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Potential for India's Entry into Factory Asia: Some Casual Findings from International Trade Data

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Abstract: *Despite its impressive economic growth in the past few decades, India is slow in adopting a task-by-task international division of labour or international production networks (IPNs). Using international trade data for international comparison from multiple angles, this paper visualises the position of India – particularly in machinery IPNs and information and communication technology (ICT) services. Although machinery industries are at the centre of IPNs in East Asia, the paper clearly visualises that India has not yet participated in Factory Asia. Rather, trade data indicate that India is still engaged in import-substituting industrialisation. The paper also argues that ICT services are a strength for the Indian economy, and its competitiveness could be utilised effectively by combining new technologies with traditional industries such as manufacturing. India still has huge potential for utilising the mechanics of a new international division of labour to accelerate economic growth, innovation, and poverty alleviation.*

Keywords: International production networks, unbundling, machinery, global value chain (GVC) participation, gravity equation
JEL classifications: F14, F68, O53

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1. Evolution of the International Division of Labour

Since it began economic reform in 1991, India's economic growth performance has been remarkable. The average annual growth rates in the 1990s, 2000s, and 2010–2018 reached 4.9%, 7.5%, and 6.6%, respectively, which pushed up its per capita gross domestic product (GDP) from $380 in 1990 to $2,040 in 2018 (APO, 2020). However, one significant puzzle remains in India's economic growth: India has been rather slow in catching up with the evolution of the international division of labour.

In the mid-1980s, the Association of Southeast Asian Nations (ASEAN) started international production networks (IPNs) (Ando and Kimura, 2005) or the 'second unbundling' (Baldwin, 2016). IPNs are characterised by the task-by-task division of labour, rather than industry by industry, which allows not only goods but also ideas – including capital, technology, and managerial know-how – to move between remotely located production blocs. Machinery manufacturing is a typical industry that applies this type of international division of labour. Together with the fragmentation of production, East Asia (including Northeast and Southeast Asia) step forward to form industrial agglomerations in the open-trade setting. Fragmentation and agglomeration accelerate poverty alleviation in the region since IPNs generate jobs for relatively poor people, and at the same time encourage people to accumulate human capital, which is different from purely labour-intensive industries such as traditional garment and footwear industries.

The application of this type of international division of labour is uneven. Amongst newly developed and developing countries, only some East Asian countries, several Eastern European countries, and Mexico have so far been successful in participating in IPNs. Other developing countries are, by and large, stuck in the traditional industry-by-industry division of labour or the first unbundling. Furthermore, only some East Asian countries have formed industrial agglomerations for efficient production networks with both short-distance and long-distance transactions (ERIA, 2010, 2015). To take advantage of IPNs, policymakers require an updated mindset that is different from the traditional thought to support infant industry protection argument or import-substitution development strategies.

Policies generate a sharp contrast between countries that can participate in IPNs and those that cannot.

India started with a thick base of industrialisation, which was much stronger than that of ASEAN Member States in the past. Even now, its engineering industry has good potential, with indigenous innovation. However, India has not yet participated in IPNs. The manufacturing value-added share of GDP decreased from 17.2% in 1990 to 13.6% in 2018 (APO, 2020). Job creation by the manufacturing sector has not been large enough to eradicate poverty quickly. Export competitiveness in the manufacturing sector is still weak. Multinational enterprises mostly come to India to target the Indian market only, not as a global production basis, except for some automobile and smart phone operations. Thus, they may not bring the best technology and managerial know-how to compete in the global market. Therefore, there is clearly huge room for India to engage in IPNs or the second unbundling.

In the 2010s, a new type of international division of labour – the third unbundling – emerged. This is a new dimension of the international division of labour that fragments a task into remotely located individuals. India is strong in information and communication technology (ICT) services and thus has a great chance to engage in the third unbundling. However, we are not sure yet whether ICT services would directly generate a large number of jobs for relatively poor people. We may still need manufacturing and other industries to eradicate poverty. Although factory automation with artificial intelligence and the introduction of 3D printers may proceed steadily, labour will likely continue to be flexible and cost-saving inputs for manufacturing at least in the coming decade. Furthermore, ICT appears to be starting to upgrade the manufacturing sector. IPNs have overcome coronavirus disease (COVID-19) shocks by enhancing the use of communications technology. In Shenzhen, China, we observe the emergence of ICT services combined with small-quantity high-variety manufacturing such as drones. India may want to consider the possibility of expanding the interface between ICT services and manufacturing.

