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Servicification in Global Value Chains: The Case of Asian Countries

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The paper studies the degree of servicification (or the role of services as inputs in manufacturing) of selected 61 Asian countries in terms of global value chain (GVC) activities at the sectoral level using domestic and foreign services from 1995 to 2011. We explore empirically the possible sources of servicification of the economies in terms of the factors driving the expansion of servicification. We categorize servicification activities into two types: (a) domestic servicification using domestic services and (b) foreign servicification using foreign value-added content in domestic exports. Servicification is confirmed in selected Asian countries, particularly in 16 East Asian countries associated with the Regional Comprehensive Economic Partnership (RCEP) negotiation. However, the selected Asian countries tend to have lower domestic servicification levels, but higher foreign servicification levels as compared to the overall sample of countries in the study. Countries with higher participation rates and lower positions in GVCs tend to have higher levels of foreign servicification across the sectors. In contrast, countries with higher participation rates and higher positions in GVCs tend to use more domestic services in manufacturing exports. The effect is larger for Asian countries as compared to the developed countries in the sample.

The study also highlights the role of technical improvement and institutional as key factors in the development of services in the global production value chain.

Key words: global value chains; servicification; institutions; RCEP countries

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1. Introduction

Increasingly from the point of view of trade and economic growth, services activities have been observed to be closely linked with manufacturing activities. As opposed to the traditional view that production and trade of manufacturing activities are independent of service activities, recent trends indicate that manufacturing industries are increasingly using services in production as well as providing services to the consumers (OECD 2014; Lodefalk 2015; Boddin and Henze, 2014). In particular, it is observed that service content is used in the manufacturing sector due to the recent development in identifying global value chain (GVC) activities within and across countries using the World Input-Output Tables (WIOD)[1], which was difficult to capture in traditional service trade measurement.

The main characteristics of GVCs are the international production and specialization by tasks. Services are recognized as 'service-linkages' or 'glue' of GVCs, which rely intensively on service linkages to link and coordinate activities across different sectors and countries (Gereffi et al., 2010). For example, the logistic services linkages allow stronger movement of manufactured goods and services domestic and internationally. Also observed are the outsourcing of services to domestic or foreign services companies that dramatically affect and improve the efficiency and reduce the production cost for manufacturing activities (Saggu and Anukoonwattaka, 2015).

The importance of services for manufacturing activities is also observed as a new trend as opposed to the importance of the manufacturing sector to services sector development in GVCs. Services trade accounts for about 20% of world trade in balance of payment terms (BOP), but they take up almost 70% of global gross domestic product (GDP) in the national accounts (Lanz and Maurer, 2015). The great discrepancy is determined by the special pattern of services in production, in which services can be used as intermediate inputs in producing goods or other services. The great proportion of service inputs used in manufacturing production is described as 'servicification' of manufacturing (Elms and Low, 2013).

Most recent studies on servicification of economies are mostly focused on developed countries although there are limited studies on developing countries. In developed countries, industries tend to increasingly use and also offer services directly to the customers (Lodefalk, 2015). In this paper, we try to fill this gap by studying the servicification of the

[1] The value added data of GVCs are obtained from OECD TIVA database.

manufacturing activities in Asian developing economies. In fact, services and manufacturing activities related to GVC have spread extensively throughout the Asia region than in the rest of the world implying a high importance of servicification, inter alia, to the development of industrial exports of the region (Anukoonwattaka et al., 2015). A recent study on Asian countries (Baldwin et al., 2014) highlights that the share of value added in manufacturing products has shifted decisively away from manufacturing and towards service since the 1990s, and the trend is stronger in the Asian economies.

The participation in GVC of services trade is also opening up new avenues and opportunities for domestic firms in developing countries to increase their participation as well, which further creates new growth areas for the domestic economy. In this paper, we examine the servicification (degree of services activities) of selected Asian economies with respect to the Organisation for Economic Co-operation and Development (OECD) countries in the global production value-chain. In this respect, we examine in a panel framework the degree of servicification at the sectoral level across 61 countries in terms of global value chain activities using domestic and foreign services from 1995 to 2011. We will compare the degree of servicification of the manufacturing sector in selected Asian countries, particularly those countries associated with the Regional Comprehensive Economic Partnership (RCEP) regional agreement, and compare that with OECD countries. We also explore empirically the possible sources of servicification of economies in terms of the factors driving the expansion of servicification, including service trade liberation, connectivity, transportation linkages, information and communications technologies (ICT), institutions, and also the linkages from the forward and backward activities in GVC (Blinder 2006; Gereffi and Fernandez-Stark, 2011; Hernández et al., 2014). This paper makes several important contributions to literature. First, there are only limited studies on the servicification of developing countries and Asian countries. This paper intends to fill this gap. Second, the paper also contributes to the understanding of the degree of servicification and its impact on the global production value chain.

The paper is organized as follows. Section 2 presents key economic trends including the role of services and that of servicification in selected Asian countries. Section 3 discusses the factors underlying the servicification of the economy and provides an empirical model to identify and explain the effects of servicification in manufacturing sectors across countries. Section 4 shows the empirical results while conclusion is presented in Section 5.

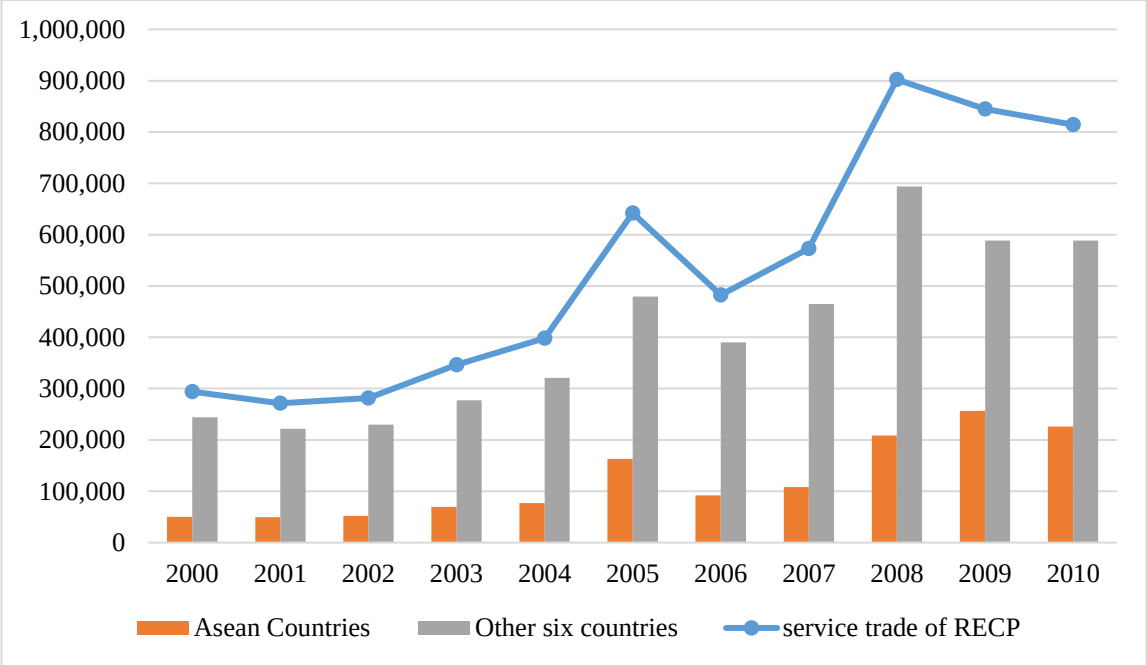
2. Services Value Chain in Selected Asian countries

2.1 Servicification in Asian Countries

Over the past 2 decades, there has been a sharp increase in free trade agreements (FTAs) in Asian countries, which greatly facilitated service trade and investment. The first major FTA for Southeast Asian countries was the ASEAN Free Trade Area (AFTA) enacted in 1992. Since the Asian financial crisis, Association of Southeast Asian Nations (ASEAN) member countries began to actively establish bilateral and regional FTAs as a group. Indeed, ASEAN established five ASEAN+1 FTAs with China, Japan, Republic of Korea (henceforth Korea), India, and Australia–New Zealand. In 2012, ASEAN and the 6 countries formed the RCEP, a regional FTA between 16 countries, including Brunei, Myanmar, Cambodia, Indonesia, Lao PDR, Malaysia, the Philippines, Singapore, Thailand, and Viet Nam of ASEAN, and the six key countries of Australia, China, India, Japan, Korea, and New Zealand (henceforth, we will term these countries as RCEP countries). It has a combined GDP of $17 trillion, and accounts for about 40% of world trade (Rahman and Ara, 2015). Needless to say, one of the objectives of RCEP is to promote foreign trade in goods and services with FTA members.

