on the manufacturing industry, dividing it into the machinery and non-machinery sectors (for sector classification, refer to Table A4.1). The total sample of this research includes 9 Asian developing countries, and the time series data ranges from 2005–2017.

From the 1980s and up until the year 2000, Japanese companies' overseas operations witnessed a surge. Then, after the year 2000, the share of Japanese investment in Asia increased significantly, with the country's direct investment in Asia going as high as 38.3 billion dollars in 2017, representing a 2.8-fold increase compared with the previous year. Figures 3.1. and 3.2. present the tendency and the average of each country's FDI flows received from Japan in both the machinery and non-machinery sectors, respectively. In this study, the machinery sector includes general machinery, electric machinery, transportation equipment, and precision

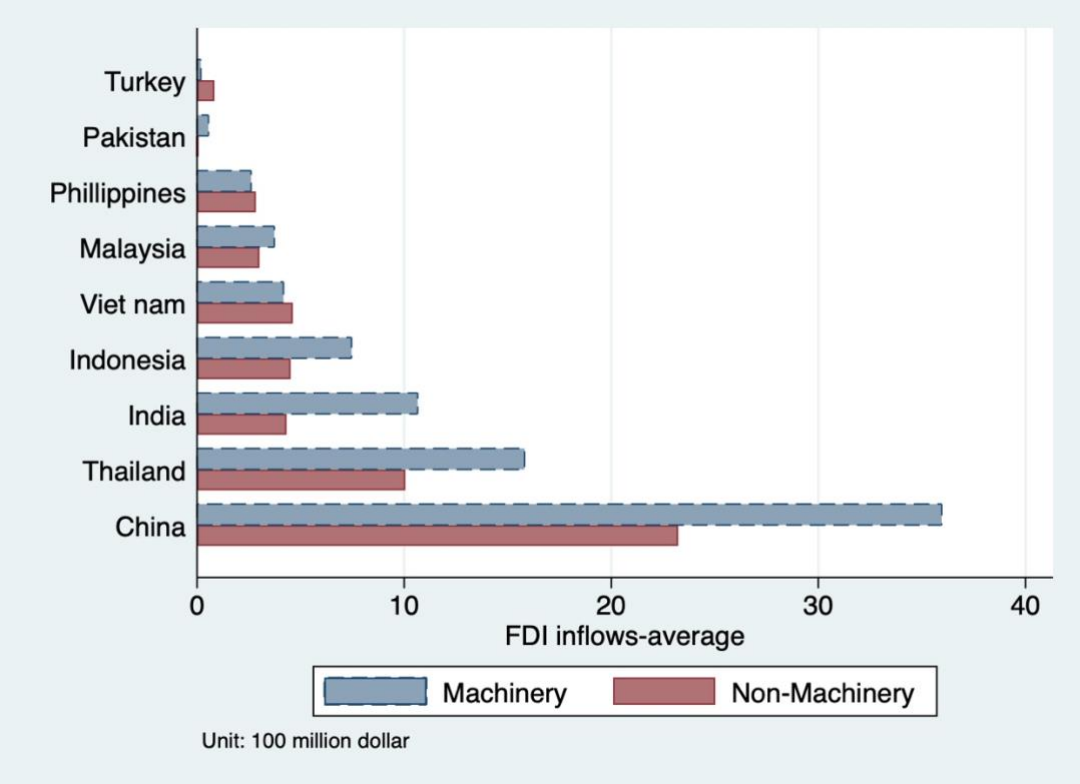
machinery. Since these are key industries in Japan, FDI inflows to most host countries in the machinery sector (e.g., China, India, and Thailand) are higher (and still increasing) than to most host countries in the non-machinery industry. The main destination is China, which had the highest FDI inflows in both the machinery and non-machinery sectors. Furthermore, major ASEAN countries have been a significant base for Japanese overseas activities in manufacture.

Figure 3.1. FDI received by Asian countries from Japan between 2005 and 2017



Source: the Bank of Japan

Figure 3.2. Average FDI flows from Japan to Asian countries in 2017



Source: the Bank of Japan

The average share of Japanese FDI inflows in the non-machinery sector is highly homogeneous across countries and sectors (Table 3.1). Furthermore, the industries with the larger FDI inflow shares are the chemicals and pharmaceuticals, the iron, non-ferrous, and metals, and the food product manufacturing industries. In India, the share of FDI in the chemicals and pharmaceuticals industry is the highest, at 40 percent, and there are also high shares in this industry for China (30 percent), Indonesia (36 percent), and Malaysia (30 percent). One of the drivers of these high shares may be the characteristic of the chemicals industry, which serves as an industrial basis and lies upstream of the supply chain. Therefore, the Japanese chemical industry manufactures and supplies basic chemicals mainly to support the production of downstream industries, such as the automobile and electrical and electronic industries, that is, the machinery sector.

Table 3.1. Average share of FDI inflows from Japan for the non-machinery sectors of Asian countries

	Food	Textile	Lumber and pulp	Chemicals and pharmaceuticals	Petroleum	Rubber and leather	Glass and ceramics	Iron, non-ferrous and metals
China	0.15	0.06	0.09	0.30	0.01	0.08	0.09	0.23
India	0.04	0.02	0.08	0.40	0.00	0.07	0.04	0.36
Indonesia	0.15	0.07	0.18	0.36	-0.07	0.11	0.10	0.10
Malaysia	0.12	0.06	0.07	0.30	0.01	0.08	0.16	0.20
Pakistan	0.00	0.00	0.00	-2.01	0.00	0.00	0.00	3.01
Philippines	0.47	0.00	0.01	0.10	0.00	0.03	0.06	0.33
Thailand	0.05	0.05	0.08	0.25	0.01	0.16	0.07	0.34
Turkey	0.29	0.00	0.00	0.25	0.00	0.36	0.00	0.10
Vietnam	0.09	0.04	0.07	0.22	0.16	0.09	0.07	0.26

Source: The Bank of Japan

3.3.2 Measuring forward and backward linkage in the GVCs

This section calculates the degree of GVC integration of Asian developing countries with the Japanese economy based on the UNCTAD-Eora Database, which offers data on the key indicators of this study for 189 countries and 26 sectors from 1990 to 2018. Hummels et al. (2001) proposed that the concept of GVCs originated from "vertical specialization," which measures the interconnections across countries within a vertical trading chain where each country specializes in some stages of the production process. For vertical international trade to occur, a good must be produced in two or more sequential stages and across at least two international borders (Hummels, Ishii, and Yei, 2001). Furthermore, the participation in vertically specialized trade can take two different forms: downstream, with direct exports of FVA, and upstream, with indirect exports of DVA through a third country (Amendolagine., et.al., 2018)

To precisely compute the extent of GVC involvement, Koopman et al. (2001) decomposed gross exports into the DVA and FVA components, with DVA being further decomposed into

other three types: 1) *direct value added*, the DVA embodied either in final or intermediate goods absorbed by direct imports; 2) *indirect value added*, the DVA contained in intermediate goods embodied in other products that are re-exported to a third country; 3) *re-imported DVA*, the DVA included in intermediate goods that return home embodied in other intermediates and used to produce exports.

The two equations to account for GVC involvement are as follows:

$$GVC\ PARTICIPATION = DVX + FVA \quad (1)$$

$$GVC\ POSITION = Ln(1+DVX) - Ln\ (1+FVA) \quad (2)$$

where *DVX* is the indirect DVA divided by total country exports (*VS*) and represents an upstream participation in GVCs; *FVA* refers to the ratio of the FVA to the total country exports (*VS*) and represents a downstream participation in GVCs. Equation (1) measures the extent of GVC participation in a given country-sector, with larger values indicating more intensive participation in the GVCs. Equation (2) represents the relative position within the GVCs, indicating whether a country-sector is primarily a net exporter or a net importer of value added. The more upstream the participation of a country, the larger its position index value. In contrast, a country with negative position index values denotes its downstream specialization in the GVCs (Koopman et al., 2011).

In this study, an upstream participation in GVCs is defined as "GVC forward linkage" and the downstream participation in GVCs is defined as "GVC backward linkage" (World Bank, 2020), as follows:

$$GVC\ forward\ linkage_{ijt} = DVX_{ijt} \,/\, VS_{ijt} \quad (3)$$

$$GVC\ backward\ linkage_{ijt} = FVA_{ijt} \,/\, VS_{ijt} \quad (4)$$

3.3.3 GVC linkage in machinery sector

Figures 3.3. and 3.4. depict the GVC linkage levels in the machinery sector between Asian countries and Japan from 2005–2017. The results show that countries in the sample generally have a higher extent of GVC backward linkage in the machinery sector, showing a pattern of exporting products assembled with imported parts and intermediate goods from Japan. Vietnam has the highest levels of GVC backward linkage in 2017, as over 10 percent of its exported value added consist of intermediates imported by Japan. Additionally, since Thailand became an important production base for Japanese automobile industries and the Philippines and Malaysia are the main exporters of electric and electronic equipment to Japan, these three countries also show a high degree of GVC backward linkage.

Figure 3.3. GVC forward and backward linkage in the machinery sector between Asian countries and Japan from 2005–2017

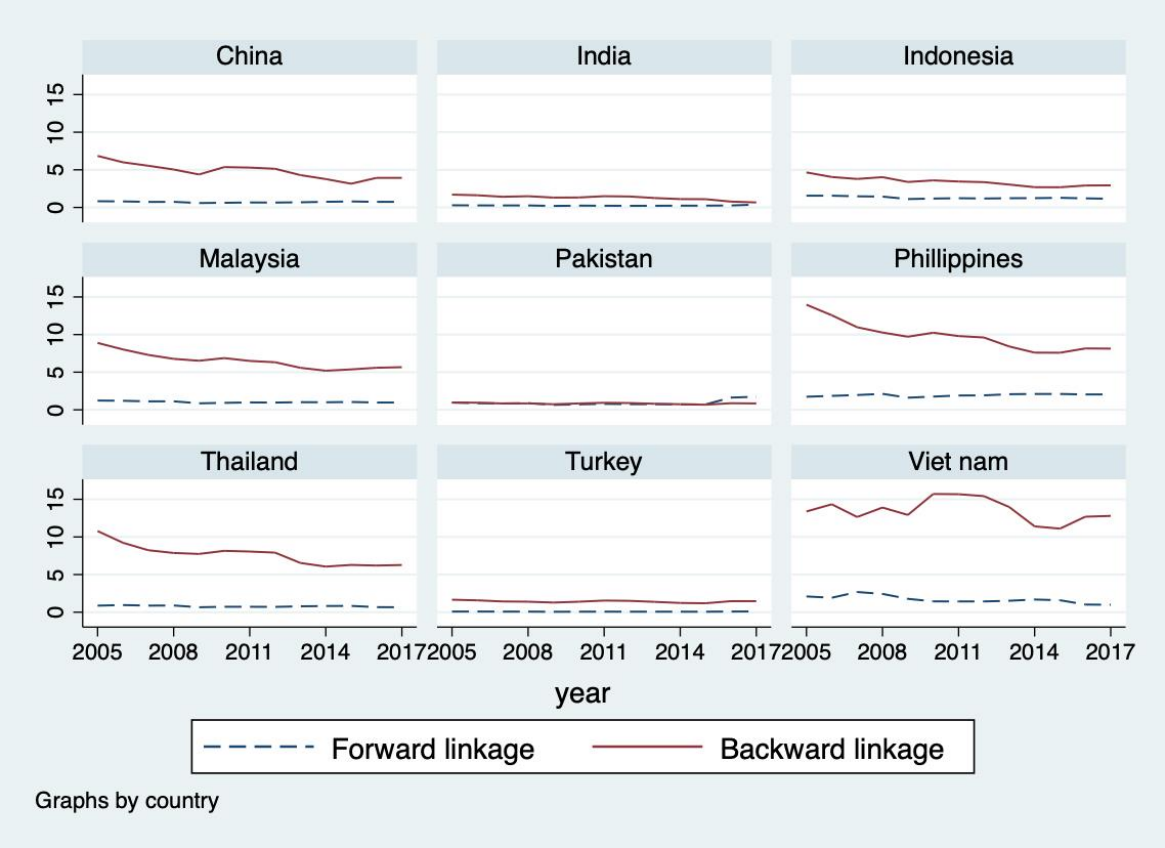
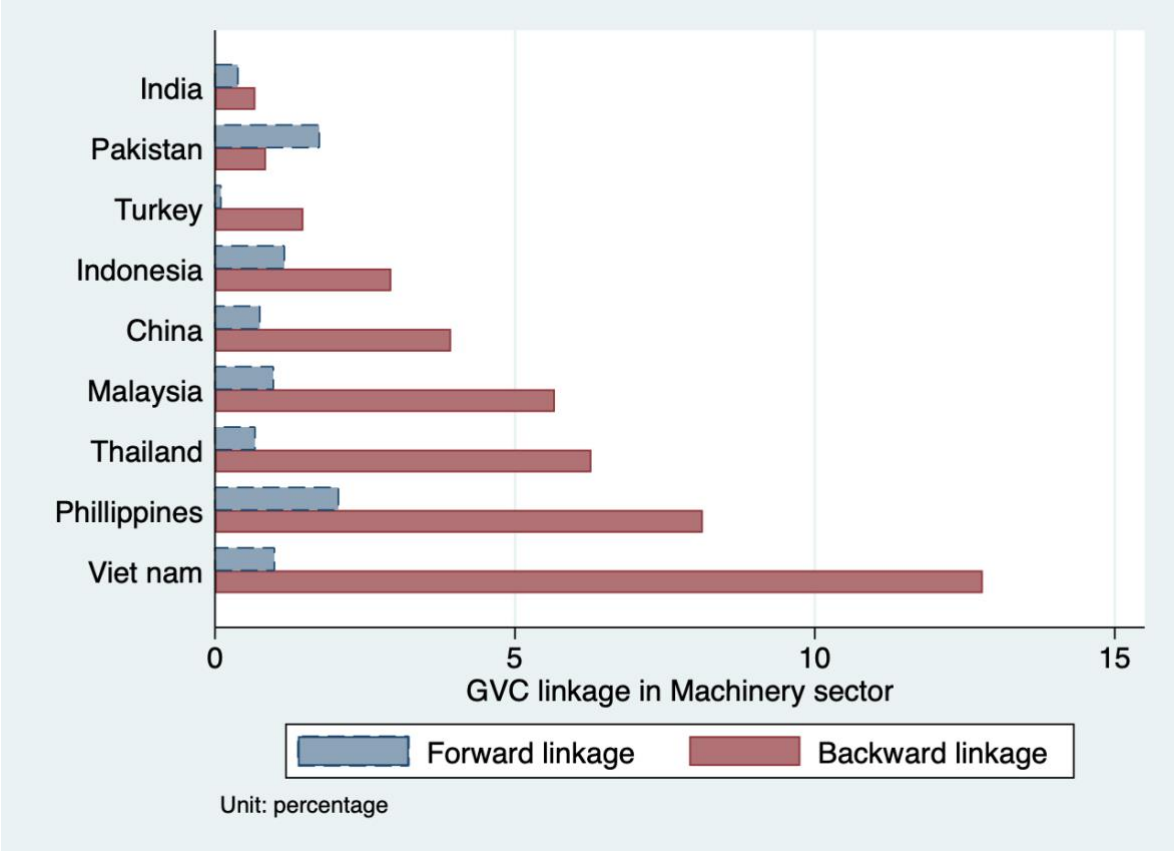


Figure 3.4. GVC linkage in the machinery sector between Asian countries and Japan for 2017



Source: Author's elaboration based on the UNCTAD-Eora GVC Database

3.3.4 GVC linkage in non-machinery sector

Figures 3.5. and 3.6. illustrate Asian countries' GVC linkage with Japan in the non-machinery sector between 2005–2017. Although the results are similar to those for the machinery sector, the GVC backward linkage levels are generally higher than the GVC forward linkage levels in the non-machinery sector, and the overall extent of the GVC integration with Japan, in both its forward and backward forms, are lower than in the machinery sector.