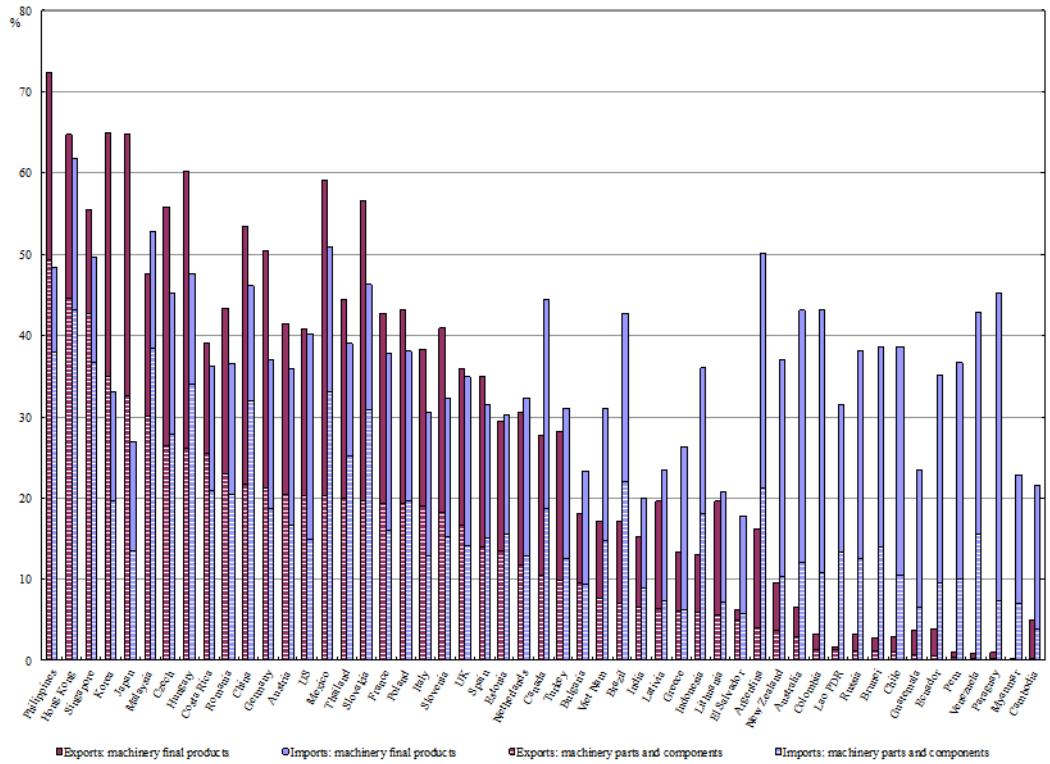
This paper illustrates India's current position in machinery IPNs by using the standard set of international trade data. The next section presents an international comparison of the importance of machinery exports and imports, parts and components, as well as final products, to show the country's current position in the IPNs. The third section shows global value chain (GVC) participation indices based on international input–output tables. The fourth section reports a gravity equation exercise to show the potential of machinery exports and imports in comparison with actual trade figures. The fifth section looks at services exports and imports to confirm India's competitiveness in ICT services. All these sections show huge untapped opportunities for India to participate in IPNs in connection with East Asia. The last section discusses the necessary policies to be incorporated in India's industrialisation strategies.

2. Proportion of Machinery Exports and Imports in Total Merchandise Trade

IPNs, or the second unbundling, are centred in machinery industries because machinery industries typically consist of multi-layered production processes with different technologies and diversified materials taken care of by many players, both domestic and cross-border. Thus, we first investigate the significance of machinery exports and imports in each country. Figures 1 and 2 present each country's machinery shares in total exports and imports for major countries in the world in 2010 and 2019, respectively, with a distinction between machinery parts and components and machinery final products.[1] Machinery sectors (Harmonized System (HS) 84-92) here include general machinery, electric machinery, transport equipment, and precision machinery. To focus on participation in IPNs, these figures arrange countries with higher export shares of machinery parts and components from left to right.