The level and growth of the services export in Asian countries associated with RCEP are shown in Figures 1 and 2. First, we observe a strong trade growth between ASEAN and its six partners in services. Service trade has more than doubled in 2010 as compared to 2000 in RCEP countries (see Figure 1). ASEAN trade in services has been expanding over the years. The ASEAN service trade increased from US$50 billion in 2000 to nearly US$230 billion in 2010, with an average annual growth rate at almost 20%. In a similar trend, service trade of non-ASEAN countries increased from US$244 billion in 2000 to US$588 billion in 2010, with an average growth rate of 11% annually.

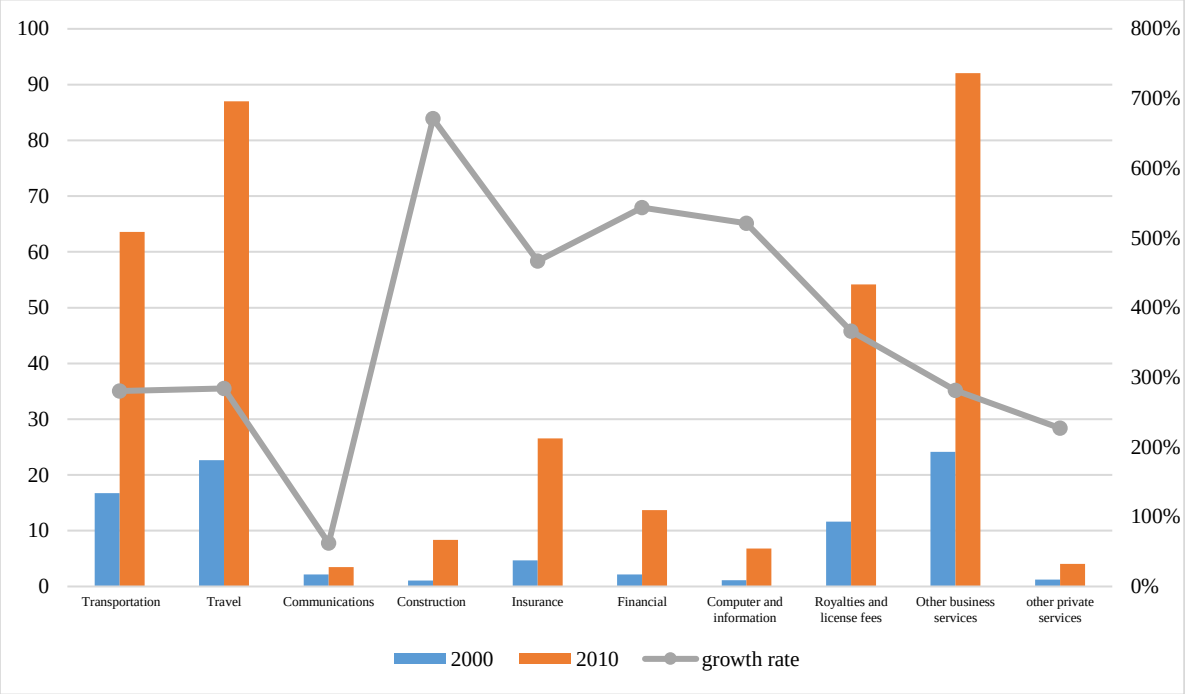
Figure 1: The Service Trade of Asian Countries (RCEP), 2000–2010 (US$ million)



Source: UN COMTRADE Database.

In Figure 2, we observe a strong total growth in service trade in 2011 as compared to 2010 for RCEP countries. In particular, the services sectors of transportation, tourism and licence royalties are three key sectors driving the service trade for RCEP countries. There is also positive and strong growth in construction services, financial and insurance services, computer and information services, and other business services. The communication service sector has also experienced strong growth in recent years, but at a rate that is relatively lower than the other service sectors. The growth trends of the service trade for RCEP countries is suggesting growing importance of services trade in Asian countries.

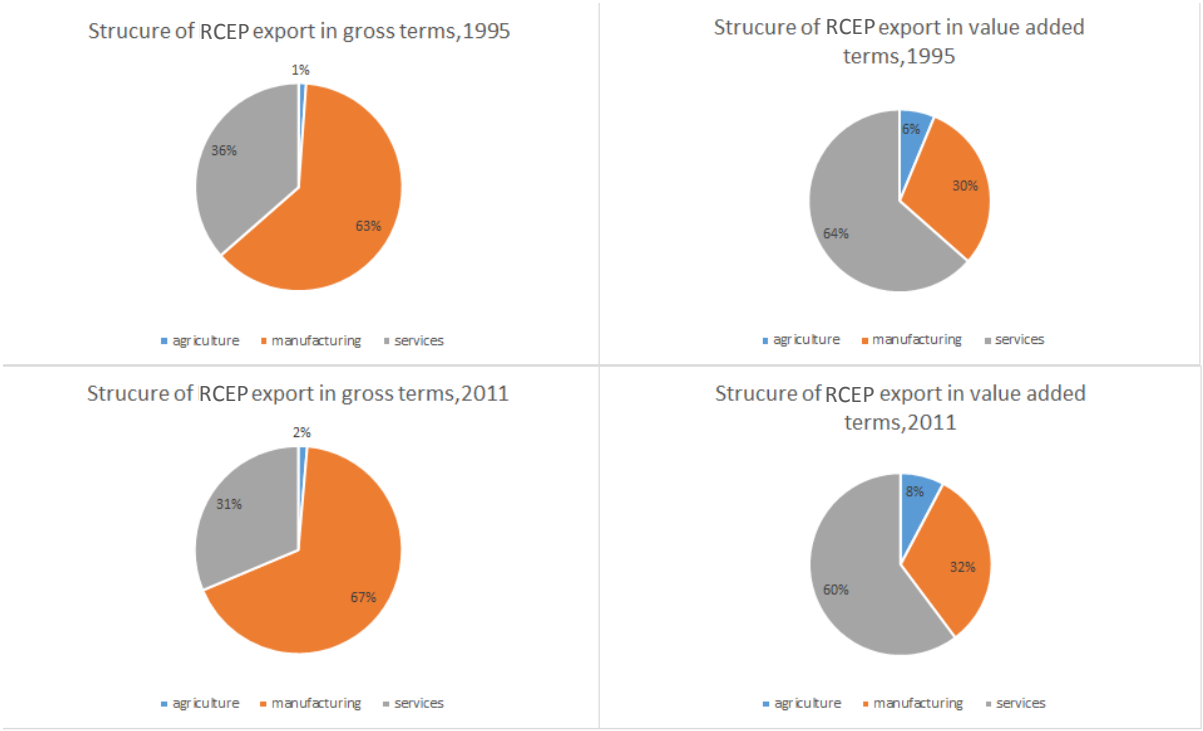
Figure 2: Service Trade in Asian Countries (RCEP), by Sector, 2000–2010 (US$ billion)



Source: UN COMTRADE Database.

In fact, both service trade and production of East Asian countries are increasingly structured around 'global value chains activities' (De Backer and Miroudot, 2014). Instead of producing in individual domestic country, productions are fragmented across countries with each country specializing in one or several tasks from the global production value chain. Services fulfil a complex and essential role in the GVCs while its importance is fairly underestimated with the cross-border service trade statistics. The traditional service trade data estimate the share of service trade at just over one-fifths of total trade (WTO, 2012). However, the story is very different when the recent study measure trade in terms of value added, which avoids the double counting problem in gross terms and excludes foreign contribution to the product (OECD, 2014). For example, in 1995, the share of services in total trade of RCEP countries account for 31% in gross terms while it accounts for 64% in value-added terms (Figure 3). Even though the share of services declines slightly in both gross trade and gross value-added in RCEP countries, it is still larger than the other two components of economic activities.