In 2017, Vietnam again shows the largest GVC backward linkage; this may be related to the country's textile and clothing industry, which is one of the world's major exporters of clothing, and the country's FVA in this industry indicates an increased share for Japan (IIMA, 2018). The primary reason for this potential association is because the production of textiles requires more capital and complex technological capacity, making Japan retain its important

role in the context of textile exportation (ASEAN-Japan Centre, 2020). Malaysia and Thailand also have high degrees of GVC backward linkage with Japan in the non-machinery sector, which are concentrated in the chemical and food industries, respectively.

Looking at the GVC linkages of Asian countries with Japan in the whole manufacturing sector (i.e., both machinery and non-machinery sectors, Figures 3.3. and 3.5., respectively), we can observe that the ratio of FVA has been declining in most countries. Although this may initially point toward a slowdown of the expansion of the GVC linkage with Japan, the decline can actually be attributed to an increase in local subsidiaries of MNCs, localization share by attempts to foster the parts industry, and the substitution of the parts exported from Japan for parts produced by local subsidiaries of the Japanese parts maker.

Figure 3.5. GVC forward and backward linkage in the non-machinery sector between Asian countries and Japan from 2005–2017

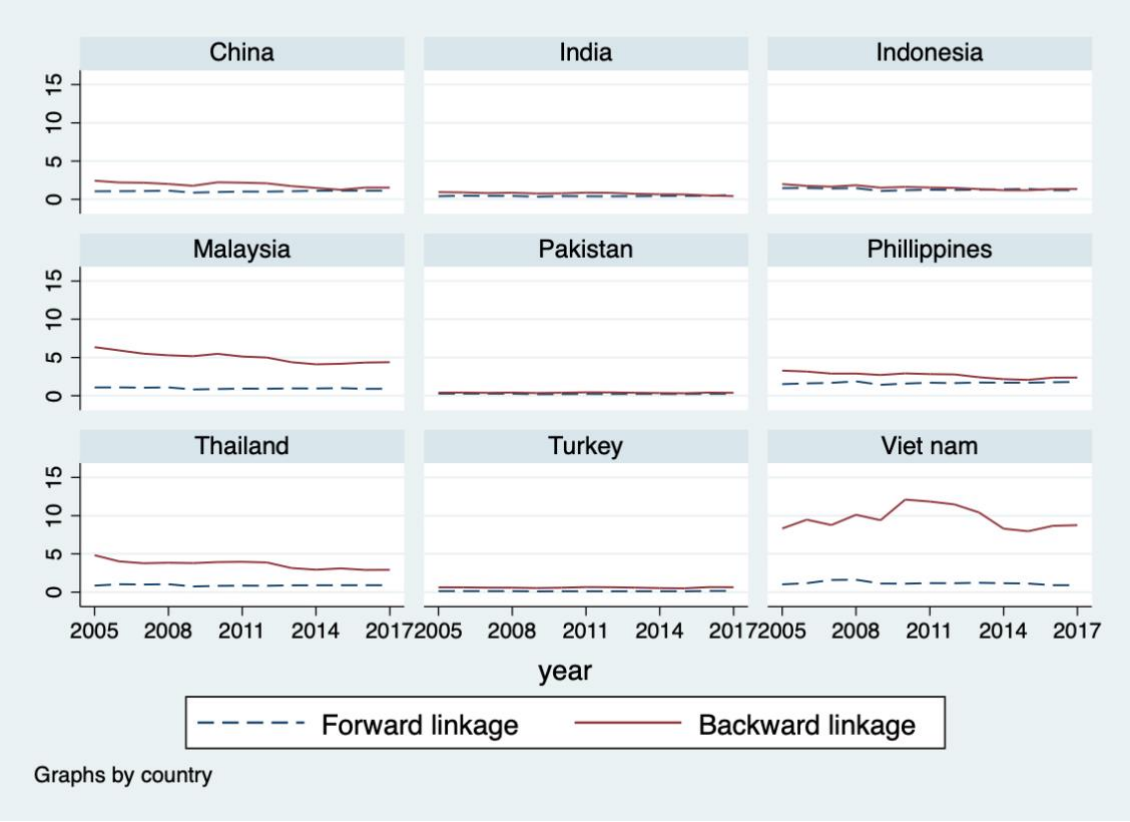
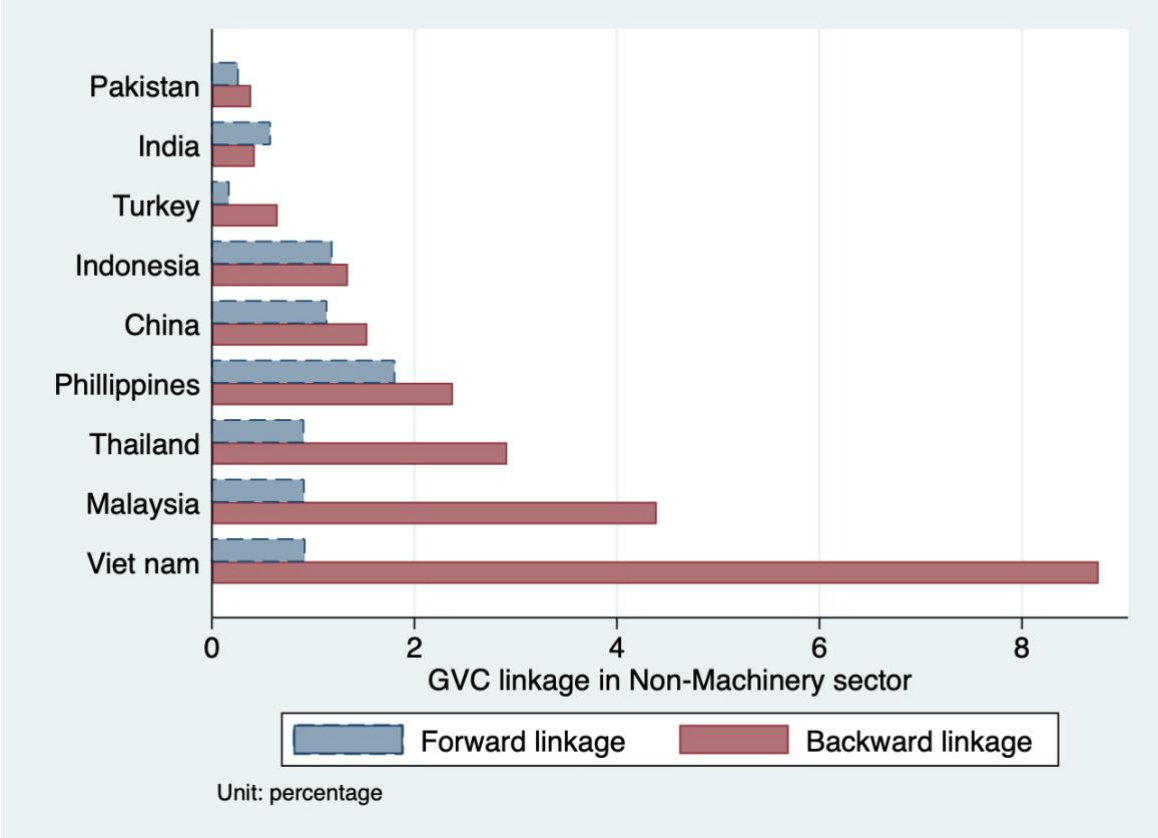


Figure 3.6. GVC linkage in the non-machinery sector between Asian countries and Japan in 2017



Source: Author's elaboration based on the UNCTAD-Eora GVC Database

3.4 Empirical framework

To examine the connection between FDI inflows and GVC integration in Asian developing countries and Japan, this research conducts an econometric analysis by estimating a fixed effect regression model. The regression equation is as follows:

$$FDI_{ijt} = \beta_1 GVC\ forward\ linkage_{ijt-1} + \beta_2 GVC\ backward\ linkage_{ijt-1} + \sum \beta_3 X_{ijt} + \gamma_i + \delta_t + \varepsilon_{ijt} \quad (5)$$

where the dependent variable FDI_{ijt} measures the ratio of FDI inflows from Japan (in current US dollars) in year *t* (ranging from 2005 to 2017) in country *i* and industry *j* divided by

the GDP of country i (in US dollars). As measured above, $GVC\ forward\ linkage_{ijt-1}$and $GVC\ backward\ linkage_{ijt-1}$ represent the forward and backward linkage in GVC integration with Japan, respectively, in country i and industry j.

Given that the potential for endogeneity and variable bias for the GVC indicators cannot be completely excluded, this regression uses lagged values (*t-1*) of forward and backward linkage (at the same time). This is because, according to prior research (Zhao, 2021), this procedure provides more flexible dynamic responses.

Furthermore, considering the wide range of potential motives for FDI decisions, it would be difficult to cover all possible control factors in the model. Thus, this study uses a framework focused on key variables of the macroeconomic environment according to past studies on the determinants of GVC linkages, using them as control variables in the regression model: 1) openness ratio, which is measured by the total merchandise trade and is consider as the share of GDP (Openness ratio); 2) gross enrollment ratio in secondary school (Education); 3) GDP per capita, which is converted by purchasing power parity (GDP per capita); 4) political stability, which is a governance index that indicates the quality of local institutions; 5) a time dummy variable indicating year t and that ranges from 2008 to 2010, which serves to control for the impact of the financial crisis of 2008 (Financial crisis); 6) by referring to other empirical studies on FDI and GVCs, two other kinds of GVC index are used (i.e. GVC participation and GVC position) for all industries at the country level.

Furthermore, to consider the omitted variables in the panel data, such as the variables that vary across countries but are constant over time, or the variables that change over time but are constant for countries, Equation (5) includes fixed effects for the host country i (γ_i) and year t (δ_t). This serves to absorb unobserved country-specific and time-invariant characteristics, respectively, that affect both GVC involvement and FDI inflows from Japan.

3.5 Estimation outcomes and discussions

Table 3.2. reports the results of the fixed effects estimation of Equation (5) in both the machinery and non-machinery sectors with lagged values for the GVC index. The coefficients of the GVC index in Column (1) indicate a positive and statistically significant relationship between FDI inflows from Japan and GVC backward linkage in both the machinery and non-machinery industries. The marginal effects suggest that as the level of GVC backward linkage with Japan (e.g., Vietnam, which had 16 percent in 2010) improves by 10 percentage points, the FDI inflow from Japan increases by 0.4 percent points in the following year in the machinery sector.

The results also show that countries with a higher level of forward specialization in stages of the production process far from the final consumption in the machinery sector (e.g., production of intermediate products used in exports by Japanese electronic or automobile industries) report the higher extent of FDI inflow from Japan.

The estimated coefficients of the control variables verify the importance of the host country's trade openness, human capital, and institutional quality as mediating attractors of FDI inflow from Japan. These results find consistency in the findings of prior research, with various researchers showing that that openness ratio is one of the key determinants of FDI inflows; in the current study, a host country with more trade openness could increase FDI inflows from Japan. Besides, the function of Asian developing countries of being the "base of exports to a third country" is steadily becoming a major attractive for Japanese companies' FDI, and this also reflects the importance of host countries' openness level in improving FDI inflow from Japan.

Upon comparing Columns (1) and (2), the findings show that Japanese investors in the machinery industry are more sensitive to the host country's degree of institutional quality, and this can be partly explained by the fact that cost of investments in the machinery industry is

generally higher than for non-machinery industries. Thus, this makes Japanese investors more attentive to the ability of the host government to protect their interests when investing on the machinery industry. In contrast, Japanese companies may be more likely to be attracted to invest in the non-machinery sector of a host country based on the latter's human capital endowment—albeit the coefficient shows that the impact of education level is very diminished.

The results also show that FDI inflow from Japan was affected by the financial crisis of 2008 (as expected), although not to a statistically significant level. This piece of evidence supports the view put forward by Thorbecke and Salike (2013), who described that once Japanese companies establish their cross-border production network, they become reluctant to withdraw their investments from a host country.