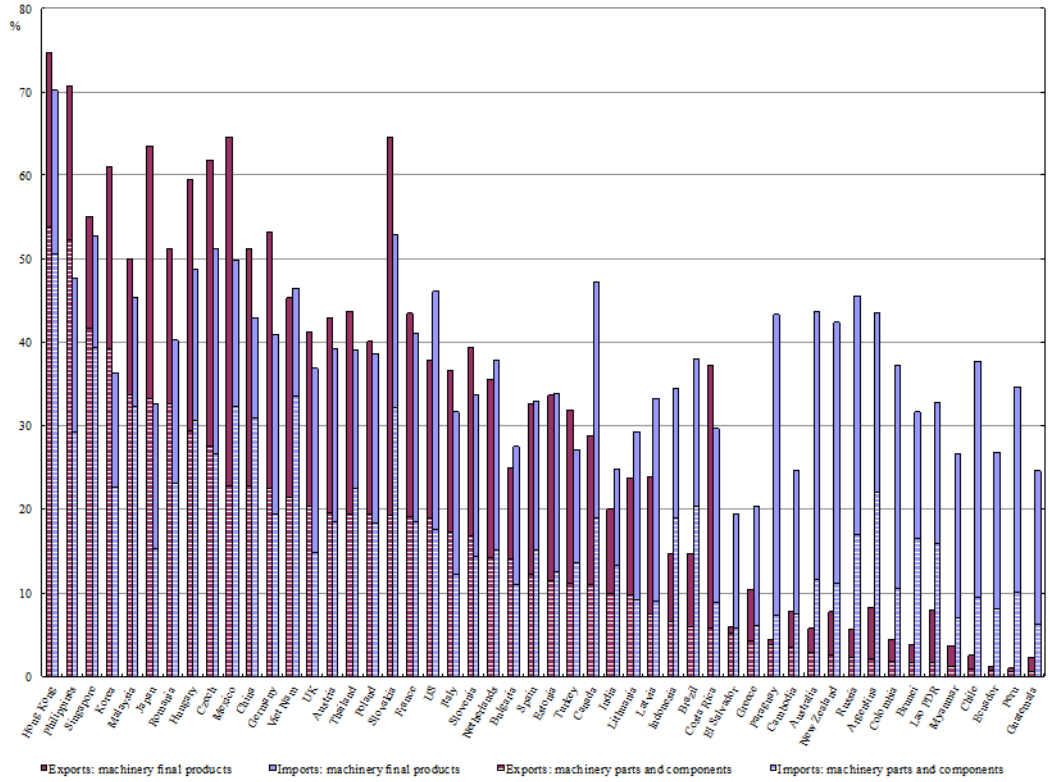
[1]See Kimura and Obashi (2010) for the definition of machinery parts and components for different versions of the HS classification. Machinery final products are regarded as machinery goods other than machinery parts and components.

Figure 1: Machinery Shares in Total Exports and Imports, 2010



Czech = Czech Republic, Korea = Republic of Korea, Lao PDR = Lao People's Democratic Republic, UK = United Kingdom, US = United States.
Source: Authors' calculations, using UN Comtrade Database (n.d.), https://comtrade.un.org/.

Figure 2: Machinery Shares in Total Exports and Imports, 2019



Czech = Czech Republic, Korea = Republic of Korea, Lao PDR = Lao People's Democratic Republic, UK = United Kingdom, US = United States.
Source: Authors' calculations, using UN Comtrade Database (n.d.), https://comtrade.un.org/.

Figures 1 and 2 provide several interesting findings for Asian countries. First, most East Asian countries are actively involved in machinery IPNs. For a number of East Asian countries, shares of parts and components for both exports and imports are high. This suggests the existence of back-and-forth transactions of parts and components. In addition, relatively high shares of exports in machinery parts and components indicate export-oriented operations in these East Asian countries. Apparently, this is opposite of the typical pattern in Latin America, excluding Mexico – for most Latin American countries, parts shares are low for exports and high for imports, which implies import-substituting operations.[2]

[2] While Costa Rica was on the left side in 2010, it moved back to the right side with a lower share in 2019. Since Intel's investment in manufacturing microchips in Costa Rica in 1998, other foreign companies have followed, contributing to high export shares of machinery parts and economic growth of this country in the 2000s. However, Intel closed its manufacturing division in Costa Rica in the mid-2010s, which must be one of the major reasons for the lower share in 2019.

In the early 1990s, most countries with higher shares of exports in machinery parts and components were developed countries.[3] By 2000, in line with the expansion of the second unbundling, machinery parts and components trade became more active, and the shares of machinery trade rose in many countries. Reflecting the rapid development of machinery IPNs in East Asia since the 1990s, however, many East Asian developing countries moved to the left, with absolute and relatively higher shares of exports in parts and components by then, and have kept such shares. Now, most countries on the left side are these East Asian countries, which participate actively in machinery IPNs, in addition to some countries in other regions, such as Mexico and some Central and Eastern European countries, which are actively involved in IPNs in North America and Europe.

Second, some Asian and Asia-Pacific countries – such as India, Indonesia, Cambodia, Australia, New Zealand, Brunei, the Lao People's Democratic Republic (Lao PDR), and Myanmar – still have lower shares of exports in machinery parts and components. While the low shares could be partially due to exports of their abundant natural resources, they are not heavily involved in machinery IPNs. India does not participate in machinery IPNs that have developed amongst East Asian countries.