Figure 3: Sectoral Contribution Comparison to Total Trade and GVC Trade for RCEP Countries, 1995–2011



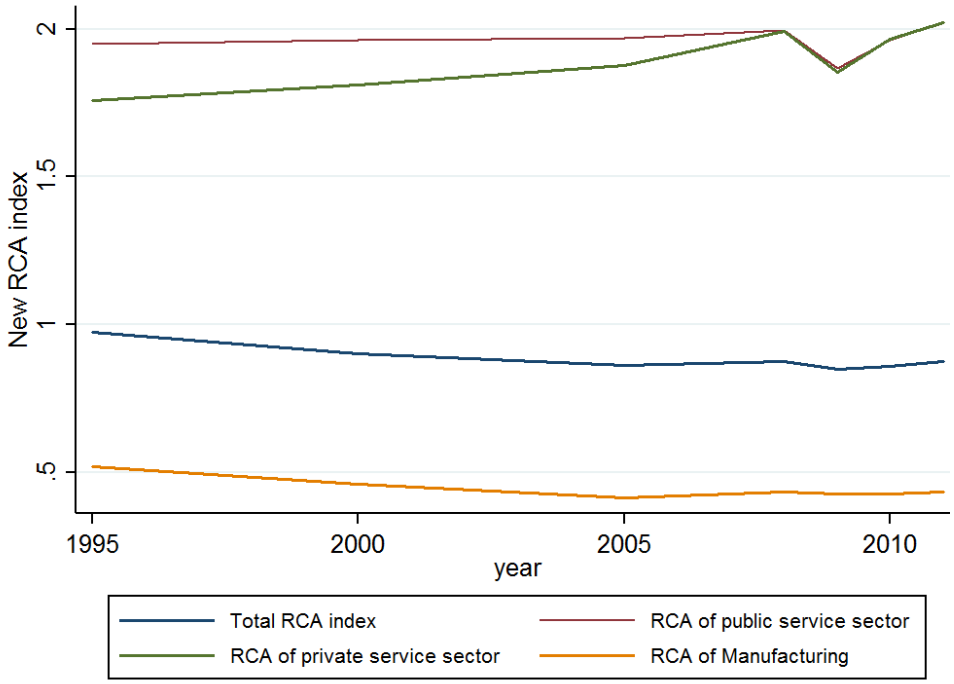
Source: OECD TIVA database.

The great discrepancy of service trade statistics in gross terms and value-added terms has three possible reasons. First, services are intangible, which is difficult to track across borders. Traditional service trade only records final service products crossing the border without distinguishing services involved in the production or intermediate products and whether the product is a good or service. Second, with international fragmentation and outsourcing, the services input in domestic products could both come from domestic as well as foreign market. It would be impossible for gross trade statistics to distinguish the origins of services. Last, and also importantly, the increasing use of services in manufacturing both in terms of production and sales, cannot be reflected in traditional service trade flows. As a result, it is not easy to identify the importance of services with gross trade statistics. Fortunately, the increased availability of value-added data has deepened our understanding of the role of services in domestic and international trade activities.

Figure 4 describes value added based on the new revealed comparative advantage (RCA) index for the RCEP countries (the index is given as the average of RCEP countries). As opposed to the traditional RCA, the new RCA is based on value added and excludes foreign-

originated value added, pure double-counted terms, and domestic value added generated in other sectors, but includes indirect exports of a sector's value added through other sectors of the exporting country. The new RCA indexes adjust the distorted image of services in international production patterns (Wei, 2015).

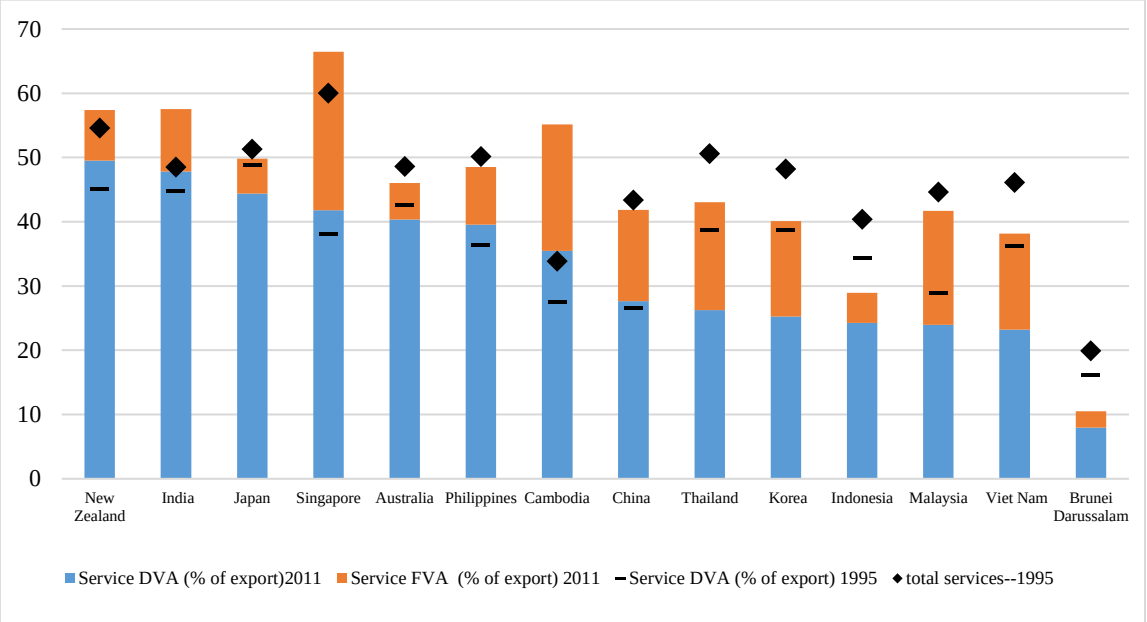
Figure 4: New RCA Index of RCEP Countries



Source: Data from OECD TIVA (2015) database and calculated by the authors.

The services content of export for RCEP countries are given in Figure 5. The result in Figure 5 indicates the importance of service sector for the trade and growth of RCEP countries. Service activities account for more than 50% of the value added in gross exports with domestic value added (DVA) percentage varying from 10% to 50%. Singapore has the highest proportion of service content in gross export at about 65%, however, the results also indicate that about 35% of its service content is imported from other countries. it is also observed that domestic value added service content went up in New Zealand, India, Singapore, Cambodia, the Philippines, and China from 1995 to 2011. The results also indicate a decline in service content for Japan, Australia, Korea, Thailand, Indonesia, Viet Nam, Malaysia, and Brunei Darussalam, of which the first three countries (Japan, Australia, and Korea) tend to use more foreign service in export.

Figure 5: Service Content of Gross Export (%) for RCEP Countries



Source: Data from OECD TIVA (2015) database and calculated by the authors.