Table 3.2. GVC linkage and FDI inflows from Japan for the machinery and non-machinery sectors

Dependent Variable:	FDI inflows from Japan	FDI inflows from Japan
Manufacture sector:	**Machinery**	**Non-Machinery**
	(1)	(2)
Lagged backward linkage	0.043*	0.042***
	(0.022)	(0.012)
Lagged forward linkage	0.155*	0.074
	(0.087)	(0.064)
Openness ratio	0.006***	0.000
	(0.002)	(0.002)
Education	-0.000	0.000**
	(0.001)	(0.000)
GDP per capita	0.000	0.000
	(0.000)	(0.000)
Political stability	0.187***	0.013
	(0.070)	(0.041)
GVC participation (country level)	-0.005	0.006
	(0.010)	(0.006)
GVC position (country level)	0.001	0.001
	(0.010)	(0.004)
Financial crisis	-0.0201	0.002
	(0.039)	(0.030)
Constant	-0.305	-0.483
	(0.570)	(0.475)
Year fixed effect	Yes	Yes
Country fixed effect	Yes	Yes
Observation	108	108
Number of countries	9	9

Notes: Columns 1 reports the estimate coefficients of the machinery sector, obtained with regression model. The dependent variable is the percentage of FDI inflows from Japan divided by GDP of host country. Columns (2) reports the coefficients of the same model but in Non-Machinery sector. Robust standard errors are report in parentheses * p<0.1, ** p<0.05, *** p<0.01.

Based on the literature, some conditions of host countries are likely to impact the decision toward FDI and the degree of GVC integration, with one of the major factors that might affect the relationship between FDI inflows and GVC integration being institutional quality. To investigate possible heterogeneity effects, this study, as described in Chapter 1, interacts the two kinds of GVC linkage with the quality of local institutions, as measured by the degree of political stability and the rule of law. The quality of local institutions is important for the aforementioned relationship because well-functioning institutions guarantee the stability of the cooperation with foreign partners. This research also considers the control of corruption index, which reflects perceptions of the extent to which public power in a host country is exercised for private benefits (e.g., petty and grand corruption) and whether elites and private interests "capture" the state. We considered this index because Chiappini (2014) described corruption as an important factor affecting FDI from Japanese companies in the manufacturing industry.

The results in Table 3.3 support the assumptions above. That is, for the machinery sector in the links between Japan and Asian developing countries, the association between GVC backward linkage and FDI inflows is stronger in countries with better institutional quality. This is consistent with a previous study showing that good political governance plays a significant role in attracting foreign capitals (Amendolagine et al., 2019), and Zhao (2021) further describes that the mechanism of such significant role lies in its reinforcement of the positive relationship between the degree of GVC participation and FDI inflows. Figure 3.7. shows the marginal effects of GVC backward linkage by political stability, and Figure 3.8. depicts the marginal effects of GVC backward linkage by control of corruption.

Table 3.3. Cross-country heterogeneity in the machinery sector

Dependent variable:			
FDI inflows from Japan	(1)	(2)	(3)
Lagged backward linkage	0.081***	0.084**	0.028
	(0.023)	(0.033)	(0.028)
Lagged forward linkage	0.168**	0.021	0.263*
	(0.084)	(0.179)	(0.150)
Openness ratio	0.006***	0.003*	0.004*
	(0.002)	(0.002)	(0.002)
Education	-0.001	0.001	-0.000
	(0.001)	(0.001)	(0.001)
GDP per capita	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)
Financial crisis	0.002	-0.040	-0.053
	(0.035)	(0.038)	(0.038)
GVC participation (country level)	-0.011	-0.005	-0.004
	(0.009)	(0.010)	(0.011)
GVC position (country level)	-0.003	0.002	0.004
	(0.009)	(0.010)	(0.011)
Political stability x Lagged backward linkage	0.042***		
	(0.010)		
Political stability x Lagged forward linkage	0.005		
	(0.051)		
Control of corruption x Lagged backward linkage		0.076*	
		(0.043)	
Control of corruption x Lagged forward linkage		-0.165	
		(0.247)	
Rule of law x Lagged backward linkage			-0.020
			(0.038)
Rule of law x Lagged forward linkage			0.272
			(0.234)
Constant	-0.282	-0.270	-0.252
	(0.522)	(0.567)	(0.600)
Year fixed effect	Yes	Yes	Yes
Country fixed effect	Yes	Yes	Yes
Observations	108	108	108
Number of countries	9	9	9

Notes: Robust standard errors are report in parentheses * p<0.1, ** p<0.05, *** p<0.01.

Figure 3.7. Average marginal effects of GVC backward linkage by political stability in the machinery sector

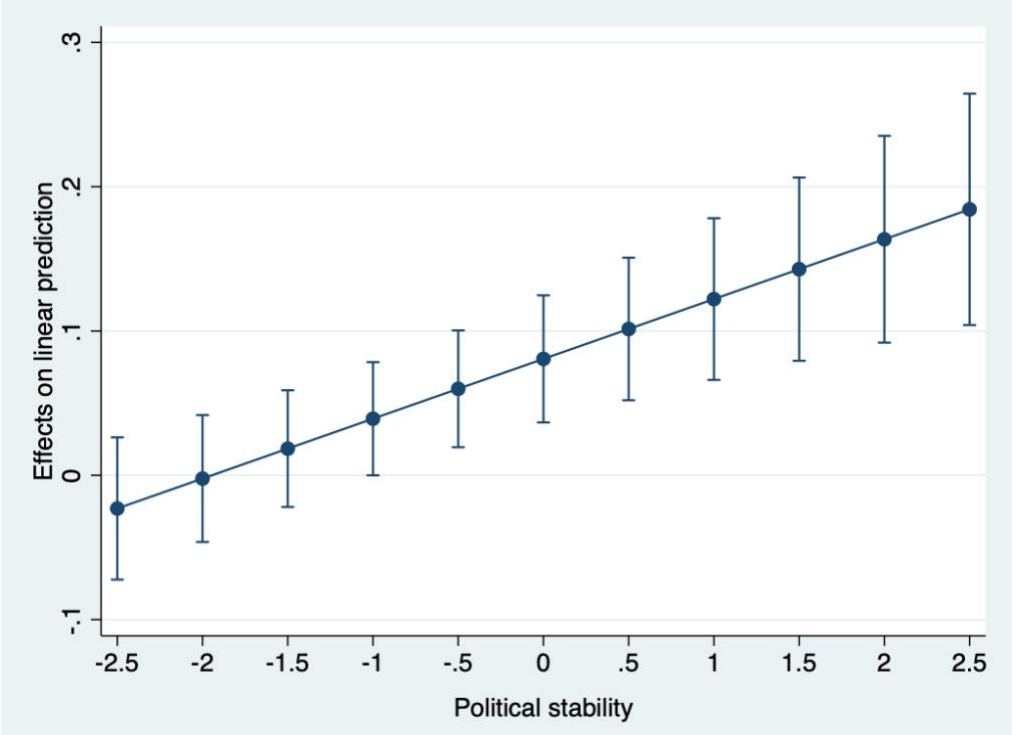
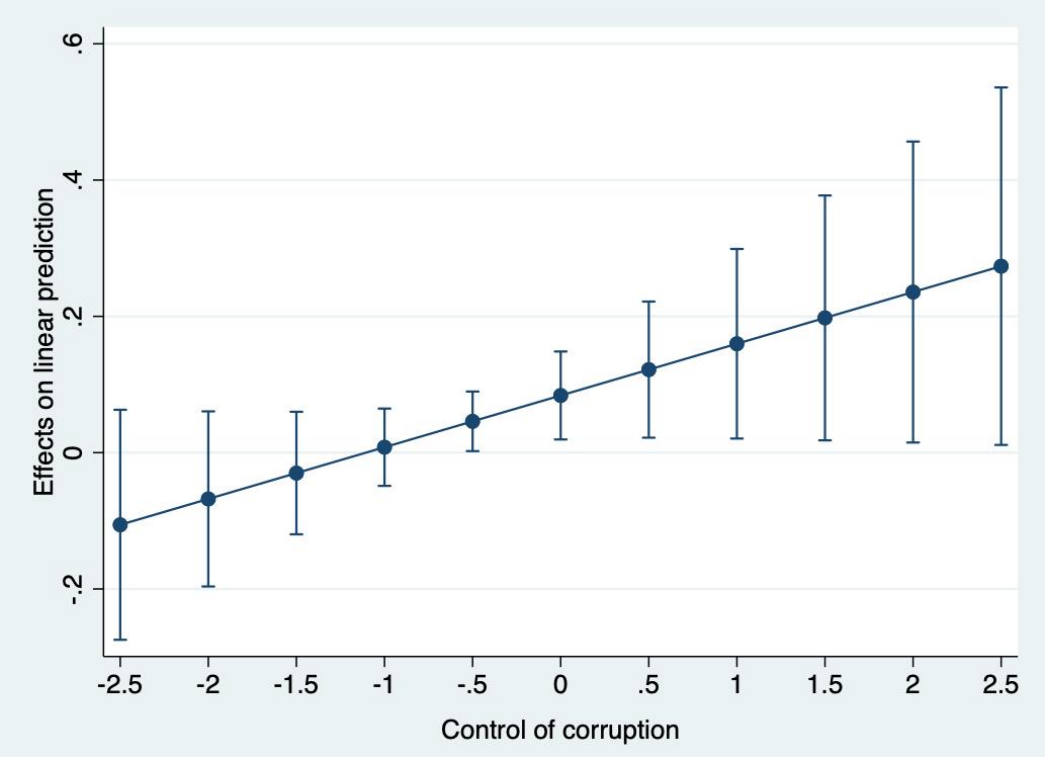


Figure 3.8. Average marginal effects of GVC backward linkage by control of corruption in the machinery sector



Source: Author's elaboration based on the UNCTAD-Eora GVC and World Bank Database

3.6 Conclusion

The increase in GVCs integration with investment-origin countries could positively impact the increase in FDI inflows, especially for developing countries. This study tests this hypothesis by using data on FDI net inflows of nine developing Asian countries from the Bank of Japan, data on GVC indicators from the UNCTAD-Eora Global Value Chain Database, and calculates two GVC involvement indexes at the country and sector levels.

The results show that countries in the manufacturing industry with greater integration in GVC backward linkages generally report higher FDI inflow, as well as that countries with machinery sectors that specialize on the production process stage that lies far from the final demand attract foreign investors with a greater willingness to invest at the local level. These results are especially relevant for countries that specialize in low value-added phases that are positioned more upstream in the GVCs (Amendolagine et al., 2019). The findings of this study support current policy efforts in some Southeast Asian countries aimed at attracting FDI by accelerating industrialization processes to lower the cost of local sourcing. This applies, for instance, to Thailand, the Philippines, and Indonesia, all of which are investing in export processing zones to be able to satisfy the demand from investors in global integrated industries.

The host country is also shown to mediate the relationship between GVC involvement and FDI inflows, with the positive relationship between GVC integration and FDI inflow being stronger in countries with better control over corruption and a more stable political governance.

This study contributes to the literature that emphasizes the benefits of involvement in GVCs (e.g., Taglioni and Winkler, 2016; Costantinescu et al., 2017), especially for Asian developing countries. It also proposes a channel through which the benefits derived from participation in GVCs can spread through the local economy, namely, by attracting foreign investors. The results of this study suggest a strong relationship between GVCs and FDI and show that policies to support countries' engagement and upgrading in GVCs could improve FDI inflows.

Appendix

Table A3.1. Country sample

China	Malaysia	Thailand
India	Pakistan	Turkey
Indonesia	Philippines	Viet Nam

Table A3.2. variable description, source, and summary statistics

Variables	Definition	Source	Number of Obs.	Number of Countries
FDI	FDI net inflows from Japan as the percentage of GDP	World Bank	117	9
GVC Backward linkage	GVC participation index (Koopman et al.2011)	UNCTAD-Eora	117	9
GVC Forward linkage	GVC position index (Koopman et al.2011)	UNCTAD-Eora	117	9
Openness ratio	Total trade as the share of GDP	World Bank	117	9
GDP per capita	Gross domestic product divided by midyear population	World Bank	117	9
Control of Corruption	Control of Corruption Index (it ranges from -2.5 to 2.5)	World Governance Indicators	117	9
Political stability	Political Stability index and Absence of Violence/Terrorism (it ranges from -2.5 to 2.5)	World Governance Indicators	117	9
Financial crisis	Dummy equal to one if the year ranges from 2008 to 2010, and zero otherwise	—	117	9

Chapter 4

China's Global Value Chain Linkage and Logistics Performances in Emerging ASEAN Economies

4.1 Introduction

The Chinese economy has shown a robust performance in its economic growth during the previous decades. The economy joined a middle-income group in the late 1990s and has stepped up to an "upper" middle-income group since 2010, according to income classification by the World Bank[2]. One of the driving forces behind China's economic growth is considered to be its integration with "global value chains (GVCs)". The economic effects of GVC integration were, for instance, estimated by the World Bank (2020): a 1 percent increase in GVC participation would boost per capita income by more than 1 percent, or cause a much more than 0.2 percent income gain from standard trade.

The GVCs themselves, however, do not necessarily guarantee a high level of value added in an economy. A typical example had been the value composition of Apple iPods and iPhones exported by China. Previous studies (e.g., Koopman et al., 2012; Backer, 2011; Xing and Detert, 2010; and Linden et al., 2009) showed that, in the production and export of these items in China, the domestic value added that had been created by the pure assembly accounted for only a small fraction of the selling price to foreign markets, and that the dominant value added had originated from foreign economies such as South Korea, Japan and the United States (the US) in terms of imported parts and components.

[2] See the website: https://datahelpdesk.worldbank.org/knowledgebase/articles/906519. (Accessed January 14, 2021)

Since the mid-2000s, however, China's GVC integration has demonstrated different patterns with industrial upgrading towards a "forward linkage" in its contribution to GVCs. Chinese industries have raised their domestic value-added shares in their exports, through productivity growth, technological progresses and development of supporting industries (e.g., Zhu, 2019; Peng and Zhang, 2020; Taguchi and Li, 2018). At the same time, China's GVC position has been upgraded from the buyers' side, as a facilitator of a "backward" GVC linkage, to the sellers' side, as a promoter of a "forward" linkage. Thus, the Chinese economy has played an increasingly significant role as a supply hub in its GVC activities (e.g., Li et al., 2019; World Bank, 2020).