Third, a drastic change from 2010 to 2019 is observed for Viet Nam and Cambodia. Cambodia had the lowest share amongst the countries in 2010. Although the absolute level is still not as high in 2019, Cambodia moved to the left and exceeded even Australia and New Zealand. Viet Nam was located at the right side of the middle in 2010. Surprisingly, however, it moved further to the left and became one of the countries with higher shares of exports in parts and components. Since parts shares expanded from less than 10% to over 20% for exports and from around 15% to over 30% for imports, we can conclude that Viet Nam has been rapidly involved in machinery IPNs during the last decade. On the other hand, India's position in this measure changed to some extent from 2010 to 2019, although its participation in IPNs is still limited.

[3] For the corresponding figures in the early 1990s and 2000, see Ando (2006) and Ando and Kimura (2005), respectively.

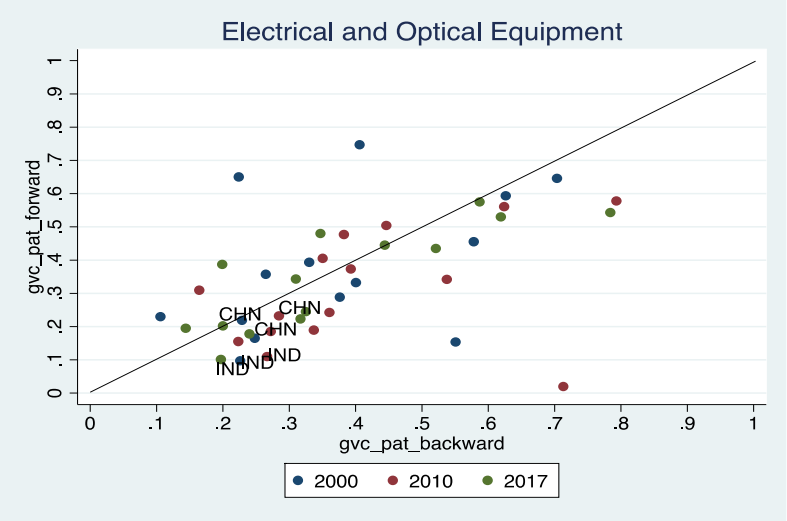
3. GVC Participation

Although international trade statistics are useful for investigating the transactions of finely disaggregated products, they do not directly show inter-industry linkages and value-added layers. This section employs indices based on international input–output tables, i.e. the UIBE GVC indices (WTO, n.d.; UIBE, n.d.), to look at GVC activities from the perspective of value added. This GVC index consists of two types: a forward linkage-based GVC index and a backward linkage-based GVC index. The forward linkage-based GVC index (producer perspective) indicates which types of production and trade are GVC activities, while the backward linkage-based GVC index (consumer perspective) indicates which parts of final goods production and trade belong to GVCs.[4] These indices have several advantages.[5] For instance, they allow us to incorporate GVC activities for domestic use, as they consider 'exporting its domestic value-added in intermediate exports used by a direct importing country to produce products for domestic consumption' and 'using other countries' value added to produce products for domestic use' in addition to conventional channels, 'exporting its domestic value-added in intermediate exports used by a direct importing country to produce products for a third country', and 'using other countries' value added to produce products for its gross exports' (Wang et al. 2017: 10). Conventional measures, such as vertical specialisation measures, which are expressed as a percentage of gross exports, could omit a large portion of international production sharing activities.[6] Since this kind of bias can be serious, particularly when a country has a large domestic market such as China and India, this paper uses these GVC indices in this section.

[4] See, for instance, Wang et al. (2017) for details on the UIBE GVC indices. Figure A1 in the Appendix summarises the concept of this index.
[5] For other advantages of the UIBE GVC indices in comparison with conventional measures, see Wang et al. (2017).
[6] See Hummels, Ishii, and Yi (2001) for vertical specialisation measures. Another popular measure of the GVC index is the ratio of value added to gross exports, or VAX ratio, proposed by Johnson and Noguera (2012).