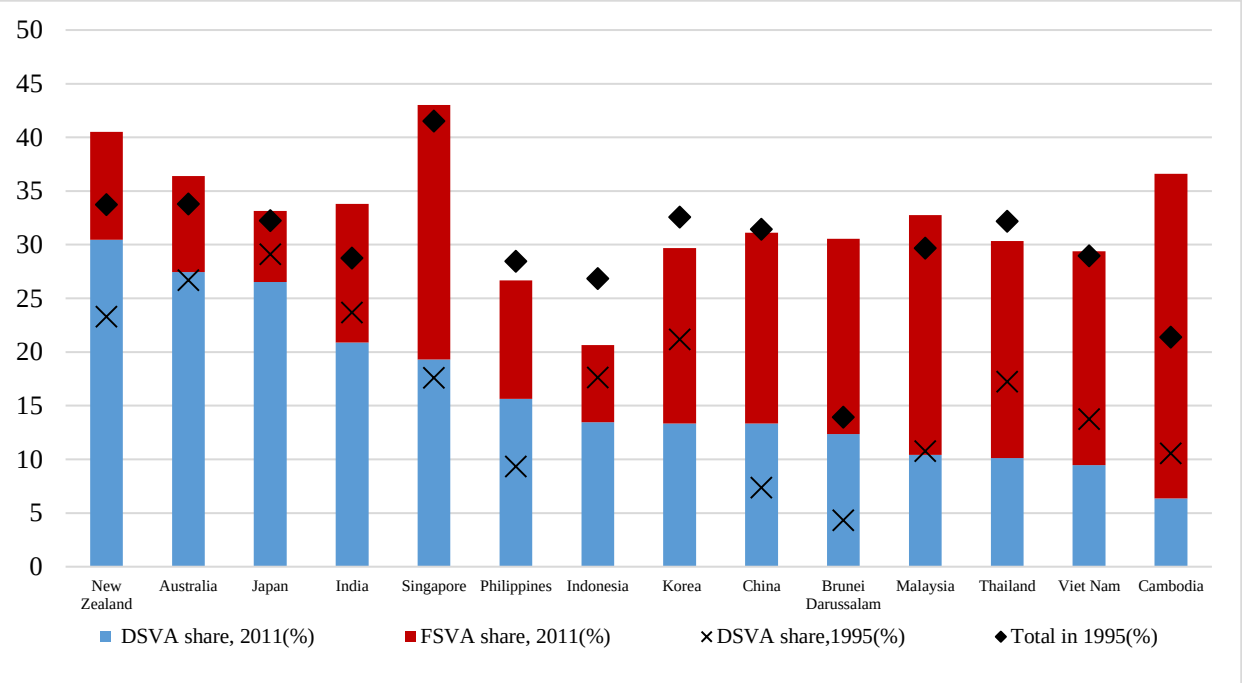
2.2 Servicification in Manufacturing

There are only a few studies on servicification, the increasing use of services in the manufacturing sector, as an important structural shift in industrial activities in both domestic and international production of OECD countries (Lodefalk, 2015). For example, Lodefalk (2013) decomposed the 1975–2005 input and output tables of Sweden and found that the manufacturing sector accounts for the major share of exports of services. Similar trends are also found in Germany (Boddin and Henze, 2014) and France (Kelle, 2013; Kelle and Kleniert, 2010). This study uses the value-added content of the service industry to manufacturing as a proxy of servicification as this provides a more accurate measurement than gross trade.

In this study, we examine the servicification trend in East Asian countries and compare the trends in OECD countries. Based on previous studies, the servicification index is calculated as the share of value-added content of the service industry to manufacturing exports. The importance of service activities to manufacturing is shown in Figure 6. The service value-added content of manufacturing export varies from 22% (Indonesia) to 47% (Singapore) across RCEP countries. From 1995, most of the RCEP countries except

Indonesia, Philippines, Thailand, and Korea, experienced an expansion of servicification in manufacturing. Also observed was a rise in the foreign services content in manufacturing, which captured international sourcing and service offshoring in RCEP countries. It is interesting to note the high foreign share of services content in manufacturing for Cambodia, indicating a high reliance on foreign firms to provide the services activities in Cambodia.

Figure 6: Service Value-added Content of Manufacturing Exports for RCEP Countries

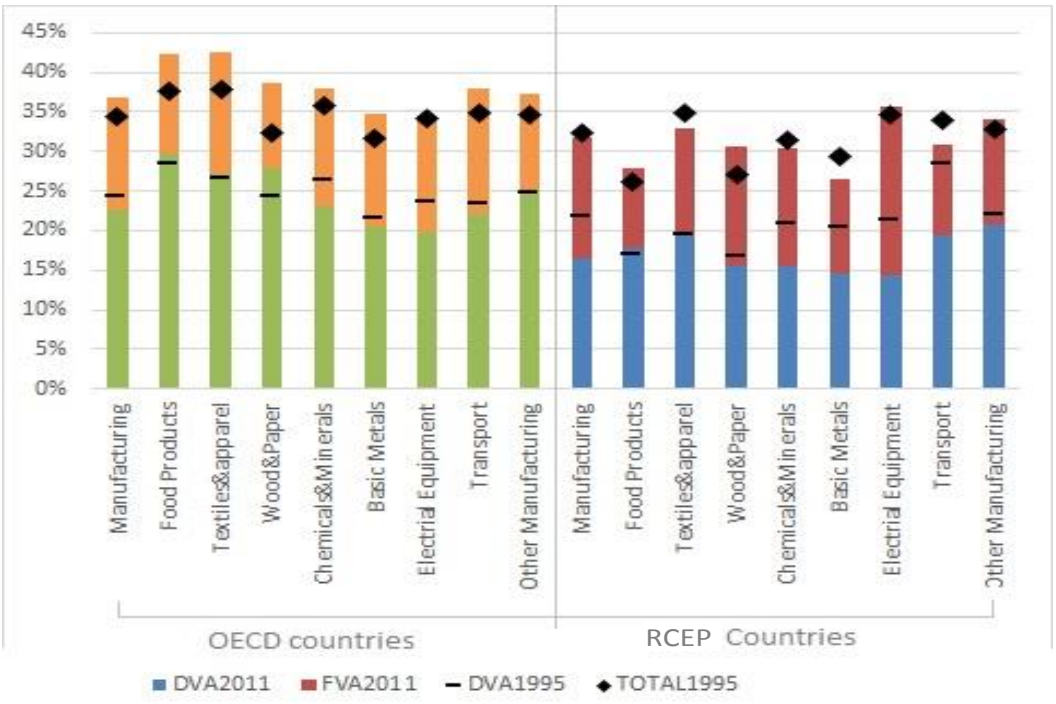


Source: Data from OECD TIVA (2015) database and calculated by the authors.

This study also explores the degree of servicification of Asian economies with that of OECD economies. In 2011, the service content in the manufacturing sector of Asian countries at 34% is slightly lower than that of the OECD countries at 37% (see Figure 7). The servicification of OECD countries is also showing an increasing trend at 4% in 2011 compared to 1995, however, there is a marginal decline in Asian countries in 2011. This decline is reflective of the decline in the services content for textile and apparels, chemical and minerals, basic metals, and transport sector. In contrast, services content increased in all

the manufacturing sectors of OECD countries, particularly in food products, textile and apparels, wood and paper, and transport sectors.

Figure 7: Servicification in the Manufacturing Sectors of OECD and RCEP Countries



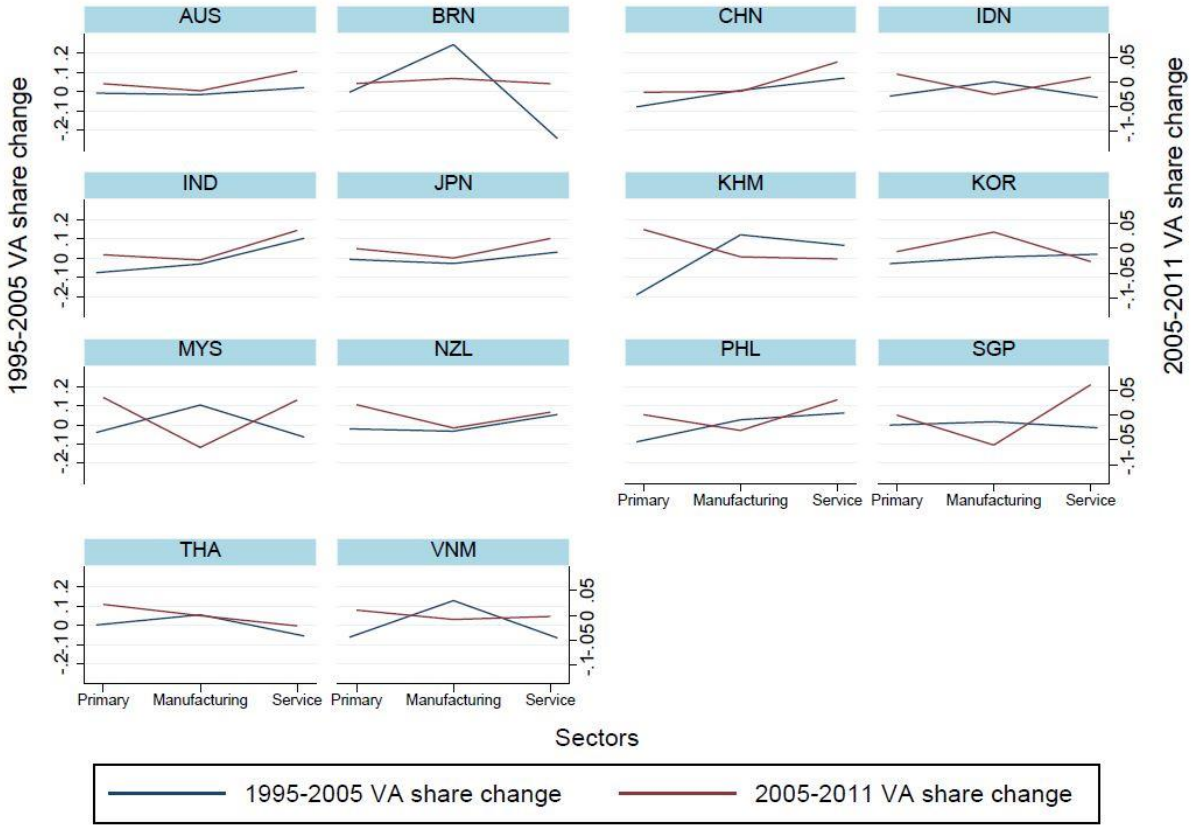
Source: Data from OECD TIVA (2015) database and calculated by the authors.