From a geographical perspective, the Chinese economy has strengthened its GVC linkage with economies in the Association of Southeast Asian Nations (ASEAN). Since the 2000s, China has taken over the positions of Japan, Taiwan, and the US, becoming a supply hub of value-added exports for ASEAN economies, while ASEAN economies have depended more on China for intermediate inputs for their exporting products, as will be shown in Section 2. China concluded its free trade agreement with ASEAN (ACFTA) and put it into force in 2005. ACFTA also seems to have contributed to the reinforcement of the GVC linkage between China and ASEAN economies. In addition, the Regional Comprehensive Economic Partnership Agreement, containing China and ASEAN economies as the targeted members, was signed in November 2020, and it is expected to further tighten GVC integration.

Considering the aforementioned backgrounds, this paper aims to evaluate the extent of China's forward GVC linkage with the emerging market economies of ASEAN (emerging ASEAN economies) compared to those with the US and Japan, and also to examine the connection of China's forward GVC linkage with the logistics performances in emerging ASEAN economies as China's trade partners. The emerging ASEAN economies in this study refer to eight countries: Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines,

Thailand and Vietnam.[3] The hypothesis of this study is that there would be much more room to deepen China's forward GVC linkage with emerging ASEAN economies under the improvements in logistics performances in emerging ASEAN economies. The GVC data are retrieved from the UNCTAD-Eora Global Value Chain Database (UNCTAD-Eora Database).[4] For the analytical methodology, this study applies a "structural" gravity trade model for the specification of estimated equations.

The contributions of this study to the literature are summarized as follows. First, this study discusses the GVC linkage in relation to a logistics performance, while few previous studies have dealt with this relationship. The GVC phenomena, characterized by vertical specialization, has often been explained by the "fragmentation" model in the context of intra-industry trade, as in Jones and Kierzkowski (1990, 2005), Deardorff (2001), and Kimura (2006). Jones and Kierzkowski (1990, 2005) argued that a firm's decision on whether to fragment production processes depends on the differences in location advantages (e.g., the differences in factor prices such as wages) and the levels of the service-link costs. They define the service-link costs as bundles of activities to connect fragmented production blocks, comprising coordination, administration, transportation, and financial services. Thus, the service-link costs are composed of not only bilateral trade costs such as transportation costs, but also country-specific costs such as logistics costs for operating in a given country. For expressing the service-link costs, previous studies such as Kimura et al. (2007) used the geographical distance between exporters and importers in their gravity trade model estimation. This study, however,

[3] Brunei Darussalam and Singapore are excluded from this study's sample, because they belong to the high-income group according to the World Bank classification.

[4] See the website: https://worldmrio.com/unctadgvc/. (Accessed January 14, 2021) The property of this database will be explained in Section 2.

focuses on the logistics performance of a trading country as a component of the service links.[5] This is because the harmonization of logistics policies has been a crucial field for trade facilitation in analyzing ASEAN economies (e.g., Nguyen et al., 2016).

The second contribution is that this study applies the UNCTAD-Eora Database (compiling value-added-trade data) for analyzing the GVC linkage. The GVCs that are characterized by vertical trade could be expressed by trade in terms of value added as well as ordinary gross trade values. Previous studies such as Kimura et al. (2007) examined the vertical trade of the fragmented manufacturing products in an intra-industry by using their gross trade values in terms of parts and components in their gravity trade model. The gross trade values, however, do not necessarily express the vertical trade accurately, because the traded parts and components could also be used for fulfilling domestic final demands, not exclusively for processing them for exports. The value-added-trade data, on the other hand, stand precisely for the vertical trade in the GVC linkage. However, these data are difficult to focus on in terms of intra-industry trade, because the value-added contains all kinds of inputs, such as raw materials and services, that manufacturing industries usually use. Thus, both indicators, the value-added trade and the gross trade values, have pros and cons, and this study, by using the value-added-trade data, would contribute toward enriching diverse evidence on the GVC linkage.

The third contribution is that this study applies a "structural" gravity trade model setting for the GVC analysis. The traditional gravity trade model had explained bilateral trade flows by the economic size of two countries and the distance between them. Piermartini and Yotov (2016), however, argued that the traditional model would lead to biased and even inconsistent

[5] The subsequent studies such as Taguchi and Ni Lar (2015 and 2016) added the logistics performance index as the proxy of the service-link costs to the equation. These studies, however, used an ordinary gravity trade model different from this study's model.

estimates, and so presented a comprehensive and theoretically consistent econometric specification of a gravity trade model setting with the following six suggestions: (i) use panel data, (ii) use interval data to allow for adjustment in trade flows, (iii) include intra-national trade flows, (iv) use directional time-varying fixed effects, (v) employ pair fixed effects, and (vi) estimate gravity model with the Poisson Pseudo Maximum Likelihood (PPML). This study applies five of the six suggestions, with the exception of recommendation (iii). The reason for excluding the recommendation (iii) is that this study focuses on the comparison in China's value-added trade among its partners.

The remainder of the paper is structured as follows. Section 2 illustrates the extent of China's GVC linkage with emerging ASEAN economies; Section 3 conducts an econometric analysis by estimating a structural gravity trade model, to examine the quantitative connection between China's forward GVC linkage and logistics performances in emerging ASEAN economies; and Section 4 summarizes and concludes the paper.

4.2 China's forward GVC linkage

This section illustrates the extent of China's GVC linkage with emerging ASEAN economies by using the UNCTAD-Eora Database. The idea on the GVC forms originated from the concept of "vertical specialization" proposed by Hummels et al. (2001). They suggested the following two types of participations in a vertical specialization chain: the country uses imported inputs to produce an exported good (expressed as VS), and the country exports goods that are used as inputs into another country's production of export goods (expressed as VS1). Koopman et al. (2010) precisely computed the share of VS and VS1 relative to gross exports to represent the extent of GVC participation, by the framework integrating vertical specialization and value-added trade in the literature, as follows:

$$GVC\ PARTICIPATION = DVX + FVA \quad (1)$$

$$GVC\ POSITION = Ln(1+DVX) - Ln\ (1+FVA) \quad (2)$$

where DVX and FVA stand for "domestic value added embodied as intermediate inputs in other countries' gross exports", "foreign value added embodied in gross exports", devided by "gross exports (VS)" respectively. In Equations (1) and (2), the first item DVX represents an upstream participation in GVCs, and the second item FVA shows a downstream participation in GVCs. These two indices can be computed for any countries and sectors, so long as the data are available. Then, Equation (1) denotes the total extent of GVC participation in a country-sector, and Equation (2) describes the country-sector's GVC position: if the country-sector lies upstream in a GVC, the numerator tends to be large, but if it lies downstream, then the denominator tends to be large.

In this study, the upstream participation in GVCs (DVX) is called "forward GVC linkage" and the downstream participation in GVCs (FVA) is called "backward GVC linkage," following, for example, the World Bank (2020). The UNCTAD-Eora database, which this study uses, offers the GVC data with global coverage (189 countries and a "Rest of World" region) and a time series from 1990 to 2018, and provides the key GVC indicators: foreign value added (FVA), domestic value added (DVA), and indirect value added (DVX).[6] The

[6] The methodological background of the UNCTAD-Eora database was described by Casella et al. (2019). The value-added-based trade data originated from the work of the OECD and WTO as the "Trade in Value Added (TiVA)" dataset (see OECD and WTO, 2012). Thus, Casella et al. (2019) also provided a comparison of the results of the UNCTAD-Eora database against the TiVA database.

variables of IV and FV in Koopman et al. (2010) correspond to DVX and FVA in the UNCTAD-Eora database, respectively.

Figure 4.1. illustrates China's GVC linkage and position for 1990 – 2018, based on the UNCTAD-Eora database. The backward GVC linkage peaked in 2011 and has since entered a declining phase. This seems to be because China has facilitated domestic value creation in exports with industrial upgrading since the previous decade, as Zhu (2019), Peng and Zhang (2020) and Taguchi and Li (2018) argued. The forward GVC linkage, on the other hand, has continued to grow. This trend is consistent with the perspective of Li et al. (2019) that the Chinese economy has played an increasingly vital role as a supply hub in its GVC activities. As a result, China's GVC position index turned from a declining phase with active backward linkage before the mid-2000s to a rising phase with dominant forward linkage after that. The World Bank (2020), describing an approximate distribution of backward and forward GVC integration across taxonomy groups, also identified China's GVC position as a group of "advanced manufacturing and services" with a rising forward GVC linkage.

China's forward GVC linkage with emerging ASEAN economies could be observed from another angle, that is, the foreign value added in exports of emerging ASEAN economies (ASEAN's backward GVC linkage) by country origins.[7] According to Table 4.1., looking at the latest year of 2018, China is counted as the country that has the largest share of foreign value added out of total foreign value added in gross exports in Cambodia, Indonesia, Malaysia, Myanmar, Thailand, and Vietnam, and as the country with the second largest share in Lao PDR and the Philippines. At the same time, looking at the time series trend for 1990-2018, the China's foreign value-added share has increased in all of the emerging ASEAN economies.

[7] The data are retrieved from the UNCTAD-Eora database, the country-by-country matrix (1990- 2018) with the rows being the country originating the VA, and with the columns being the country exporting that VA.

However, Japan, the US, and Taiwan have lost their foreign value-added share during the same period. One additional point to note is that the intra-regional linkages among ASEAN economies have been strengthened in terms of the increasing trends in their shares of foreign value added from themselves, such as Cambodia from Thailand, Indonesia from Malaysia, Lao PDR from Thailand, Malaysia from Indonesia, Thailand from Malaysia, and Vietnam from Thailand.

In sum, China's forward GVC linkage has been strengthened including the linkage with emerging ASEAN economies during the past decades. Thus, the subsequent analysis of a gravity trade model focuses on China's forward GVC linkage with emerging ASEAN economies.

4.3 Econometric analysis

This section conducts an econometric analysis by estimating a structural gravity trade model, to examine the quantitative connection between China's forward GVC linkage and logistics performances in emerging ASEAN economies. This section first specifies the estimation model and the sample data, and then presents estimation outcomes with discussions.

4.3.1 Specification of estimation model and data

This study equips the following two types of structural gravity model specifications for examining China's forward GVC linkage: (i) the model setting using the directional time-varying fixed effects (Equation 3), and (ii) the model setting using the logistics performances of China's partner countries instead of their time-varying fixed effects (Equation 4). The models for the estimations are specified as follows:

$$DVX_{ci,t} = exp\,[\mu_{ci} + \pi_{c,t} + \chi_{i,t}] + \varepsilon_{ci,t} \quad (3)$$

$$DVX_{ci,t} = exp\,[\mu_{ci} + \pi_{c,t} + \alpha\, LPI_{i,t}] + \varepsilon_{ij,t} \quad (4)$$

where the subscripts c, i, and t denote China (offering foreign value added in exports), China's partner countries (receiving foreign value added in exports), and trading years, respectively; DVX is the value added exports from China to its partners; μ_{ci} is the pair fixed effects between China and its partners i (excluding emerging ASEAN economies); $\pi_{c,t}$ and $\chi_{i,t}$ are the time-varying fixed effects of China and its partner i (targeting emerging ASEAN economies)[8], respectively; LPI is the logistics performance index; ε is an error term; α is an estimated coefficient of LPI.

The value-added exports from China to its partners (DVX) are defined as China's domestic value added embodied as intermediate inputs in its partners' gross exports (corresponding to China's forward GVC linkage in this study). The UNCTAD-Eora database provides the country/sector-by-country matrix for all years from 1990 to 2017, reporting, for each country of exports, the value contributed by all other country/sector in the world, where the rows show the country/sector originating the value added and the columns show the country exporting that value added. China's value-added exports (DVX) are represented by the row in China's country/sector column, that is, China's value-added contributions to its partners' exports. The DVX in this study's estimation targets three groups of sectors: total industry, manufacturing, and machinery (the industrial classification is defined in Appendix 1). The reason for focusing on the manufacturing and machinery sectors is that GVC activities with many multi-layered

[8] The pair fixed effects, μ_{cj}, exclude emerging ASEAN economies, and the time-varying fixed effects of the partners, $\chi_{i,t}$, target only emerging ASEAN economies, because the inclusion of all the partners in their effects causes near singular matrix errors due to the perfect collinearity among regressors.

vertical production processes as the mode of fragmentation are typically observed in these sectors, as Kimura (2006) argued.

Equation (3), the structural gravity model setting, conforms to the following recommendations of Piermartini and Yotov (2016). First, the time-varying fixed effects of China and its partners, $\pi_{c,t}$ and $\chi_{i,t}$, are incorporated in the equation to control for the multilateral resistances, as suggested initially by Anderson and van Wincoop (2003). The time-varying fixed effects absorb all the observable and unobservable country-specific characteristics that influence bilateral trade (e.g., China's and its partners' GDPs). For the time-varying fixed effects of China's partners, this study treats the US and Japan as a benchmark of the partners, for examining the effects of emerging ASEAN economies on China's value-added exports. Second, the pair fixed effects between China and its partners, μ_{ci}, are introduced to the equation to account for the effects of all time-invariant bilateral trade costs, as Agnosteva et al. (2014) demonstrated. The pair fixed effects contain all the time-invariant bilateral elements such as geographical distance and the presence of contiguous borders and a common official language. Third, the estimation applies the PPML as its methodology to manage the possibility of zero trade flows and heteroscedasticity of trade data, as Santos Silva and Tenreyro (2006) recommended.[9] The estimation of Equation (3) also adopts the Ordinary Least Squares (OLS) estimator as a robustness check, as Head and Mayer (2014) suggested.