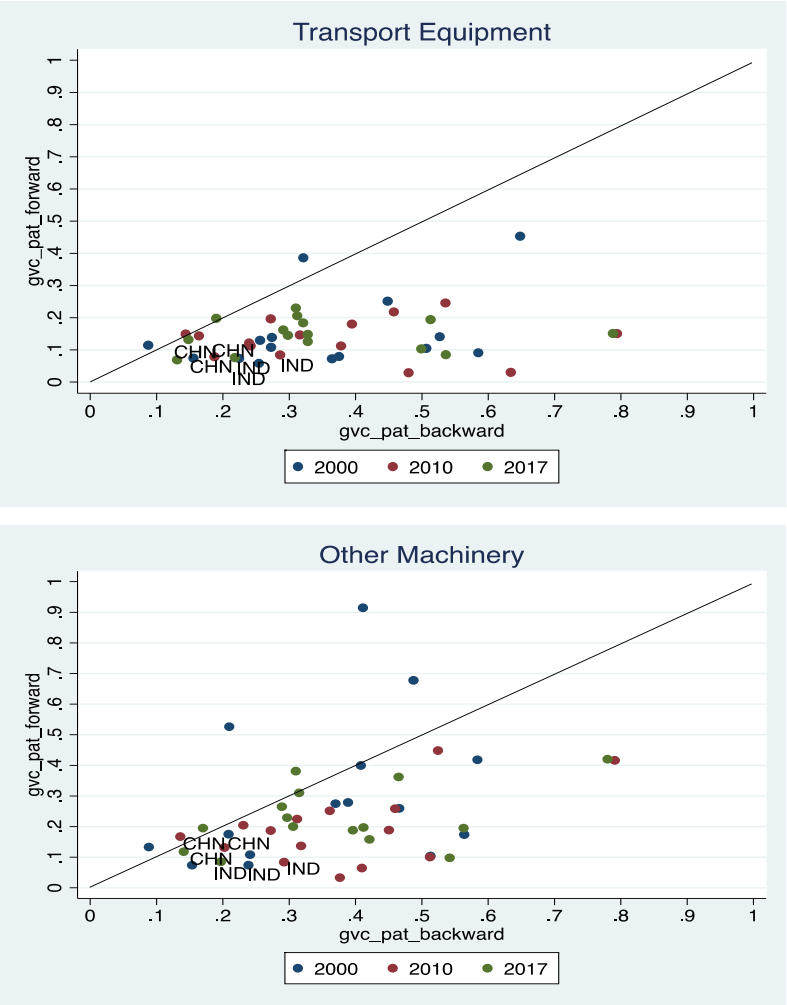
Figure 3 shows the forward linkage-based GVC index and the backward linkage-based GVC index in machinery sectors for ASEAN+6 countries[7] in 2000, 2010, and 2017.[8] Three machinery sectors – electric and optical equipment, transport equipment, and other machinery – are presented separately. We obtain several interesting findings. First, cross-border transactions in IPNs, in terms of both forward and backward linkages, are active in machinery sectors, particularly in the electrical and optical equipment sector. In the previous section, we discussed active machinery transactions based on international trade statistics. The similar results based on the value-added statistics here confirm how active machinery IPNs are in the ASEAN+6 area.

Figure 3: GVC Participation Indices for ASEAN+6 Countries



[7] ASEAN+6 refers to the 10 ASEAN Member States plus Australia, China, India, Japan, the Republic of Korea (henceforth, Korea), and New Zealand.

[8] These GVC indices allow us to distinguish simple and complex (twice or more times of cross-border transactions) GVCs. The GVC index in Figure 3 is the total GVC index, i.e. the sum of the simple and complex GVC indices. See Figures A2 (a) and A2 (b) in the Appendix for simple GVC and complex GVC indices, respectively.



CHN = China, IND = India.
Note: gvc_pat_forward and gvc_pat_backward denote a forward linkage-based GVC index and a backward linkage-based GVC index, respectively.
Source: Authors, using the UIBE GVC index database (WTO, n.d.; UIBE, n.d.).

Second, both backward and forward linkages are low for India, and the forward linkage is very weak. This suggests that India is not yet significantly involved in machinery IPNs and that it imports intermediate goods mostly for domestic production. Since India has a large domestic market, the portion of domestic consumption can be large. Compared with China, which also has a large domestic market, however, India has lower indices – particularly in terms of the forward linkage. This implies that India still has significant room to become involved in machinery IPNs in the ASEAN+6 area.

Third, in the electrical and optical equipment sector, not only simple cross-border transactions but also twice or more times of cross-border transactions (transactions across borders multiple times) in IPNs are active in terms of both

forward and backward linkages (Figure A2). This suggests that many countries are actively engaged in upstream/downstream production activities in this sector.

Fourth, unlike the electrical and optical equipment sector, the forward linkage index tends to be lower than the backward linkage index for the transport equipment sector (Figure 3). In particular, the complex index is quite low for the forward linkage while it is not as low for the backward linkage in many cases (Figure A2). This indicates that a large portion of cross-border transactions, particularly twice or more times of cross-border transactions, are likely to be downstream production activities in GVCs in this sector.

4. Gravity Exercise to Show a Gap Between Potential and Actual Machinery Trade

This section evaluates the current status of India's machinery trade and explores the possibility of expanding the machinery trade and participation in IPNs by calculating a gap between potential and actual machinery trade values. We first provide an explanation of the method and data to estimate the potential machinery trade. We then present the estimation results and discuss India's potential.