We also observe a higher level of international outsourcing in Asian countries compared to OECD countries, an indication of wider multinational activities and greater role for global and regional value chain activities in the manufacturing and services sectors in Asia. Among the Asian countries, a higher international outsourcing of services is observed in the foreign services value-added share in manufacturing exports. This illustrates the importance of imported service in strengthening the competitive position of manufacturing and the importance of GVC in the services sector. This is also an indication of increasing participation of RCEP countries in GVCs.

One of the most commonly used diagrams in describing the trend of servicification in global value chains is the 'smile curve.' By decomposing the origins of manufacturing value added into the primary sector, manufacturing sector and service sector, the recent trends of servicification could be further examined by the changes in each sector between 1995 and 2011. For most RCEP countries in the sample period, service activities did not post

advantage over the manufacturing and primary sectors. In countries such as Brunei Darussalam, Cambodia, Malaysia, the Philippines, and Viet Nam, manufacturing activities experienced the fastest growth in value-added share during 1995–2005. However, in recent years, there is a stronger emergence of servicification in manufacturing for most ASEAN countries. The rising importance of services in value-added activities across Asian countries is clearly visible from the 'smile curve' of servicification, an indication of the shift from manufacturing activities to more services activities and trade (Baldwin et al., 2014, 2015).

Figure 8: Servicification in the Manufacturing Sectors of OECD and RCEP Countries



Source: Data from OECD TIVA (2015) database and calculated by the authors.

The results have confirmed the existence of servicification in manufacturing sectors in RCEP countries as well as in OECD economies. Although the servicification level is slightly lower in RCEP countries than OECD economies, authors observe a higher level of foreign service offshoring in the RCEP countries. The next section will empirically examine the key sources of the servicification trends in OECD and RCEP countries. In particular, it will

identify the determinants of servicification and estimate their impacts on the manufacturing sectors in both OECD and RCEP countries.

3. Empirical Model

3.1. Determinants of Servicification

Servicification is seen as an important activity that increases the opportunity for developing countries to move up the regional and global production value chains. While some of the bundling or modularization occurs along the global value chains, servicification may appear with the exigencies of locational dispersion in production and consumption or by regulatory requirements (Low, 2013). Moreover, the servicification tendencies are likely to be fed by the strategic motivations of firms to move upwards along the global value chains (Kommerskollegium, 2016. Baldwin et al. (2015) identifies possible sources in the increase in services activities in the domestic economy as follows: (a) reclassification of services, (b) increase in the participation of GVCs, (c) motivation to move upwards along GVCs, and (d) increase in intercountry connectivity through technical and transportation improvement.

The reclassification of services has been discussed in the analysis of the discrepancy of gross trade and GVC trade. For example, services used in manufacturing sectors were classified as manufacturing exports in gross trade flows. However, with the value-added decomposition, it is possible to distinguish the source of manufacturing value added, and recognize the role of services in manufacturing sectors. The change is mainly due to statistic error rather than changes in the structure of economy.

Also, countries participate in GVCs in order to differentiate their production activities and earn higher profits through international fragmentation. The outsourcing and fragmentation of manufacturing production in GVCs are accompanied by higher service inputs such as telecommunication, transportations, and research and development (R&D) services.

Concurrently, countries at a relative upstream position in GVCs tend to use servicification to realize reindustrialization, the trend that is observed among OECD countries. Furthermore, the progress in transport and ICT will improve the tradability of services and promote outsourcing. Thus, products with higher technical level have higher

demands for services such as software, design, and R&D services. With the declining cost of transportation, it becomes easier to source offshore intermediate goods rather than intermediate service, thus resulting in increasing intermediate service content in goods exporting.

Recent studies have also identified institutional reforms as the other key factor in the servicification of the economy (Miroudot and Shepherd, 2014). For example, the regulation in services such as telecommunication services tends to bring extra cost and create excessive barriers of service offshoring. Thus, deregulation creates more flexibility in production activities and likely result in a higher proportion of service offshoring that leads to an increasing trend of servicification.

3.2. Data and Empirical Model

The empirical model to explore the key factors driving the servicification in manufacturing is discussed in this section. As previously highlighted, there are four key factors determining servicification: reclassification of services, participation and upgrading in GVCs, technical improvement, and institutional reforms. The first factor can be controlled by using service value-added content in manufacturing exports, which eliminate the reclassification problem and describe the real contribution of service sectors in manufacturing industries.[2] The other three factors are considered in the empirical model.

We define servicification as the share of service content in manufacturing exports. It can have two sources: (a) the domestic service value added ($DSVAshare_{ijt}$) from local companies or local presence of foreign companies, and (b) the foreign service value added ($FSVAshare_{ijt}$) from foreign countries involved in domestic production and exports. The $DSVAshare_{ijt}$ measures the domestic servicification in all the sectors while $FSVAshare_{ijt}$ describes foreign servicification level in domestic production and exports. The $FSVAshare_{ijt}$ can also be seen as a proxy of service offshoring index of RCEP countries.

We now identify the key control factors in our analysis. For participation in the GVCs, we derive the GVC participation index to measure the engagement in GVCs and the GVC

[2] The discussion on reclassification in value-added activities is in the Appendix. Although, there might still be some minor issues with reclassification due to aggregation, recent international input-output database such as the OECD TIVA database, the WIOD database and JETRO AIIO, on the other hand, are fairly able to address the issues related to reclassification of services to allow the authors to examine the impact of services in manufacturing activities.

position index to define upstream activities of countries in GVCs as highlighted by Koopman et al. (2014). The GVC participation index is defined as the sum of the foreign value added in exports and the share of domestic value added in exports of intermediate inputs used for exports in third world countries. The GVC position index is constructed such that countries with high forward participation record relative to backward participation record a higher value.

We also incorporate other factors (X_{it}) such as technology improvement that is measured by R&D expenditure share in GDP and computer usage in 100 persons, and institutions (government efficiency and regulation quality) in the empirical model. In addition, we also include country specific characteristics (X_{it}) such as GDP per capita and service workers in total employment. We also control the fixed effects of country, industry, and time. The panel empirical model could be written as follows:

$$DSVAshare_{ijt} = \beta_0 + \beta_1 GVCparti_{ijt} + \beta_2 GVCposition_{ijt} + \sigma_i X_{it} + \delta_{it} + \theta_{jt} + \varepsilon_{ijt} \quad (1)$$

$$FSVAshare_{ijt} = \beta_0 + \beta_1 GVCparti_{ijt} + \beta_2 GVCposition_{ijt} + \sigma_i X_{it} + \delta_{it} + \theta_{jt} + \varepsilon_{ijt} \quad (2)$$

where δ_{it} and θ_{jt} are country- and industry-specific fixed effects, respectively.

Table 1 describes the variables in the model. The value-added data of GVCs are taken from the OECD TIVA database. The database contains 61 economies that vary from OECD countries to developing countries. There are 14 RCEP countries in the database except for the Lao PDR and Myanmar.[3] The panel in this study comprises 34 sectors from the database, including 16 manufacturing firms and 14 services firms.

The study covered the following years: 1995, 2000, 2005, 2008, and 2011. The country-specific variables are obtained from various databases. The GDP per capita, service labour share to total employment, R&D expenditure share in GDP, and 100 computer users are obtained from the World Bank database. The regulation indicators are from the Doing Business database of the World Bank.

[3] Although these countries are important, they only account for a small component of the economic and GVC activities for ASEAN and Asia. We hope future studies are able to include data from these two countries.