Equation (4) replaces the time-varying fixed effects of China's partners in Equation (3) by their logistics performances. As mentioned in the introduction, the service-link costs are a key determinant of GVC linkage in the framework of the fragmentation theory, and contain not only bilateral trade costs such as transportation costs, but also country-specific costs such as

[9] The UNCTAD-Eora database this study uses does not include zero trade data. However, the application of PPML estimation is still appropriate and effective because of the heteroscedasticity of trade data.

logistics costs in a trading country (Jones and Kierzkowski, 1990). Thus, the service-link costs occupy some portions of the time-varying fixed effects of China and its partners ($\pi_{c,t}$, $\chi_{j,t}$) and their pair fixed effects (μ_{ci}).[10] This study focuses on the time-varying logistics costs of China's partners as one part of the service-links (Figure 4.2). The logistics costs are expressed by the Logistics Performance Index (LPI) of the World Bank.[11] The index measures the performance on trade logistics from the six perspectives: customs, infrastructure, international shipments, logistics quality and competence, tracking and tracing, and timeliness, and takes the number ranging from 1 (very low in the performances) to 5 (very high).[12] The estimation of Equation (4) is expected to verify positive significance of the LPI variable, and the study, using the estimated coefficient α, demonstrates the contribution of the logistics performances to the time-varying country-specific fixed effects in emerging ASEAN economies as China's partners. This estimation also uses the PPML estimator.

The sample economies and period are set as follows. China is the host country, and the partners for its value-added exports are 39 economies including eight emerging ASEAN economies (see Appendix 2), which account for more than 95 percent of China's value-added exports in 2017. As for the sample period, the study selects discrete years such as 2007, 2010,

[10] The service-link costs are also affected by the "time-varying" bilateral trade costs, represented by the effects of, for instance, new regional trade agreements. This study omits these effects to highlight the arguments on country-specific effects.

[11] See the website: https://lpi.worldbank.org/. (Accessed January 14, 2021)

[12] The logistics costs are also shown by other indexes such as the score of "Trading across borders" in the Doing Business of the World Bank (https://www.doingbusiness.org/en/custom-query, accessed May 12, 2021). In the subsequent estimations in Table 4.3., the LPI is replaced by the score of Trading across borders, and the almost same results are obtained with its positive coefficients at conventionally significant levels. Since this score's availability is confined to the period after 2015, the subsequent estimations focus on the LPI index.

2012, 2014, 2016, and 2017 because of the constraint of data availability of the LPI[13]. The study then constructs panel data for six years with the 39 combinations between China and its partners (6 times 39 = 234) for the estimation. The selection of discrete sample years and the construction of panel data also fits the suggestions of Piermartini and Yotov (2016) in the structural gravity trade model setting.

For the subsequent panel estimation, this study investigates the stationary property of the constructed panel data by employing panel unit root tests: the Levin, Lin, and Chu test (Levin et al. 2002) as a common unit root test; and the Fisher-ADF and Fisher-PP tests (Maddala and Wu 1999; Choi 2001) and the Im, Pesaran and Shin, test (Im et al. 2003) as individual unit root tests. The common unit root test assumes that there is a common unit root process across cross-sections, and the individual unit root test allows for individual unit root processes that vary across cross-sections. These tests are conducted based on the null hypothesis that a level of panel data has a unit root, by including 'intercept' and 'trend and intercept' in the test equations. Table 4.2. reports the test results as follows: the common unit root test, that is, the Levin, Lin, and Chu test, identifies the rejection of the null hypothesis of a unit root at the 99 percent significance level in all the variables in both test equations. The individual unit root tests do not necessarily reject the null hypothesis of a unit root in all cases, but the Fisher-PP test rejects it at more than the 99 percent level in all the variables in the test equation with the intercept. Thus, it is speculated that the there is no serious problem of low power in the unit root tests, thus using the level of panel data for the estimation in this study.

[13] The UNCTAD-Eora database has the data range for 2017, and the LPI data in 2018 are applied to the data as 2017, since the LPI does not have the data for 2017.

4.3.2 Estimation outcomes and discussions

Table 4.3. reports the estimation outcomes of Equation (3) and (4) with the US and Japan benchmarks for the cases of total industry, manufacturing and machinery. The cases with any benchmarks and in any industries produce similar results with the same direction of the coefficients' signs, although their magnitudes slightly differ among the cases. Thus, this section focuses mainly on the results with the US benchmark in total industry, and it adds explanations in the other cases later on.

Columns (i) and (iii) correspond to the results of Equation (3) estimation by the OLS and the PPML, respectively, and display the time-varying fixed effects of emerging ASEAN economies as China's partners ($\chi_{i,t}$) with the US benchmark (the time-varying fixed effects of China $\pi_{c,t}$ and the pair fixed effects μ_{ci} are omitted for brevity). They clearly show negative effects at conventionally significant levels, except for Thailand and Malaysia in 2010, 2012, and 2014 in column (i), with the wide range of their magnitudes from the largest negative values in Myanmar to the least negative values in Malaysia. They imply that China is less linked with emerging ASEAN economies than with the US as the partner of China's forward GVC linkage. In a comparison of the estimation methodologies, the OLS estimation provides extremely large coefficients in their absolute magnitudes in column (i): the coefficient of Myanmar in 2007 is, for instance, exp. (-11.079) = 0.00001, whereas the PPML estimator gives reasonable levels of coefficients in column (iii): that of Myanmar is exp. (-1.135) = 0.321. Another difference between the OLS and the PPML estimation is the one in the result of the Ramsey RESET test shown at the bottom of Table 4.3. The test detects model specification errors from possible omission of variables, with the null hypothesis that the model does not suffer from misspecification errors. The RESET p values in these columns reveal that it is not the OLS but the PPML estimator that passes the misspecification tests. Thus, this study

identifies the PPML as a reasonable standard of estimation, and so the subsequent estimation of Equation (4) applies only to the PPML estimator.

In the other cases, almost the same results as those above in total industry with the US benchmark are obtained, although there are slight differences in the coefficients' magnitudes. The cases of manufacturing and machinery (columns ix and xv) have larger magnitudes of their negative coefficients of the time-varying fixed effects of emerging ASEAN economies than total industry. As for the comparison of the benchmarks, the Japan benchmark (column iv and x) provides larger magnitudes of their coefficients than the US benchmark in total industry and manufacturing.

Column (v) reports the PPML estimation result of Equation (4) that applies explicitly to the logistics performances of China's partners (LPI) instead of their time-varying fixed effects. It shows that the LPI coefficient α is significantly positive as expected, and it implies that the logistics performances of China's partners have some effects to explain the less linkage of China's forward GVC with emerging ASEAN economies. The RESET p value in this column suggests that the estimation of Equation (4) does not pass the misspecification tests even by the PPML estimator. It seems to be probably because there are omitted variables in this estimation so that the logistics performances themselves cannot cover all the time-varying country-specific factors. All the other cases, that is, those in manufacturing and machinery and with the Japan benchmark, have positively significant LPI coefficients, although their magnitudes are larger in manufacturing and machinery (columns xi and xvii) and those are smaller with the Japan benchmark (columns vi, xii, and xviii) than with the US benchmark.

Here comes the final step to examine the contribution of the logistics performances to the time-varying country-specific fixed effects in emerging ASEAN economies as China's partners. Table 4.4. compares emerging ASEAN economies' fixed effects and their effects of logistics performances (LPI) in terms of the period average of 2007-2017 with the US and

Japan benchmarks in total industry, manufacturing and machinery. Column (a) shows the period-average coefficients of emerging ASEAN economies' fixed effects; the LPI deviations from the US and Japan benchmarks in column (c) is computed by subtracting the benchmarks' LPI from each emerging ASEAN economies' LPI in column (b); and the LPI effects in column (d) is then calculated by multiplying the LPI deviations with the estimated coefficients of LPI in Table 4.3.

Focusing on the case with the US benchmark in total industry in Table 4.4., the negative LPI effects in column (d) are comparable to the country-specific negative fixed effects in column (a) in the absolute levels. In Myanmar, Lao PDR and Cambodia, their LPI effects account for most of their fixed effects. In Vietnam, the Philippines, Indonesia, Thailand, and Malaysia, on the other hand, their LPI effects exceed largely their fixed effects in the magnitudes. It seems to be probable because the country-specific fixed effects in these countries contains the other factors that offset the LPI effects, such as their preferential tax systems and the other incentives for their industries. The similar results are shown in the other cases in manufacturing and machinery and with the Japan benchmark. In sum, the lack of logistics performances of emerging ASEAN economies as China's partners is a significant factor in explaining the less linkage of China's forward GVC with them. This finding is also consistent with the analytical messages from the World Bank (2016 and 2020) that GVC integrations are highly sensitive to logistics performances.

4.4 Policy implications

GVC integrations offer great opportunities that allow China to improve its economic development. Along with China's industrial upgrading, emerging ASEAN economies have become absolutely necessary trade partners for China since the 2000s. The analysis of China's

forward GVC linkage, nevertheless, reveals that the connection of China with emerging ASEAN economies is weaker than with the US and Japan, and that one of the significant reasons is the lack of logistics performances in emerging ASEAN economies. The findings in this paper have the following policy implications for China to improve its GVC integrations, especially the forward linkage with emerging ASEAN economies.

Policy makers in China can strengthen the assistance to enhance the logistics performances in emerging ASEAN economies through the framework of the Belt and Road Initiative (BRI). The BRI was proposed in 2013 with the objective to make China's domestic overcapacities and capitals contribute to the infrastructure development and economic growth in South-East Asian, Central Asian, and European countries, through improving the connectivity with these countries along with the Belt and Road. According to Arvis (2016), the World Bank has marked the BRI as one of the "major new international initiatives address logistics issues". The official documents issued by the National Development and Reform Commission in 2015 indicate that the Chinese government identified five key cooperation areas for advancing the BRI, that is, policy coordination, facilities connectivity, unimpeded trade, financial integration, and people-to-people bond, which are considered to have positive effects on the strategic decisions in logistics performance (J. Ye and H.-D. Haasis). Particular the facilities connectivity includes a series of infrastructure projects such as the construction of roads, railways, ports, and airports, etc., which influence the transportation factors significantly (Ylander, 2017). As important trade partners on the BRI route, the Chinese authorities have actively promoted cooperation with ASEAN economies by linking the BRI and the Master Plan on ASEAN Connectivity. As one of the important areas of China-ASEAN cooperation, the transportation field, for instance, the promotion of the Trans-Asian Railway and the construction of sea and air transportation has made major achievements during the second decade in the 21st century. On the other hand, the case studies on Pakistan, Kazakhstan, and Thailand in James and Selina (2018) shows the

BRI has played a role as a catalyst and an obligatory passage point to obtain the required resources and supports for facilitating mega transnational transport infrastructure projects in the regional scale. Furthermore, based on a modified gravity prediction model, Zeng et al. (2017) calculate the changes in transshipment traffic to analyze the impact of the Carat Canal. It is concluded that under the BRI, the opening of the Carat Canal affects the market shares of transshipment among hub ports and diversifies shipping network patterns.

The government documents and previous studies above provide evidence that it is possible for China to help improve the logistics performance in emerging ASEAN economies through the BRI framework, so that China could enhance its forward GVC linkage with them.

In addition, the Chinese government could intensify its assistance and investment of logistic infrastructure in emerging ASEAN economies through the "dual circulation strategy". The dual circulation strategy was first mentioned in 2020, which is a new development pattern that places a greater focus on internal circulation, at the same time allows domestic and international double circulation to promote each other. According to the Central Finance and Economics Committee of China, as an important link of the dual circulation, the logistics system connects production, distribution, circulation, and consumption, which is an important support and guarantee for opening up the supply chain and coordinating the industrial chain. Therefore, it is necessary to improve the construction and logistics efficiency of the transportation network both in domestic and foreign countries. Overall, the dual circulation strategy can be expected to improve the logistic performance in emerging ASEAN economies and strengthen the GVC forward link with them.

Finally, the government of China could encourage private companies in the field of logistics services to promote their foreign direct investments (FDI) in emerging ASEAN economies. Through the FDI, emerging ASEAN economies as the host countries could expect

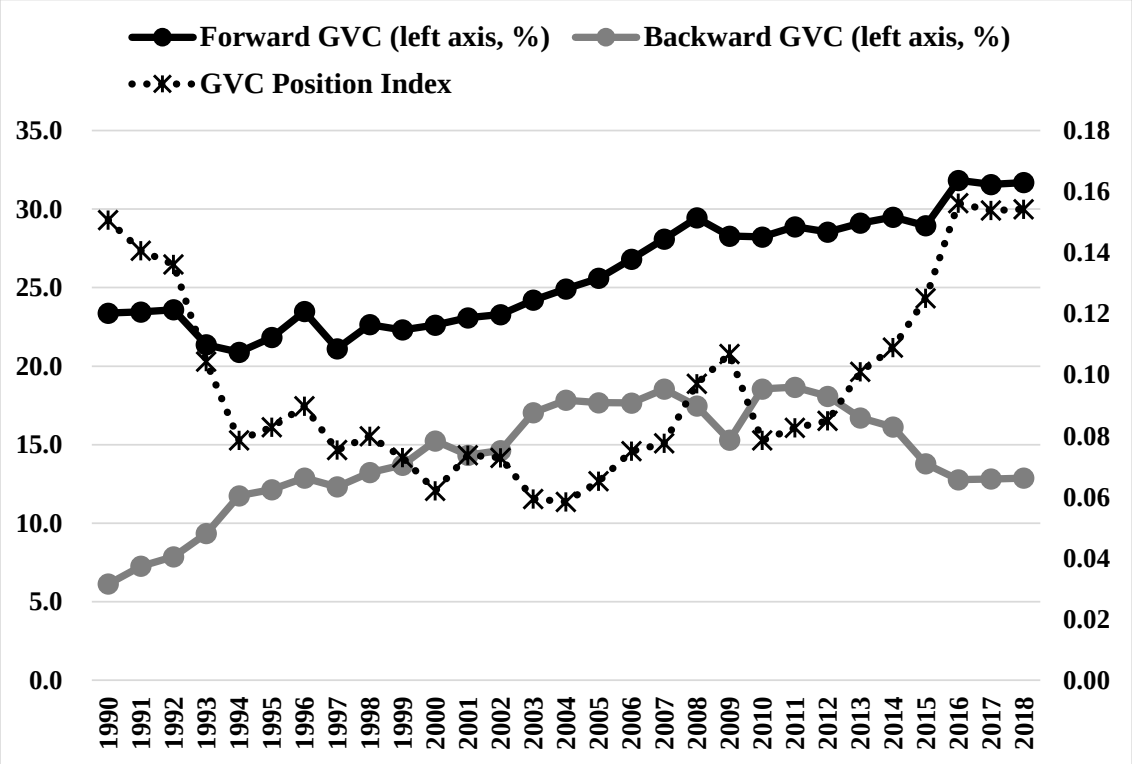
to gain the spillover effects from the Chinese investors in the field of innovative logistics both directly and indirectly.