4.1. Method and data

This section calculates the gap between the potential and actual machinery trade values to evaluate the current status and explore the room for India's expanding machinery trade and its participation in East Asian IPNs. To this end, we take two steps. First, we estimate a gravity model, using some variables of economic size and geographical conditions. Then, we predict the trade values to regard them as the potential levels and compare them with actual values. As a first step, the gravity model is estimated conventionally (Yotov et al., 2016). The estimating equation is as follows:

$$X_{ij} = \exp\left(\boldsymbol{x_i\beta_1} + \boldsymbol{x_j\beta_2} + \boldsymbol{d_{ij}\beta_3}\right) * u_{ij}.$$

X_{ij} denotes the export value of machinery goods from country i to country j in 2019. $\boldsymbol{x_i}$ denotes a vector of explanatory variables specific to export country i. We include the log of GDP, log of population, World Trade Organization (WTO) dummy, and log of remoteness index in the set of explanatory variables. The remoteness index of country i is defined as

$$Remoteness_i = \left(\sum_{j \neq i} GDP_j / distance_{ij} \right)^{-1}.$$

$\boldsymbol{x_j}$ denotes a vector of explanatory variables specific to import country j, and we use the same set of variables for importers as exporters. $\boldsymbol{d_{ij}}$ denotes a vector of bilateral variables of the country pair i and j; and includes bilateral distance, a contiguity dummy, a common language dummy, a common religion dummy, and a common coloniser dummy. u_{ij} is disturbance.[9] Following Santos Silva and Tenreyro (2006), we estimate the above equation by Poisson Pseudo Maximum Likelihood (PPML).

The second step is to construct predicted values, using estimated coefficients obtained at the first step and explanatory variables, and to calculate a ratio of the actual value to the predicted value. The variation in unobservable bilateral factors is excluded from the predicted values. We can, therefore, interpret them as 'appropriate' values for their economic sizes and geographical conditions. Those predicted values are potentially practicable and expected to be realised by improving the investment climate, reducing trade costs, and participating in IPNs. If the ratio of actual value to predicted value is small, it suggests that the flow is currently inactive and has significant room to be expanded.

[9] We estimate a naïve form of gravity equation (Head and Mayer, 2014). They recommended the use of country fixed effects to take multilateral resistance terms into account. In addition, Yotov et al. (2016) recommended the use of panel data and country-pair fixed effects to account for unobservable time-invariant trade costs. These approaches are important to estimate the gravity model for causal inference. When the exporter fixed effects, for example, are included, the sum of predicted export values for each country must be fixed to actual total export values by adding up constraints (Fally, 2015). As we would like to keep the sum of predicted values for each country unconstrained, we estimate the gravity model using country-specific variables like GDP instead of the country fixed effects.

The source of the trade data is the BACI database of the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII), which provides disaggregated data on bilateral trade flows for more than 5,000 products and 200 countries.[10] We aggregate the trade values of HS84-92 to calculate the trade values in machinery products in 2019. The explanatory variables are taken from the Gravity database of the CEPII.[11] Our sample comprises 176 countries and regions (Table A1 in the Appendix).