Table 1: Variable Description

Variable	Description	Obs	Mean	Std.	Min	Max
SDVA	share of service	20,491	46.14	31.89	0.31	97.81
SFVA	share of foreign service	20,491	8.12	5.49	0.25	35.03
Participation	GVC participation Index	20,491	62.27	27.02	0.68	100.00
Position	GVC position index	20,491	0.67	1.35	-3.70	3.34
SSE	Service labour share of total employment	20,491	56.79	15.06	12.20	75.40
RDS	R&D share in GDP	20,491	1.84	1.09	0.08	3.74
Computer	computer user in 100 persons	20,491	42.26	33.81	0.00	83.76
GDP	GDP per capita (1000 USD)	20,491	15.95	14.20	0.47	36.71
GE	Government Effective Index	20,491	0.84	0.78	-0.42	1.94
ReguQ	Regulation Quality Index	20,491	0.64	0.83	-0.44	1.97
Manu	dummy for manufacturing sector	20,491	0.44	0.50	0.00	1.00
SRCEP	interaction of SSE and RCEP	20,491	56.79	15.06	12.20	75.40
RRCEP	interactions of RDS and RCEP	20,491	1.84	1.09	0.08	3.74
CRCEP	computer * RCEP	20,491	42.26	33.81	0.00	83.76
GRCEP	interactions of GE and RCEP	20,491	0.84	0.78	-0.42	1.94
RQRCEP	ReguQ * RCEP	20,491	0.64	0.83	-0.44	1.97
ΔParticip	five year change in participation	8,765	-.076	7.88	89.21	88.40
Δ Posit	The five year change of position	8,765	-0.01	-0.51	-5.27	4.56
MP	manufacturing*ΔParticipation	20,491	32.74	38.74	0.00	98.40
MPOSIT	manufacturing*ΔPosition	20,491	0.22	0.57	-1.87	2.71
PRCEP	Δparticipation * RCEP	20,491	62.27	27.02	0.68	100.00
PositRCEP	Δposition * RCEP	20,491	0.67	1.35	-3.70	3.34

4. Results Analysis of the Empirical Model

4.1. Baseline Results for All Countries

Table 2 shows the results of the above model based on equations (1) and (2) for all countries. Since we regress GVC participation and GVC position variables on the domestic service value added ($DSVAshare_{ijt}$) and foreign service value added ($FSVAshare_{ijt}$), there are likely to be endogeneity and feedback effects in the regressions. The Hausman test

is used to examine the endogeneity of GVC participation and GVC position variables in the model using lagged variables as instruments. Results indicate there are no endogeneity issues in the regressions[4] hence results are presented in fixed-effect estimations.

Table 2: Basic Model Results for All Countries

	DSVA	FSVA
GVC participation index	-0.113***	0.234***
	(0.024)	(0.011)
GVC position index	2.799***	-5.636***
	(0.420)	(0.234)
Service labour share of total employment	0.046***	0.001
	(0.015)	(0.007)
R&D expenditure in GDP	0.561*	-0.044
	(0.333)	(0.142)
Computer usage per 100 persons	0.030***	0.006
	(0.009)	(0.004)
GDP per capita	-0.033	0.252***
	(0.043)	(0.032)
Government effectiveness	0.751	-0.970***
	(0.509)	(0.212)
Regulation quality	1.179*	0.150
	(0.624)	(0.198)
Constant	25.801***	-1.107
	(1.973)	(0.879)
Observations	2961	2961
Time effect	Fixed	Fixed
Sector effect	Fixed	Fixed
Country effect	Fixed	Fixed

Notice: Standard errors in parentheses.
* p < 0.10, ** p < 0.05, *** p < 0.01

In Table 2, the first column reports the results on domestic servicification. The GVC participation variable has a negative and significant effect on the domestic service value added in manufacturing, which suggests that greater participation in GVC activities will lead to a lesser use of domestic service in manufacturing. The high GVC participation index represents high fragmentation and internationalization of production processes across the world. Meanwhile, the rise in participation in GVCs means a reduction in domestic service and a rise in services from overseas. The second column reports the degree of foreign

[4] The results of the Hausman test for endogeneity is available from the authors.

services in GVC activities. The GVC participation variable coefficient verifies that the foreign services content in manufacturing is affected by the GVC participation index in a positive and significant manner.

The GVC position is an indicator of upstream activities of countries in GVCs. Countries with higher position in GVCs are more efficient in productive knowledge and innovative capabilities and tend to produce quality and higher value-added services. For example, let's look at the iPad. Apple, a United Sates-based company captures between one-third or one-half of an iPad's retail price from designing while firms in China capture no more than 2% from assembling. The effects of GVC position is captured by the significant and positive coefficient in Table 2's column 1. Countries that are moving towards a more upstream position in production will improve domestic service value added in manufacturing while reducing the usage of service from foreign countries.

The results of key country fundamentals show very interesting results. The coefficient of service labour share in total employment is statistically significant and positive in domestic service value-added share. However, it is not statistically significant for the foreign service value-added share (SFVA). This is not surprising as the growth of service labour will lead to an increase in service products without any effects on foreign services output. The R&D expenditure to GDP has a positive impact on servicification, which is only statistically significant for the domestic service content in manufacturing. The technology variable 'computer usage per 100 persons' is also positive and indicates more technological adoption and usage that will promote domestic servicification in the economy. The results confirm a previous statement that improvement in technology and ICT have accelerated the tradability of services and promoted the servicification of manufacturing.

It is also observed that GDP per capita has no significant effect on domestic servicification, however, it has a marginal positive impact on foreign services content in manufacturing on a significant and positive degree. This may indicate that countries with higher GDP tend to outsource their key services activities. Also observed is the importance of institutional variables to the servicification of manufacturing activities. A strong and stable institution tends to promote more service activities – but we do not find a statistically significant impact on domestic servicification – and tends to reduce reliance of foreign services in domestic production. Furthermore, it is observed that the improvement of service regulation quality accelerates domestic servicification in manufacturing.

It is quite interesting to witness institutional variables having important but different impacts on the servicification of manufacturing activities. Two different institutional

variables from the World Bank database are utilized in this study: (a) Government effectiveness (GE) rates perceptions on the quality of public services, quality of civil services, and degree of independence from political pressures; and (b) Regulatory quality (ReguQ) captures the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Both of these variables have different impact on the level of domestic servicification in the manufacturing activities. Increase in government effectiveness tends to reduce foreign service value-added activities and to increase domestic services in the manufacturing and export activities (it is negative and statistically significant in the foreign service value-added regressions). Positive impact is observed on domestic service value-added activities but it is not statistically significant. However, improvements in regulation quality in terms of promoting private sector activities tend to have a larger and positive impact on both domestic and foreign service value-added activities as compared to the GE variable. This suggests that better and well formulated policies to promote private and market activities tend to increase domestic services and value-added activities in both the manufacturing and exports sector of the domestic economy.

4.2. Servicification in RCEP Countries

Table 3 reports the degree of services activities in RCEP countries, majority of which are developing countries with relatively lower position, less technical advantage, and have poor institutions.

It is not surprising that institutional factors in Asia have negative impact (negative coefficient and statistically significant) on service activities in the region. Institutional impediments and regulations have created large monopolies and state-owned enterprises (SOEs) that restrict the development of key services activities in the domestic economy. Excessive institutional interventions and extra regulations in services increase transaction cost and create excessive bottlenecks for services activities and services trade. If institutions are efficient with less regulations, the services intensity and servicification will place a higher value added of services in economic activities.

Table 3: Baseline Results for RCEP Countries

	DSVA	FSVA
GVC participation Index	-0.155***	0.228***
	(0.036)	(0.013)
GVC position index	3.156***	-6.123***
	(0.452)	(0.199)
Service labour share of total employment	0.008	-0.010
	(0.015)	(0.006)
R&D expenditure in GDP	2.099***	0.380
	(0.586)	(0.356)
computer usage per 100 persons	0.037**	-0.005
	(0.014)	(0.009)
GDP per capita	-0.192***	0.251***
	(0.065)	(0.048)
Government effectiveness	-4.544***	-1.569**
	(1.360)	(0.783)
Regulation quality	0.441	-2.172***
	(0.892)	(0.418)
Constant	40.445***	-0.534
	(3.328)	(1.955)
Observations	468	468
Time effect	Fixed	Fixed
Sector effect	Fixed	Fixed
Country effect	Fixed	Fixed

Notice: Standard errors in parentheses.
* p < 0.10, ** p < 0.05, *** p < 0.01

4.3 Robustness Check

The emerging ‘smile curve’ of value added shifting to service activities provides further evidence of servicification in the manufacturing sector. As previously described, the ‘smile curve’ describes the trend wherein the value added of the manufacturing sector is more intensive in the service sectors rather than in the manufacturing sector. Baldwin et al. (2015) examines the existence of the ‘smile curve’ by introducing ‘total servicification’ or the increase in service sector inputs in all sectors in the period between 1990 and 2005, with various measure of changes in GVC participation. However, due to the unavailability of measures of other non-GVC factors, the fixed effect to control country and industrial variables is instead used. In fact, the country or industry fixed effect can only control country-industry specific bias. Thus, the lack of other control variables in their regression leads to the missing variable problem and raises the question on the robustness of the analysis. It turns out that most coefficients in the analysis are not statistically significant and the sign of GVC participation is contrary to the expected hypothesis.