4.5 Conclusion

This paper aimed to evaluate the extent of China's forward GVC linkage with emerging ASEAN economies compared to those with the US and Japan, and also to examine the connection of China's GVC linkage with logistics performances in emerging ASEAN economies as China's trade partners. The hypothesis of this study was that there would be much more room to deepen China's forward GVC linkage with emerging ASEAN economies under the improvements in logistics performances in emerging ASEAN economies. This study used the UNCTAD-Eora Database and applied a structural gravity trade model for the analysis. The statistical observations have highlighted that the major position of China's GVC has transformed from a backward linkage to a forward linkage since the mid-2000s. The empirical estimation of a structural gravity trade model has identified the less linkage of China's forward GVC with emerging ASEAN economies than with the US and Japan, and has demonstrated that the lack of logistics performances in emerging ASEAM has been a significant factor in explaining the less linkage of China's forward GVC with them.

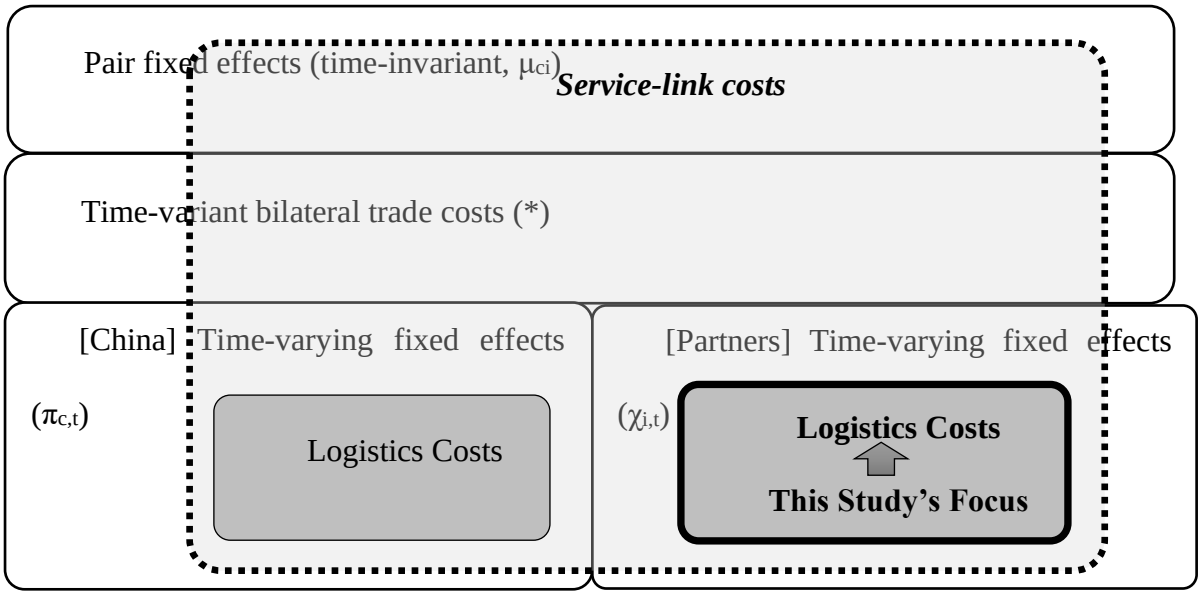
As the logistics performances are one of manageable factors for countries' strategies, there should still be the policy space for emerging ASEAN economies to improve them. From the Chinese perspective, it could be a good strategy for deepening its forward GVC linkage to strengthen its assistance to emerging ASEAN economies for enhancing their logistics performances through, for instance, the framework of the Belt and Road Initiative.

Figure 4.1. Forward and backward GVC linkage in China



Source: Author's estimation based on the UNCTAD-Eora Global Value Chain Database

Figure 4.2. Relationship between service-link costs and logistics costs



*: They are not incorporated in the estimation.

Source: Author's description based on Jones and Kierzkowski (1990).

Table 4.1. Foreign value added in exports by country origins

Cambodia							**[% of total foreign value added]**
Country Origins	1990	1995	2000	2005	2010	2015	2018
China	2.2	7.7	9.7	14.1	18.1	20.2	25.7
Thailand	3.2	13.2	13.4	15.5	14.4	15.8	19.6
Indonesia	1.7	6.1	6.1	5.1	5.7	6.1	6.6
Japan	6.3	9.6	8.3	7.7	6.7	5.0	5.2
Malaysia	1.5	2.8	3.8	4.2	4.2	4.3	4.5
Taiwan	39.7	11.2	10.5	5.5	4.0	3.5	3.8
US	5.9	6.3	6.0	5.3	4.6	3.9	3.7

Indonesia							**[% of total foreign value added]**
Country Origins	1990	1995	2000	2005	2010	2015	2018
China	3.5	5.0	6.3	9.7	12.9	15.4	18.2
Japan	18.2	19.3	15.2	13.1	12.2	9.9	10.2
US	13.2	14.2	13.9	10.9	9.6	8.9	9.0
Malaysia	3.6	3.1	5.4	6.1	6.4	6.8	6.8
South Korea	4.9	5.0	5.6	5.2	5.1	5.7	5.4
Taiwan	7.3	3.8	5.0	2.4	1.5	1.3	1.1

Lao PDR							**[% of total foreign value added]**
Country Origins	1990	1995	2000	2005	2010	2015	2018
Thailand	27.4	39.8	39.5	40.9	38.8	42.3	41.5
China	2.5	3.6	4.7	6.4	8.3	10.4	10.7
Vietnam	1.5	1.6	2.2	1.8	1.2	1.4	8.9
Japan	7.3	7.7	6.8	5.8	4.9	3.7	4.5
India	1.0	0.9	1.1	1.4	2.0	2.0	2.4
US	5.7	5.6	5.1	4.2	3.8	3.3	1.7

Malaysia							**[% of total foreign value added]**
Country Origins	1990	1995	2000	2005	2010	2015	2018
China	2.6	4.0	6.4	9.4	13.1	16.6	18.1
Japan	25.9	25.0	21.6	17.8	14.7	12.1	11.9
US	14.4	15.4	16.0	12.6	10.7	9.8	10.7
Indonesia	2.6	4.1	3.9	4.3	5.3	5.7	6.3
Germany	5.4	5.6	5.0	5.7	5.6	4.4	5.4
Taiwan	11.4	4.4	5.8	3.1	2.0	1.7	1.5

Table 4.1. (continued) Foreign value added in exports by country origins

Myanmar							**[% of total foreign value added]**
Country Origins	1990	1995	2000	2005	2010	2015	2018
China	2.0	3.4	4.0	3.8	3.4	4.6	9.0
US	7.0	7.9	6.9	6.7	5.8	6.0	8.1
India	0.9	1.3	1.7	1.6	1.7	1.8	3.5
Japan	6.3	6.9	6.0	5.1	4.8	3.8	1.6
Taiwan	21.4	4.5	2.9	2.2	1.2	1.0	0.4

The Philippines							**[% of total foreign value added]**
Country Origins	1990	1995	2000	2005	2010	2015	2018
Japan	20.0	26.4	23.5	20.8	18.9	15.8	15.4
China	1.9	2.7	4.4	7.0	10.6	13.0	15.3
US	11.7	12.1	14.5	11.0	10.2	9.3	9.8
South Korea	4.5	8.2	6.9	8.0	6.3	7.2	6.8
Taiwan	31.5	15.5	13.0	11.4	8.7	7.8	6.5

Thailand							**[% of total foreign value added]**
Country Origins	1990	1995	2000	2005	2010	2015	2018
China	3.0	4.8	8.9	13.0	18.7	23.1	24.7
Japan	28.2	25.4	22.5	17.5	14.7	12.0	11.2
US	10.5	11.6	11.7	8.3	7.5	6.8	7.0
Malaysia	2.7	3.3	4.0	4.8	5.4	5.5	5.6
Germany	6.4	5.9	5.0	5.7	5.7	4.4	5.4
Taiwan	7.0	3.3	5.1	2.3	1.6	1.3	1.2

Vietnam							**[% of total foreign value added]**
Country Origins	1990	1995	2000	2005	2010	2015	2018
China	5.0	8.1	8.5	11.9	15.0	18.5	22.8
Japan	13.1	23.4	16.0	23.9	26.0	21.8	20.6
South Korea	5.3	6.3	7.8	7.9	8.1	9.3	7.7
Thailand	3.2	5.4	5.2	5.8	5.1	5.7	5.5
US	7.1	7.0	7.6	6.6	5.7	4.9	4.8
Taiwan	37.4	20.1	19.3	7.9	4.5	3.8	2.9

Source: Author's estimation based on the UNCTAD-Eora Global Value Chain Database

Table 4.2. Panel unit root tests

	DVX [Total Industry]	DVX [Manufacturing]	DVX [Machinery]	LPI
[Intercept]				
Levin, Lin & Chu Test	-17.763 ***	-14.676 ***	-15.011 ***	-15.135 ***
Fisher ADF Chi-square	103.178 **	91.024	98.045 *	145.068 ***
Fisher PP Chi-square	178.513 ***	166.005 ***	177.496 ***	188.214 ***
Im, Pesaran and Shin W-stat	-1.225	-0.466	-1.000	-3.943 ***
[Intercept & Trend]				
Levin, Lin & Chu Test	-5.806 ***	-4.242 ***	-4.623 ***	-18.333 ***
Fisher ADF Chi-square	81.227	62.251	54.352	97.143 *
Fisher PP Chi-square	146.146 ***	108.588 **	90.382	184.368 ***
Im, Pesaran and Shin W-stat	0.276	1.373	1.683	-0.384

Note: *, **, and *** denote the rejection of the null hypothesis at the 90%, 95%, and 99% levels of significance.

Sources: Author's estimation

Table 4.3. Estimation outcomes
[Total Industry]

Estimation		(i)	(ii)	(iii)	(iv)	(v)	(vi)
Equation		(3)	(3)	(3)	(3)	(4)	(4)
Methodology		OLS	OLS	PPML	PPML	PPML	PPML
Benchmark		US	Japan	US	Japan	US	Japan
LPI						0.375 ***	0.369 ***
						(0.045)	(0.043)
Dummy: Myanmar	2007	-11.079 ***	-11.466 ***	-1.135 ***	-1.157 ***		
	2010	-11.275 ***	-11.662 ***	-1.141 ***	-1.163 ***		
	2012	-11.015 ***	-11.402 ***	-1.068 ***	-1.090 ***		
	2014	-10.908 ***	-11.296 ***	-1.032 ***	-1.054 ***		
	2016	-9.402 ***	-9.7894 ***	-0.776 ***	-0.799 ***		
	2017	-9.411 ***	-9.7984 ***	-0.776 ***	-0.799 ***		
Dummy: Lao PDR	2007	-7.638 ***	-8.025 ***	-0.629 ***	-0.652 ***		
	2010	-7.581 ***	-7.968 ***	-0.611 ***	-0.633 ***		
	2012	-7.528 ***	-7.915 ***	-0.595 ***	-0.617 ***		
	2014	-7.545 ***	-7.932 ***	-0.589 ***	-0.611 ***		
	2016	-8.047 ***	-8.434 ***	-0.620 ***	-0.643 ***		
	2017	-8.111 ***	-8.498 ***	-0.626 ***	-0.649 ***		
Dummy: Cambodia	2007	-5.220 ***	-5.607 ***	-0.383 ***	-0.406 ***		
	2010	-5.315 ***	-5.702 ***	-0.386 ***	-0.408 ***		
	2012	-5.307 ***	-5.694 ***	-0.379 ***	-0.402 ***		
	2014	-5.301 ***	-5.688 ***	-0.375 ***	-0.397 ***		
	2016	-5.875 ***	-6.262 ***	-0.412 ***	-0.435 ***		
	2017	-5.972 ***	-6.360 ***	-0.420 ***	-0.443 ***		
Dummy: Vietnam	2007	-2.209 ***	-2.596 ***	-0.143 ***	-0.166 ***		
	2010	-2.215 ***	-2.602 ***	-0.142 ***	-0.165 ***		
	2012	-2.265 ***	-2.652 ***	-0.144 ***	-0.167 ***		
	2014	-2.284 ***	-2.671 ***	-0.144 ***	-0.167 ***		
	2016	-2.282 ***	-2.669 ***	-0.141 ***	-0.164 ***		
	2017	-2.283 ***	-2.671 ***	-0.141 ***	-0.164 ***		
Dummy: Philippines	2007	-1.442 ***	-1.829 ***	-0.090 ***	-0.113 ***		
	2010	-1.445 ***	-1.832 ***	-0.090 ***	-0.112 ***		
	2012	-1.486 ***	-1.873 ***	-0.092 ***	-0.114 ***		
	2014	-1.509 ***	-1.896 ***	-0.093 ***	-0.116 ***		
	2016	-1.925 ***	-2.312 ***	-0.118 ***	-0.141 ***		
	2017	-1.948 ***	-2.335 ***	-0.119 ***	-0.142 ***		

Table 4.3. (continued**)** Estimation outcomes
[Total Industry]