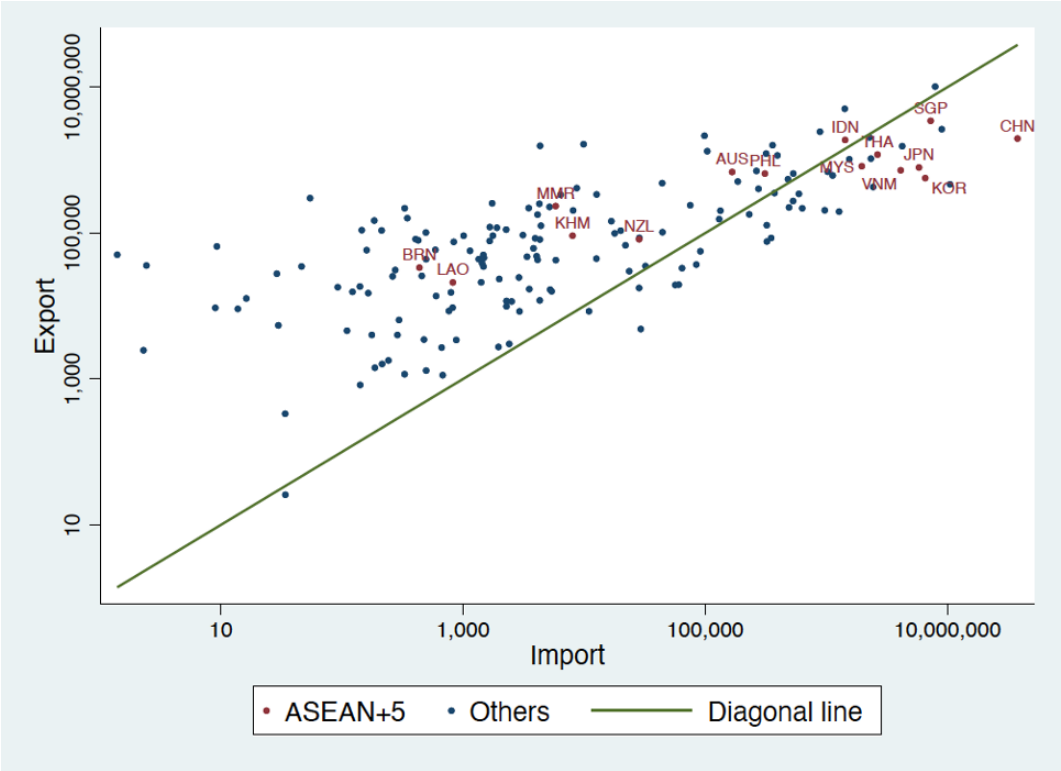
4.2. Estimation results

Before showing the estimation results, we briefly look at India's actual machinery trade with each trading partner in 2019. In Figure 4, each dot shows the export and import values of India on log scales; red dots with abbreviated country names denote East Asian countries or the ASEAN+5 countries, and blue dots denote other countries. The figure clearly shows that India's main trading partners for machinery products are East Asian countries. For instance, the export value to Singapore is the third largest while the import value from China is the largest for India. Export and import values with other East Asian countries are also relatively large, except for the lowest-income countries in ASEAN (Cambodia, the Lao PDR, and Myanmar) as well as resource-rich countries (Brunei, Australia, and New Zealand). Thus, India seems closely connected to East Asian countries, at least from this figure. We, however, need to take into consideration some determinants of international trade such as economic size and geographical conditions. China and Japan, for example, are the second and third largest economies in the world and are also geographically close to India. It is natural that the trade values with these countries are larger than with other countries. We, therefore, rely on the gravity model estimation to control these basis conditions and evaluate the connectivity of India with East Asian countries more formally.

[10] The BACI database was constructed by Gaulier and Zignago (2010).
[11] The Gravity database was constructed by Head, Mayer, and Ries (2010) and Head and Mayer (2014).

Figure 4: Machinery Trade Values of India, 2019

($'000)



AUS = Australia, BRN = Brunei, CHN = China, IDN = Indonesia, JPN = Japan, KHM = Cambodia, KOR = Rep. of Korea, LAO = Lao PDR, MMR = Myanmar, MYS = Malaysia, NZL = New Zealand, PHL = Philippines, SGP = Singapore, THA = Thailand, VNM = Viet Nam.
Notes: ASEAN+5 refers to the ASEAN+6 countries other than India. Each dot shows the actual export and import values of India on log scales with each trading partner; red dots denote ASEAN+5 countries and blue dots denote other countries.
Source: Authors' calculation, using the BACI database of CEPII, constructed by Gaulier and Zignago (2010).

Table 1 reports the actual and predicted values in machinery trade for specific country/region pairs and the corresponding ratios of actual to predicted values. The predicted values are estimated by the gravity model with PPML. In this table, North America refers to Canada, Mexico, and the United States; European Union (EU) refers to the EU27 countries plus the United Kingdom; and 'Rest of the world' refers to 129 countries/regions, including Hong Kong, Macao, and Taiwan. The predicted figures for regions are calculated by summing up the member countries' predicted figures.

Table 1: Actual and Predicted Machinery Trade Values

($ million)