Based on Baldwin et al., (2015), authors examined the effects of 'total servicification' but improved Baldwin's model (2015) by including national variables to control the unobservable factors affecting the servicification of the manufacturing sector. We rewrite the model as follows:

$$\Delta Service\ VAshare_{ijt} = \beta_0 + \beta_1 \Delta GVC\ Partic_{ijt} + \beta_2 \Delta GVCposition_{ijt} + \gamma_{it} X_{it} + \delta_{it} + \theta_{jt} + \varepsilon_{ijt} \quad (3)$$

The model $\Delta Service\ VAshare_{ijt}$ is a five-year change in the share of service value added in gross exports for all the sectors. It contains the domestic service content changes (ΔSDVA) and the changes of service content imported from foreign countries (ΔFDVA). $\Delta GVC\ Partic_{ijt}$ and $\Delta GVCposition_{ijt}$ are the changes in the GVC participation and position index. X_{it} is the national control variables similar to the basic model. The panel data consists of 61 countries, 34 sectors and spans three periods (1995–2000, 2000–2005, and 2005–2010).

Table 4: Robustness Check of 'Smile Curves'

	ΔSDVA			ΔFDVA		
	1	2	3	4	5	6
ΔGVC participation	-0.215***	-0.245***	-0.199***	0.220***	0.216***	0.225***
	(0.015)	(0.014)	(0.017)	(0.010)	(0.011)	(0.011)
ΔGVC position	4.415***	4.896***	4.340***	-4.588***	-4.346***	-4.863***
	(0.258)	(0.293)	(0.299)	(0.202)	(0.231)	(0.237)
Service labour	0.028	0.034	0.062*	-0.026**	-0.022**	0.037***
	(0.024)	(0.023)	(0.032)	(0.011)	(0.011)	(0.014)
R&D in GDP	-0.520	-0.529	-0.196	0.026	0.024	0.369**
	(0.331)	(0.331)	(0.353)	(0.169)	(0.169)	(0.183)
Computer	0.007	0.005	0.011	-0.007	-0.006	-0.007
	(0.010)	(0.009)	(0.010)	(0.005)	(0.005)	(0.005)
GDP per capita	-0.082	-0.069	-0.100	0.399***	0.397***	0.372***
	(0.059)	(0.059)	(0.062)	(0.037)	(0.038)	(0.039)
GE	-0.318	-0.275	0.556	-1.314***	-1.289***	-1.064***
	(0.479)	(0.477)	(0.546)	(0.261)	(0.260)	(0.281)
ReguQ	1.809***	1.748***	1.669***	0.535**	0.510**	1.016***
	(0.470)	(0.475)	(0.517)	(0.262)	(0.255)	(0.279)
Manufacturing		-0.240			0.000	
		(0.398)			(0.202)	
Manu*Δpart		0.215***			-0.039	
		(0.063)			(0.026)	
Manu* Δposit		1.114**			-1.442***	
		(0.563)			(0.412)	
RCEP			4.072			7.026***
			(2.499)			(1.179)
Δpart* RCEP			-0.098***			-0.012
			(0.033)			(0.019)
Δposit * RCEP			0.124			-1.328***
			(0.565)			(0.384)
SSE * RCEP			-0.057			-0.101***
			(0.046)			(0.019)
R&D * RCEP			0.792			-0.450
			(0.837)			(0.421)
computer*RCEP			-0.023**			0.011
			(0.012)			(0.007)
GE* RCEP			-1.318			0.466
			(1.667)			(1.116)
ReguQ* RCEP			0.061			-3.654***
			(1.106)			(0.681)
Constant	-1.265	-1.778	-3.804	0.543	0.319	-3.945***
	(1.717)	(1.710)	(2.331)	(0.851)	(0.837)	(1.089)
Observations	6526	6526	6526	6526	6526	6526
Time effect	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
Country effect	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
Sector effect	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed

Notice: Standard errors in parentheses.
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 4 presents the result of the 'smile curve' and supports the hypothesis that GVC variables are important in the servicification of manufacturing activities. Most of the key variables are statistically significant and highlight the robust fit of the model. Columns 1 and 4 in Table 4 suggest that the participation of GVCs has a negative impact on domestic servicification but positive effect on foreign servicification. Countries that have more participation in GVCs tend to import service from foreign countries, which is also consistent with the above results. However, countries at the upstream of GVCs will shift the origin of service input from aboard to domestic firms, which suggests that countries at the upstream of GVCs prefer to use more domestic services rather than offshoring service tasks. The domestic service employment has no effect on domestic servicification but it is negative on service offshoring. Regulation Quality is the most important factor in both domestic and foreign servicification, which means countries with better regulations will use more services in their production. The other national control variables have no significant effect on domestic servicification but wealthier countries with free government will use more foreign service content in their production.

Columns 2 and 5 compare the servicification determinants in the manufacturing sectors and other sectors. For the manufacturing sectors, countries with higher participation in GVCs use more domestic services in their production, which indicates an increasing trend in servicification in manufacturing sectors. However, for other sectors such as the service and the agricultural sectors, countries with higher participation in GVCs prefer to use more foreign service value added. The GVC position of countries has a positive impact on the domestic servicification in manufacturing sectors but a negative effect on the foreign servicification in manufacturing sectors. The results correspond to the current situation of reindustrialization through servicification in OECD countries, which have relatively high participation and upstream position in the GVCs.

The third and last column of Table 4 compares the factors of servicification in RCEP countries and OECD countries. RCEP countries with lower participation and higher position in GVCs will use more domestic service content in production, which is similar to the effect on OECD countries. Meanwhile, the service human capital has more significant effect on the domestic servicification in OECD countries than in RCEP countries. The lack of service labour and poor quality of regulations increase foreign servicification in RCEP countries. In addition, the development of technology has improved the connectivity of RCEP countries with the world, which decreases domestic servicification but raises the level of foreign servicification in RCEP countries.

5. Policy Discussions and Conclusion

It is widely recognized that services are playing an indispensable role in international trade and economic growth of developed and developing countries. The current globalisation trend due to the unbundling – the internationalisation and fragmentation of the production process across the world – is changing the production and trade pattern of services. From a value-added perspective, services could be used not only as final products but as intermediates in both manufacturing and service production. The increase of service content in economic activities, particularly in the manufacturing sector, is identified as servicification.

In this paper, we explore the trend of servicification in domestic economies and the manufacturing sectors of Asian countries that are also RCEP member countries. The servicification in the paper is classified into two types according to the source of service value added, namely domestic servicification and foreign servicification. Domestic servicification uses domestic services in production and exports, while foreign servicification measures the content of foreign services embodied in the domestic production and exports. Our results indicate that despite the slightly lower level of servicification, RCEP countries have a higher foreign servicification level, captured by foreign services value-added share in comparison to OECD countries. We also observe a high relative advantage in the services sector compared to the manufacturing sector in RCEP countries. The importance of services in RCEP countries has triggered a shift from manufacturing to services activities in the region – defined by the 'smile curve' that indicates an increasing servicification in Asia.

The emerging trend of servicification is affected by several factors. Empirical results indicate that GVC participation, GVC positions, technological, and institutional factors are the key to the increasing services activities in the region. The ability to participate in GVC offers new opportunities for domestic small and medium-sized enterprises (SMEs) to integrate into the global economy through service activities, and both in- and outsourcing activities. This implies that more involvement in GVCs can shift activities from domestic service input to importing services from other countries. Results from this study also indicate that the position in GVC affects the types of services adopted in the manufacturing activities. Upstream countries in GVCs tend to have more fundamentals in human capital, infrastructure and connectivity that increase the domestic service content – they tend to outsource labour-intensive manufacturing services overseas, while keeping technology-

intensive services at home. The effect of GVC factors on servicification is positive and statistically significant for RCEP countries.