Estimation		(i)	(ii)	(iii)	(iv)	(v)	(vi)
Equation		(3)	(3)	(3)	(3)	(4)	(4)
Methodology		OLS	OLS	PPML	PPML	PPML	PPML
Benchmark		US	Japan	US	Japan	US	Japan
LPI						0.375 ***	0.369 ***
						(0.045)	(0.043)
Dummy: Indonesia	2007	-1.621 ***	-2.008 ***	-0.102 ***	-0.125 ***		
	2010	-1.549 ***	-1.936 ***	-0.097 ***	-0.119 ***		
	2012	-1.461 ***	-1.848 ***	-0.090 ***	-0.113 ***		
	2014	-1.540 ***	-1.927 ***	-0.095 ***	-0.118 ***		
	2016	-1.847 ***	-2.234 ***	-0.113 ***	-0.136 ***		
	2017	-1.847 ***	-2.234 ***	-0.113 ***	-0.136 ***		
Dummy: Thailand	2007	-0.319	-0.706 ***	-0.017 ***	-0.040 ***		
	2010	-0.299	-0.686 ***	-0.017 ***	-0.039 ***		
	2012	-0.268	-0.655 ***	-0.015 ***	-0.038 ***		
	2014	-0.278	-0.665 ***	-0.016 ***	-0.039 ***		
	2016	-0.833 ***	-1.220 ***	-0.050 ***	-0.073 ***		
	2017	-0.849 ***	-1.236 ***	-0.051 ***	-0.074 ***		
Dummy: Malaysia	2007	-0.242	-0.629 ***	-0.013 **	-0.035 ***		
	2010	-0.207	-0.594 ***	-0.011 *	-0.034 ***		
	2012	-0.226	-0.613 ***	-0.013 **	-0.035 ***		
	2014	-0.258	-0.645 ***	-0.015 ***	-0.038 ***		
	2016	-0.645 ***	-1.032 ***	-0.039 ***	-0.061 ***		
	2017	-0.654 ***	-1.041 ***	-0.039 ***	-0.062 ***		
c,t Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
i,t Fixed Effects		Yes	Yes	Yes	Yes	No	No
c,i Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
RESET p-vals		0.000	0.000	0.771	0.771	0.000	0.000

Table 4.3. (continued**)** Estimation outcomes
[Manufacturing]

Estimation		(vii)	(viii)	(ix)	(x)	(xi)	(xii)
Equation		(3)	(3)	(3)	(3)	(4)	(4)
Methodology		OLS	OLS	PPML	PPML	PPML	PPML
Benchmark		US	Japan	US	Japan	US	Japan
LPI						0.406 ***	0.394 ***
						(0.049)	(0.048)
Dummy: Myanmar	2007	-11.364 ***	-11.485 ***	-1.299 ***	-1.306 ***		
	2010	-11.548 ***	-11.669 ***	-1.300 ***	-1.307 ***		
	2012	-11.265 ***	-11.386 ***	-1.203 ***	-1.210 ***		
	2014	-11.158 ***	-11.279 ***	-1.151 ***	-1.159 ***		
	2016	-9.679 ***	-9.800 ***	-0.862 ***	-0.869 ***		
	2017	-9.686 ***	-9.807 ***	-0.861 ***	-0.869 ***		
Dummy: Lao PDR	2007	-7.781 ***	-7.902 ***	-0.687 ***	-0.694 ***		
	2010	-7.726 ***	-7.847 ***	-0.665 ***	-0.673 ***		
	2012	-7.673 ***	-7.794 ***	-0.647 ***	-0.654 ***		
	2014	-7.692 ***	-7.813 ***	-0.637 ***	-0.645 ***		
	2016	-8.177 ***	-8.298 ***	-0.670 ***	-0.677 ***		
	2017	-8.237 ***	-8.358 ***	-0.676 ***	-0.683 ***		
Dummy: Cambodia	2007	-5.365 ***	-5.486 ***	-0.418 ***	-0.426 ***		
	2010	-5.462 ***	-5.583 ***	-0.420 ***	-0.427 ***		
	2012	-5.453 ***	-5.574 ***	-0.413 ***	-0.420 ***		
	2014	-5.444 ***	-5.565 ***	-0.406 ***	-0.413 ***		
	2016	-5.975 ***	-6.096 ***	-0.442 ***	-0.449 ***		
	2017	-6.065 ***	-6.186 ***	-0.450 ***	-0.457 ***		
Dummy: Vietnam	2007	-2.514 ***	-2.635 ***	-0.173 ***	-0.180 ***		
	2010	-2.524 ***	-2.645 ***	-0.171 ***	-0.179 ***		
	2012	-2.577 ***	-2.698 ***	-0.173 ***	-0.181 ***		
	2014	-2.579 ***	-2.700 ***	-0.172 ***	-0.179 ***		
	2016	-2.563 ***	-2.684 ***	-0.167 ***	-0.175 ***		
	2017	-2.562 ***	-2.683 ***	-0.167 ***	-0.174 ***		
Dummy: Philippines	2007	-1.455 ***	-1.576 ***	-0.095 ***	-0.102 ***		
	2010	-1.467 ***	-1.588 ***	-0.095 ***	-0.103 ***		
	2012	-1.507 ***	-1.628 ***	-0.097 ***	-0.105 ***		
	2014	-1.520 ***	-1.641 ***	-0.098 ***	-0.105 ***		
	2016	-1.952 ***	-2.073 ***	-0.125 ***	-0.133 ***		
	2017	-1.978 ***	-2.099 ***	-0.127 ***	-0.134 ***		

Table 4.3. (continued**)** Estimation outcomes
[Manufacturing]

Estimation		(vii)	(viii)	(ix)	(x)	(xi)	(xii)
Equation		(3)	(3)	(3)	(3)	(4)	(4)
Methodology		OLS	OLS	PPML	PPML	PPML	PPML
Benchmark		US	Japan	US	Japan	US	Japan
LPI						0.406 ***	0.394 ***
						(0.049)	(0.048)
Dummy: Indonesia	2007	-1.886 ***	-2.007 ***	-0.126 ***	-0.133 ***		
	2010	-1.806 ***	-1.927 ***	-0.119 ***	-0.126 ***		
	2012	-1.722 ***	-1.843 ***	-0.112 ***	-0.120 ***		
	2014	-1.792 ***	-1.913 ***	-0.116 ***	-0.124 ***		
	2016	-2.067 ***	-2.188 ***	-0.133 ***	-0.140 ***		
	2017	-2.066 ***	-2.187 ***	-0.133 ***	-0.140 ***		
Dummy: Thailand	2007	-0.240 **	-0.361 ***	-0.013 *	-0.020 ***		
	2010	-0.222 **	-0.343 ***	-0.012 *	-0.020 ***		
	2012	-0.188 **	-0.309 ***	-0.011 *	-0.018 **		
	2014	-0.200 **	-0.321 ***	-0.012 **	-0.020 ***		
	2016	-0.764 ***	-0.885 ***	-0.048 ***	-0.055 ***		
	2017	-0.784 ***	-0.905 ***	-0.049 ***	-0.057 ***		
Dummy: Malaysia	2007	-0.305 ***	-0.426 ***	-0.017 **	-0.024 ***		
	2010	-0.270 ***	-0.391 ***	-0.015 **	-0.023 ***		
	2012	-0.287 ***	-0.408 ***	-0.017 ***	-0.024 ***		
	2014	-0.317 ***	-0.438 ***	-0.019 ***	-0.027 ***		
	2016	-0.698 ***	-0.820 ***	-0.044 ***	-0.051 ***		
	2017	-0.710 ***	-0.831 ***	-0.045 ***	-0.052 ***		
c,t Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
i,t Fixed Effects		Yes	Yes	Yes	Yes	No	No
c,i Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
RESET p-vals		0.000	0.000	0.770	0.770	0.000	0.000

Table 4.3. (continued**)** Estimation outcomes

[Machinery]

Estimation		(xiii)	(xvi)	(xv)	(xvi)	(xvii)	(xviii)
Equation		(3)	(3)	(3)	(3)	(4)	(4)
Methodology		OLS	OLS	PPML	PPML	PPML	PPML
Benchmark		US	Japan	US	Japan	US	Japan
LPI						0.462 ***	0.444 ***
						(0.056)	(0.056)
Dummy: Myanmar	2007	-11.767 ***	-11.743 ***	-1.605 ***	-1.603 ***		
	2010	-11.924 ***	-11.900 ***	-1.590 ***	-1.589 ***		
	2012	-11.637 ***	-11.613 ***	-1.451 ***	-1.450 ***		
	2014	-11.537 ***	-11.513 ***	-1.377 ***	-1.376 ***		
	2016	-9.967 ***	-9.943 ***	-1.001 ***	-0.999 ***		
	2017	-9.972 ***	-9.948 ***	-1.000 ***	-0.998 ***		
Dummy: Lao PDR	2007	-8.010 ***	-7.987 ***	-0.783 ***	-0.781 ***		
	2010	-7.949 ***	-7.925 ***	-0.755 ***	-0.753 ***		
	2012	-7.904 ***	-7.880 ***	-0.733 ***	-0.732 ***		
	2014	-7.947 ***	-7.924 ***	-0.724 ***	-0.722 ***		
	2016	-8.319 ***	-8.296 ***	-0.751 ***	-0.750 ***		
	2017	-8.368 ***	-8.344 ***	-0.757 ***	-0.755 ***		
Dummy: Cambodia	2007	-5.852 ***	-5.828 ***	-0.503 ***	-0.502 ***		
	2010	-5.967 ***	-5.943 ***	-0.506 ***	-0.505 ***		
	2012	-5.968 ***	-5.944 ***	-0.498 ***	-0.496 ***		
	2014	-5.968 ***	-5.945 ***	-0.489 ***	-0.488 ***		
	2016	-6.407 ***	-6.383 ***	-0.523 ***	-0.521 ***		
	2017	-6.496 ***	-6.472 ***	-0.532 ***	-0.530 ***		
Dummy: Vietnam	2007	-3.088 ***	-3.064 ***	-0.232 ***	-0.230 ***		
	2010	-3.114 ***	-3.090 ***	-0.231 ***	-0.229 ***		
	2012	-3.178 ***	-3.154 ***	-0.234 ***	-0.232 ***		
	2014	-3.204 ***	-3.180 ***	-0.233 ***	-0.231 ***		
	2016	-3.037 ***	-3.014 ***	-0.216 ***	-0.214 ***		
	2017	-3.033 ***	-3.009 ***	-0.215 ***	-0.214 ***		
Dummy: Philippines	2007	-1.428 ***	-1.405 ***	-0.098 ***	-0.097 ***		
	2010	-1.424 ***	-1.400 ***	-0.098 ***	-0.096 ***		
	2012	-1.462 ***	-1.438 ***	-0.100 ***	-0.099 ***		
	2014	-1.443 ***	-1.419 ***	-0.098 ***	-0.097 ***		
	2016	-1.839 ***	-1.816 ***	-0.126 ***	-0.124 ***		
	2017	-1.875 ***	-1.851 ***	-0.128 ***	-0.127 ***		

Table 4.3. (continued**)** Estimation outcomes
[Machinery]

Estimation		(xiii)	(xvi)	(xv)	(xvi)	(xvii)	(xviii)
Equation		(3)	(3)	(3)	(3)	(4)	(4)
Methodology		OLS	OLS	PPML	PPML	PPML	PPML
Benchmark		US	Japan	US	Japan	US	Japan
LPI						0.462 ***	0.444 ***
						(0.056)	(0.056)
Dummy: Indonesia	2007	-2.187 ***	-2.163 ***	-0.157 ***	-0.156 ***		
	2010	-2.103 ***	-2.080 ***	-0.149 ***	-0.148 ***		
	2012	-2.019 ***	-1.995 ***	-0.141 ***	-0.140 ***		
	2014	-2.089 ***	-2.065 ***	-0.146 ***	-0.144 ***		
	2016	-2.298 ***	-2.274 ***	-0.159 ***	-0.158 ***		
	2017	-2.291 ***	-2.267 ***	-0.159 ***	-0.157 ***		
Dummy: Thailand	2007	-0.044	-0.020	0.000	0.001		
	2010	-0.017	0.006	0.000	0.002		
	2012	0.020	0.043	0.001	0.003		
	2014	0.015	0.039	0.000	0.001		
	2016	-0.443 ***	-0.419 ***	-0.030 ***	-0.029 ***		
	2017	-0.463 ***	-0.439 ***	-0.032 ***	-0.030 ***		
Dummy: Malaysia	2007	-0.392 ***	-0.369 ***	-0.023 ***	-0.022 ***		
	2010	-0.344 ***	-0.320 ***	-0.021 ***	-0.019 ***		
	2012	-0.359 ***	-0.335 ***	-0.023 ***	-0.021 ***		
	2014	-0.384 ***	-0.360 ***	-0.025 ***	-0.024 ***		
	2016	-0.709 ***	-0.686 ***	-0.048 ***	-0.046 ***		
	2017	-0.722 ***	-0.698 ***	-0.049 ***	-0.047 ***		
c,t Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
i,t Fixed Effects		Yes	Yes	Yes	Yes	No	No
c,i Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
RESET p-vals		0.000	0.000	0.740	0.740	0.000	0.000

Note: ***, **and * denote the rejection of null hypothesis at the 99%, 95% and 90% level of significance.

The standard errors are in parentheses attached in the coefficients.