The results also indicate that ICT reduces the costs of services, improves transaction efficiency, and increases the tradability of services. These variables are positive and suggest a positive impact on the servicification of manufacturing.

The results of this study indicate that institutions play an important role in the process of servicification of the economy and the manufacturing sector. For developed countries, the effectiveness of institutions tends to have more impact on service offshoring to foreign countries and less on domestic servicification. However, the institutional factors in RCEP countries tend to be important for domestic as well as foreign service activities. Results show that institutions in Asia tend to have a larger negative impact on service activities compared to OECD countries, thus indicating greater barriers for services trade in the region.

It is observed that GDP per capita is not a major factor in domestic service value added but it does play an important role in foreign servicification. The number of service workers in relation to total employment does not seem to affect the domestic servicification in RCEP countries, which is a surprising result as human capital is expected to have a significant impact on the servicification of the domestic economy. However, this result may indicate that workers in Asia may be undertaking more unskilled intensive services compared to workers in developed countries.

In conclusion, this paper contributes to the ongoing debate on the servicification of domestic economy, particularly the manufacturing sector, in developing countries. The important factor affecting the growth of the services activities in the domestic economy are human capital, level of institutional reforms, and connectivity to both regional and global value-chain activities. Together, these have significant implications in developing services activities and trade in developing countries.

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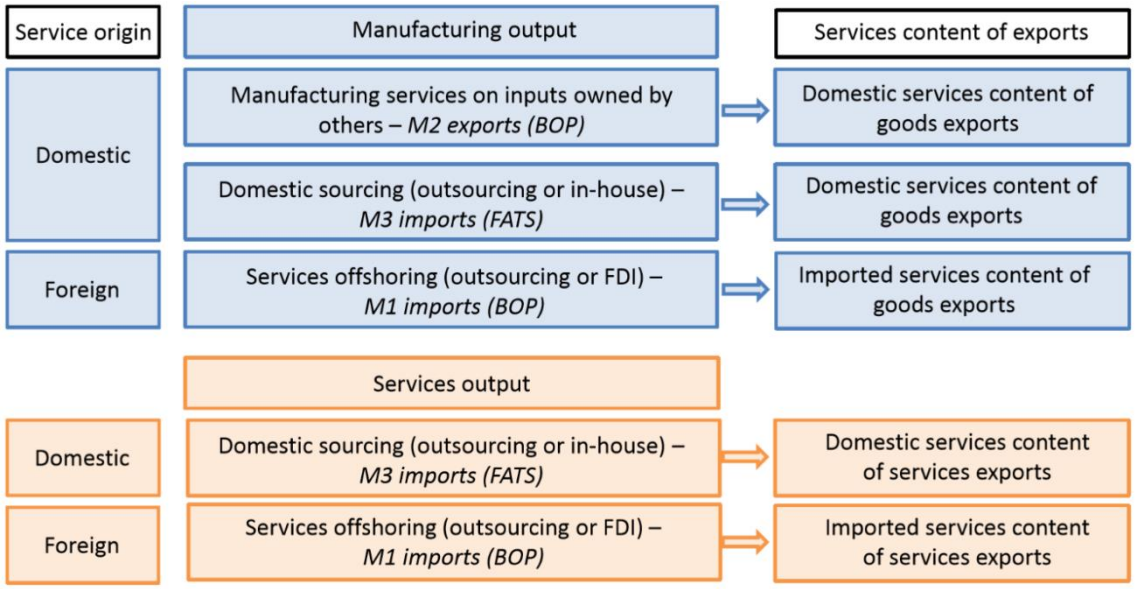
Appendix

The General Agreement on Trade Services (GATS) defined four modes of international service supply: cross border supply (mode 1), consumption abroad (mode 2), commercial presence (mode 3) and presence of natural persons (mode 4). But it failed to capture service as inputs or intermediates, which is very important in GVCs and trade patterns. As Figure 1A shows, services, which origin domestically or aboard, can be used as inputs for both manufacturing and service sector. Domestic supply of services could be either from domestic service companies or from local affiliates of foreign companies (Mode 3), which is called the domestic service content of goods. Also, manufacturers may also import service overseas, constructing the imported service content of goods. Similarly, the export of service sectors contains domestic service content and imported service content. Obviously, BOP can capture the direct cross-border service trade, but it fails to recognize indirect trade that service embodied in goods export, let alone services content produced by the movement of labour (mode 4) and capital (mode 3).

Figure 1A: The Role of Service in GVCs and Trade Patterns



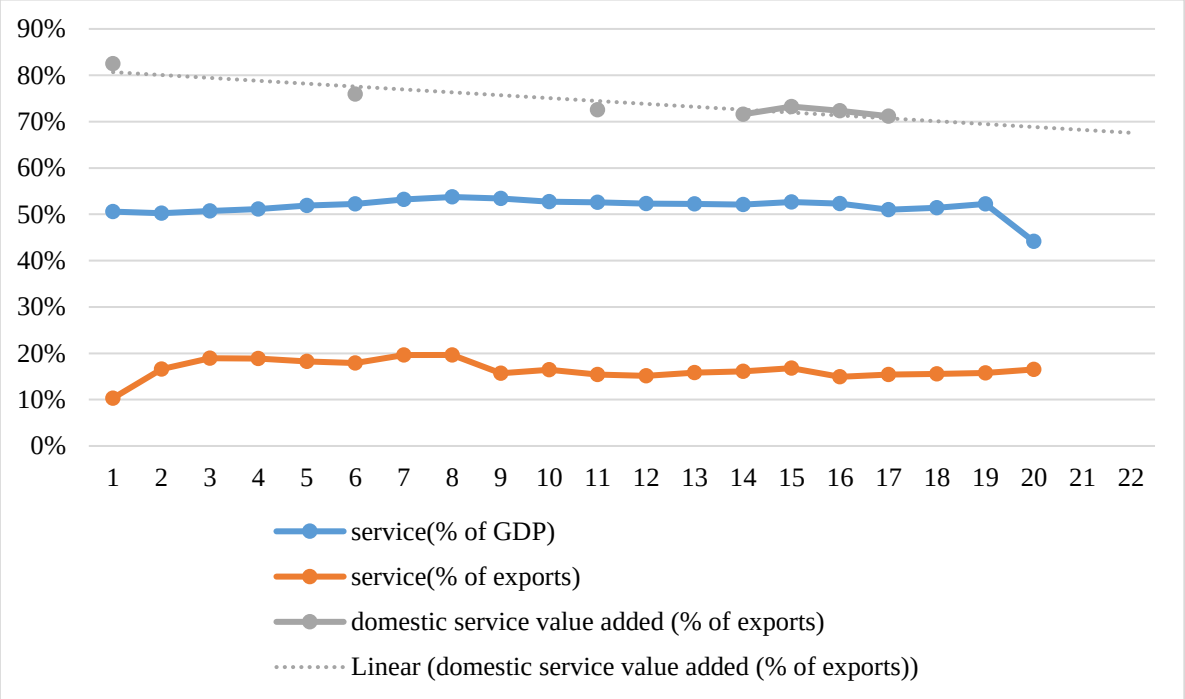
Source: Lanz and Maurer (2015).

The international input and output tables create a multinational, multi-industry framework that make it possible to trace the origin of value added in international trade. In Figure 1A, value added of service export can thus be estimated as the direct export of service and the indirect export of service embodied in goods. Furthermore, service supplied by

foreign affiliates (Mode 3) can be measured as foreign value added in exports. Recent years have seen an emerging rise in international input and output database such as OECD TIVA database, WIOD database and JETRO AIIO database. This study uses the OECD TIVA database.

Figure 2A depicts the share of service in exports with conventional measurement and new value-added database. It is striking that the share of service value added reaches 70% of gross export in TIVA database compared to 20% in the BOP. It reveals the high proportion of service content in goods export that is neglected by conventional measurement. The vast service input used in manufacturing process has been described as 'servicification of manufacturing, also termed as 'servicizing' or 'manuservice' (Elms and Low, 2013).

Figure 2A: The Share of Service from GDP, Trade, and GVCs' Perspective



Source: Data from OECD TIVA (2015) database and calculated by the authors.

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