Source: Author's estimation based on the UNCTAD-Eora Global Value Chain Database and the World Bank's Logistics Performance Index

Table 4.4. Partner country's Fixed effect and logistics performance [US Benchmark]

Total Industry	**Partner Country's Fixed Effects (average: 2007-2017)**	**LPI (average: 2007-2017)**	**LPI (b) - US LPI**	**(c) × 0.375 [coefficient]**
	(a)	**(b)**	**(c)**	**(d)**
Myanmar	-0.988	2.261	-1.643	-0.616
Lao PDR	-0.612	2.395	-1.509	-0.566
Cambodia	-0.393	2.592	-1.312	-0.492
Vietnam	-0.143	3.044	-0.860	-0.323
Philippines	-0.101	2.937	-0.967	-0.363
Indonesia	-0.102	2.989	-0.916	-0.343
Thailand	-0.028	3.313	-0.592	-0.222
Malaysia	-0.022	3.442	-0.462	-0.173
Manufacturing	**Partner Country's Fixed Effects (average: 2007-2017)**	**LPI (average: 2007-2017)**	**LPI (b) - US LPI**	**(c) × 0.406 [coefficient]**
	(a)	**(b)**	**(c)**	**(d)**
Myanmar	-1.113	2.261	-1.643	-0.667
Lao PDR	-0.664	2.395	-1.509	-0.613
Cambodia	-0.425	2.592	-1.312	-0.533
Vietnam	-0.171	3.044	-0.860	-0.349
Philippines	-0.107	2.937	-0.967	-0.393
Indonesia	-0.124	2.989	-0.916	-0.372
Thailand	-0.025	3.313	-0.592	-0.240
Malaysia	-0.027	3.442	-0.462	-0.188
Machinery	**Partner Country's Fixed Effects (average: 2007-2017)**	**LPI (average: 2007-2017)**	**LPI (b) - US LPI**	**(c) × 0.462 [coefficient]**
	(a)	**(b)**	**(c)**	**(d)**
Myanmar	-1.338	2.261	-1.643	-0.759
Lao PDR	-0.751	2.395	-1.509	-0.697
Cambodia	-0.509	2.592	-1.312	-0.606
Vietnam	-0.227	3.044	-0.860	-0.397
Philippines	-0.109	2.937	-0.967	-0.447
Indonesia	-0.152	2.989	-0.916	-0.423
Thailand	-0.010	3.313	-0.592	-0.273
Malaysia	-0.032	3.442	-0.462	-0.213

Table 4.4. (continued**)** Partner country's Fixed effect and logistics performance [Japan Benchmark]

Total Industry	**Partner Country's Fixed Effects (average: 2007-2017)**	**LPI (average: 2007-2017)**	**LPI (b) - US LPI**	**(c) × 0.369 [coefficient]**
	(a)	**(b)**	**(c)**	**(d)**
Myanmar	-1.011	2.261	-1.711	-0.631
Lao PDR	-0.635	2.395	-1.577	-0.582
Cambodia	-0.416	2.592	-1.380	-0.509
Vietnam	-0.166	3.044	-0.928	-0.343
Philippines	-0.124	2.937	-1.036	-0.382
Indonesia	-0.125	2.989	-0.984	-0.363
Thailand	-0.051	3.313	-0.660	-0.243
Malaysia	-0.045	3.442	-0.530	-0.196
Manufacturing	**Partner Country's Fixed Effects (average: 2007-2017)**	**LPI (average: 2007-2017)**	**LPI (b) - US LPI**	**(c) × 0.394 [coefficient]**
	(a)	**(b)**	**(c)**	**(d)**
Myanmar	-1.120	2.261	-1.711	-0.674
Lao PDR	-0.672	2.395	-1.577	-0.621
Cambodia	-0.433	2.592	-1.380	-0.544
Vietnam	-0.179	3.044	-0.928	-0.366
Philippines	-0.114	2.937	-1.036	-0.408
Indonesia	-0.131	2.989	-0.984	-0.388
Thailand	-0.032	3.313	-0.660	-0.260
Malaysia	-0.034	3.442	-0.530	-0.209
Machinery	**Partner Country's Fixed Effects (average: 2007-2017)**	**LPI (average: 2007-2017)**	**LPI (b) - US LPI**	**(c) × 0.444 [coefficient]**
	(a)	**(b)**	**(c)**	**(d)**
Myanmar	-1.336	2.261	-1.711	-0.760
Lao PDR	-0.749	2.395	-1.577	-0.700
Cambodia	-0.508	2.592	-1.380	-0.613
Vietnam	-0.226	3.044	-0.928	-0.412
Philippines	-0.107	2.937	-1.036	-0.460
Indonesia	-0.151	2.989	-0.984	-0.437
Thailand	-0.008	3.313	-0.660	-0.293
Malaysia	-0.030	3.442	-0.530	-0.235

Source: Author's estimation based on the UNCTAD-Eora Global Value Chain Database and the World Bank's Logistics Performance Index

Appendix

Table A4.1. Industrial classification

[Manufacturing]
Grain mill products
Feeding stuff production and processing
Vegetable oil and forage
Sugar refining
Slaughtering , meat processing, eggs and dairy products
Prepared fish and seafood
Other food products
Wines, spirits and liquors
Non-alcoholic beverage
Tobacco products
Cotton textiles
Woolen textiles
Hemp textiles
Other textiles not eslseshere classified
Knitted mills
Wearing apparel
Leather, furs, down and related products
Sawmills and fibreboard
Furniture and products of wood, bamboo, cane, palm, straw, etc.
Paper and products
Printing and record medium reproduction
Cultural goods
Toys, sporting and athletic and recreation products
Petroleum refining
Coking
Raw chemical materials
Chemical fertilizers
Chemical pesticides
Chemicals for painting, dying and others
Synthetic chemicals
Chemicals for special usages
Chemical products for daily use
Medical and pharmaceutical products
Chemical fibers
Rubber products
Plastic products
Cement and cement asbestos products
Glass and glass products
Pottery, china and earthenware
Fireproof products
Other non-metallic mineral products
Iron-smelting
Steel-smelting
Steel-processing
Alloy iron smelting
Nonferrous metal smelting
Nonferrous metal processing
Metal products
Other manufacturing products
[Manufacturing: Machinery]
Boiler, engines and turbine
Metalworking machinery
Other general industrial machinery
Agriculture, forestry, animal husbandry and fishing machinery
Other special industrial equipment
Railroad transport equipment
Motor vehicles
Vehicles fittings production
Ship building
Other transport machinery
Generators
Household electric appliances

Table A4.1. (continued) Industrial classification

Other electric machinery and equipment
Communication equipment
Electronic computer
Other computer devices
Electronic element and device
Electronic appliances
Other electronic and communication equipment
Instruments, meters and other measuring equipment
Cultural and office equipment
Arts and crafts products
[Other Industries]
Crop cultivation
Forestry
Logging and transport of timber and bamboo
Livestock and livestock products
Fishery
Technical services for agriculture, forestry, livestock and fishing
Coal mining and processing
Crude petroleum products and Natural gas products
Ferrous ore mining
Non-ferrous ore mining
Salt mining
Non-metal minerals and other mining
Scrap and waste
Electricity and steam production and supply
Gas production and supply
Water production and supply
Construction
Railway passenger transport
Railway freight transport
Highway freight and passangers transport
Domestic public transport
Water freight and passangers transport
Air passenger transport
Air freight transport
Pipeline transport
Warehousing
Post
Telecommunication
Computing services and software
Wholesale and retail trade
Hotels
Eating and drinking places
Finance
Insurance
Real estate
Leasehold
Business services
Tourism
Scientific research
General technical services
Geological prospecting
Water conservancy
Environmental resources and public infrastructure
Resident services and other services
Educational services
Health services
Social welfare
Culture and arts, radio, film and television
Sports
Recreational services
Public administration and other sectors

Source: The UNCTAD-Eora Global Value Chain Database

Table A4.2. Sample economies

Australia	Austria	Belgium	Brazil
Cambodia	Canada	Czech Republic	Denmark
Finland	France	Germany	Hong Kong
Hungary	India	Indonesia	Ireland
Italy	Japan	Laos	Malaysia
Mexico	Myanmar	Netherlands	Philippines
Poland	Romania	Russia	Singapore
Slovakia	South Korea	Spain	Sweden
Switzerland	Taiwan	Thailand	Turkey
UK	US	Viet Nam	

Source: The UNCTAD-Eora Global Value Chain Database

Chapter 5

Concluding Remarks

Undoubtedly, the increasing fragmentation of value chains has transformed international trade for countries worldwide. Today, companies are virtually limitless because they are no longer constrained to the domestic market for sourcing their products for any activity in the value chain. GVCs deliver more productive jobs primarily through scale effects that result from increased productivity and expanded output, with the latter two being capable of boosting income and productive employment. Research also shows that a country's involvement in GVCs is associated with reduced poverty. Furthermore, while FDI was a primary driver of the GVC expansion, international integration into GVCs stimulated FDI inflows.

In this dissertation, I used the UNCTAD-EORA Global Value Chain database to analyze the role of GVC involvement in FDI attraction and Japan's forward linkage in GVCs with emerging ASEAN countries.

Chapter 2, titled "Impacts of Global Value Chains on Foreign Direct Investment: The Case of Asian Developing Countries" is the revised version of the study by Zhao (2021), with the results indicating that the degree and position of GVC participation affects FDI inflows. In addition, a higher level of trade openness and better economic growth are positively related to FDI inflow, indicating the importance of a country's economic development and environment as mediating factors of the extent of FDI inflows. The FDI inflows are also mediated by the host country's institutional quality, with the positive relationship between GVC indicators and local FDI inflow being stronger in countries reporting better political stability and stronger rule of law.

To improve the results of Chapter 2, in Chapter 3, titled "Impacts of Global Value Chains on Foreign Direct Investment: The Case of Asian Developing Countries," I adopted the same

analysis approach and database as in Chapter 1, calculated the GVC backward and forward linkage with Japan's manufacturing industries for nine developing countries in Asia, and investigated the relationship between GVCs and FDI between Asian emerging countries and Japan at the sector level (i.e., the machinery and non-machinery sectors). The results show that the degree of GVC integration into Japanese industries is positively correlated with capital inflows from Japanese investors. Furthermore, in the machinery sector, the relationship between GVC backward linkages and FDI is stronger in countries with better institutional quality, and higher levels of forward specialization in a production process stage are also important.

Finally, to determine the GVC integration between China and emerging ASEAN countries, Chapter 4, titled "China's global value chain linkage and logistics performances in emerging ASEAN economies," delivers a revised version of the study by Taguchi and Zhao (2022). We evaluate the extent of China's forward GVC linkage with emerging ASEAN economies compared to its linkage with the United States of America and Japan. This chapter also examines the connection of China's GVC linkage with logistics performances in emerging ASEAN economies as China's trade partners. The statistical observations show that the major position of China's GVC has transformed from a backward to a forward linkage since the mid-2000s. The empirical estimation of the structural gravity trade model showed China's forward GVC had less linkage with emerging ASEAN economies than with the United States of America and Japan. It also demonstrated that the lack of logistics performances in emerging ASEAN economies was a significant factor in explaining their lower linkage with China's forward GVC.

According to UNCTAD (2013), there is a positive relationship between participation in GVCs and economic growth in advanced and emerging economies. This dissertation also

provides evidence at both the country and industry levels that, for developing countries, participation in GVCs is a strong attractor of FDI.

With the intensification of global competition, purchasing parts and intermediate products of the optimal quality and low cost has become a key measure for company survival. Furthermore, building a GVC is an important strategy for MNCs to reduce costs, maintain quality, and competitiveness. For companies participating in GVCs, many of which are in emerging economies, participation enables them to access global markets and increase productivity through technology transfer. Furthermore, GVCs offer many developmental opportunities and risks to developing countries. For instance, some risks are the impact of business cycles in advanced economies, increased domestic competition, and the worsening of environmental or employment problems (UNCTAD, 2013). In addition, the gains from GVC participation are not distributed equally across and within countries, which can lead to inequalities in the distribution of firm markups across countries. GVCs are also considered to exacerbate inequalities between skilled and unskilled workers and between male and female workers (World Bank, 2020).

The increase in the share of FVA exports throughout the globalization process suggests that the total value of a country's exports does not contribute as much to the country's GDP growth as the total value suggests. In emerging and developing countries, there is a concern that participation in GVCs will lead these countries to focus only on low value-added processes and lose growth opportunities. Especially in Malaysia and Thailand, which have achieved economic growth and become upper-middle-income countries, finding ways to improve productivity, which is indispensable for them to overcome the middle-income trap, is a major challenge, as well as finding ways for these countries to make better use of GVCs to solve this problem. Moreover, for countries such as Cambodia, Laos, Myanmar, and Vietnam to eventually join the group of low- and middle-income countries and enjoy the aforementioned

benefits of participating in GVCs, lowering the threshold for foreign companies to expand GVCs will be a top priority. This can be notably done by improving GVC infrastructure and reviewing regulations and systems for greater transparency (Yamaguchi, 2018). Therefore, these countries are urged to make strategic assessments of whether they should promote GVCs and which industries they should target.

Meanwhile, regarding GVC upgrading, governments in developing countries could put more effort into boosting human capital quality in their education systems and working environments (e.g., through technology transfer and on-the-job training). The development and implementation of educational programs to promote the quality of education should be the first priority, and governments must act promptly to deal with this pressing issue. Substantial efforts toward infrastructure development are also necessary because technology is a prerequisite for upgrading into higher levels in GVCs.

Despite these suggestions, it is important to underpin that being in a GVC does not guarantee benefits from participation for a country and nor a growth in benefits. In addition, many traditional approaches to industrial policies, such as fucousing on low value-added production activities may not help to enhance a country's GVC participation or position. The provision of a range of proactive policies can enhance GVC participation. First, because the examined countries experience institutional quality issues, they must strengthen contract enforcement, property rights protection, and regulatory standards, and this is because GVCs thrive on the flexible formation of corporate networks. Specifically, strengthening contract enforcement serves to ensure that legal arrangements within the network are stable and predictable; strengthening property rights protection creates an environment for more innovative and complex value chains; strengthening regulatory standards allows for governments to facilitate participation of companies in GVCs by strengthening their national certification and testing capabilities, which in turn secures compliance with international public

and private standards. Second, countries can promote linkages between domestic small and medium companies and GVC lead firms by coordinating the local suppliers, providing access to information about supply opportunities, and supporting the training and capacity building of small and medium companies. Additionally, governments can help domestic suppliers access capital and technology to support these suppliers' increased productivity and compliance with global standards, as well as strengthen sector-specific human capital through targeted workforce development strategies—such as through promoting a close coordination between the public and private sectors. Countries can also support companies in improving their management and innovation capabilities, as these can support the upgrading of GVCs.

This study contributes to the growing literature on the potential benefits of GVC and its forward linkage, especially in developing countries, and proposes a channel through which the benefits of participating in GVCs can spread through the local economy, thereby attracting foreign investors. The results of this study demonstrate a strong relationship between GVCs and FDI and suggest that policies that support countries participation and upgrading in GVCs can improve FDI inflows.

This study is limited by its estimation approach, which cannot completely exclude the potential endogeneity issue. This could be improved in the future if data are available to estimate it in a better way.

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