Exporter/Importer	Value	China	Japan	Rep. of Korea	ASEAN	Australia and New Zealand	India	North America	EU	Rest of the world	Total
China	Actual (A)		75,889	58,515	185,277	7,708	37,831	296,546	249,381	453,641	1,364,788
	Predicted (B)		118,680	65,970	99,018	9,470	50,039	164,000	176,914	269,221	953,314
	(A)/(B) (%)		*64*	*89*	*187*	*81*	*76*	*181*	*141*	*169*	*143*
Japan	Actual (A)	81,031		20,245	69,323	2,582	5,817	126,272	64,669	100,855	470,795
	Predicted (B)	74,330		22,411	33,052	3,931	7,175	64,155	60,352	73,462	338,867
	(A)/(B) (%)	*109*		*90*	*210*	*66*	*81*	*197*	*107*	*137*	*139*
Rep. of Korea	Actual (A)	84,679	9,161		57,551	744	6,551	66,569	36,682	73,791	335,729
	Predicted (B)	45,878	24,885		12,437	1,308	2,995	21,767	22,319	31,843	163,431
	(A)/(B) (%)	*185*	*37*		*463*	*57*	*219*	*306*	*164*	*232*	*205*
ASEAN	Actual (A)	83,854	39,820	24,735	136,460	6,022	17,900	120,853	86,668	142,355	658,665
	Predicted (B)	47,598	23,820	8,243	58,999	4,892	9,707	46,692	48,955	71,459	320,365
	(A)/(B) (%)	*176*	*167*	*300*	*231*	*123*	*184*	*259*	*177*	*199*	*206*
Australia and New Zealand	Actual (A)	114	57	66	1,257	11	45	1,215	930	7,511	11,206
	Predicted (B)	2,695	1,767	531	3,280	301	540	7,922	5,267	11,588	33,892
	(A)/(B) (%)	*4*	*3*	*12*	*38*	*4*	*8*	*15*	*18*	*65*	*33*
India	Actual (A)	1,971	792	566	9,792	228		13,273	11,687	27,064	65,373
	Predicted (B)	56,211	12,868	4,837	24,038	2,043		32,894	45,697	82,874	261,462
	(A)/(B) (%)	*4*	*6*	*12*	*41*	*11*		*40*	*26*	*33*	*25*
North America	Actual (A)	63,106	28,621	23,338	60,223	5,678	9,328	617,230	161,678	160,388	1,129,588
	Predicted (B)	105,300	65,765	20,097	68,387	16,002	18,797	592,094	291,395	301,899	1,479,736
	(A)/(B) (%)	*60*	*44*	*116*	*88*	*35*	*50*	*104*	*55*	*53*	*76*
EU	Actual (A)	144,804	37,144	30,659	85,761	8,846	24,562	286,773	1,517,637	407,268	2,543,454
	Predicted (B)	122,564	66,877	22,265	75,116	11,858	27,957	318,792	1,298,462	518,489	2,462,379
	(A)/(B) (%)	*118*	*56*	*138*	*114*	*75*	*88*	*90*	*117*	*79*	*103*
Rest of the world	Actual (A)	91,718	22,495	16,332	62,403	6,811	21,034	92,016	177,557	185,161	675,527
	Predicted (B)	129,853	54,508	21,500	73,518	15,459	37,304	216,034	370,401	323,101	1,241,678
	(A)/(B) (%)	*71*	*41*	*76*	*85*	*44*	*56*	*43*	*48*	*57*	*54*
Total	**Actual (A)**	**551,277**	**213,978**	**174,456**	**668,046**	**38,631**	**123,069**	**1,620,747**	**2,306,888**	**1,558,033**	**7,255,125**
	Predicted (B)	**584,429**	**369,171**	**165,855**	**447,844**	**65,265**	**154,513**	**1,464,350**	**2,319,762**	**1,683,936**	**7,255,125**
	(A)/(B) (%)	***94***	***58***	***105***	***149***	***59***	***80***	***111***	***99***	***93***	***100***

Notes: 'Actual (A)' denotes the actual values of specific country/region pairs, 'Predicted (B)' denotes the corresponding predicted values, and '(A)/(B) (%)' denotes the ratio of actual to predicted values in percentage. North America refers to Canada, Mexico, and the United States; EU refers to the 27 EU member countries and the United Kingdom; and 'Rest of the world' refers to 129 countries and regions, including Hong Kong, Macao, and Taiwan. The predicted values for regions are calculated by totalling the member countries' predicted values.

Source: Authors' calculation, using the BACI database of CEPII, constructed by Gaulier and Zignago (2010), and the Gravity database of CEPII, constructed by Head, Mayer, and Ries (2010) and Head and Mayer (2014).

We can see three important points from the table. First, East Asian countries have larger actual export values than predicted, except Australia and New Zealand. ASEAN apparently places itself at the centre of Factory Asia. China is a massive exporter of machinery, but exports particularly to non-East-Asian countries. On the other hand, ASEAN has the highest actual predicted ratios for both exports (206%) and imports (149%) to and from the world amongst the countries/regions listed in this table. Furthermore, ASEAN has both exports and imports actively with China, Japan, and the Republic of Korea (henceforth, Korea). Considering its economic size and other factors, ASEAN's commitment to IPNs as a hub is particularly strong.

Second, the total machinery export value of India is much smaller than the predicted value. Only one quarter of the potential value is realised as actual machinery exports. India has significant room to expand its machinery exports. In contrast, India's import value of machinery products is not so small, compared with the predicted value. Some 80% of the predicted value is realised as the total import value. This implies that India is largely conducting import-substituting operations in machinery industries.

Third, in addition to the total export value, India's export value to China is extremely small given their economic size and geographical distance. While India's export value to China is predicted as $56 billion, the actual export value is only $2 billion. Thus, the ratio of actual value to predicted value is only 4% for India's exports to China. The export values to some of the East Asian countries are also far smaller than the predicted values, e.g. the ratio is 6% for Japan and 12% for Korea. In other words, India has a large untapped opportunity to expand its machinery exports to these East Asian countries.

In sum, although India seems closely connected to East Asian countries, trade values with those countries are large simply because of their large economic size and geographical proximity to India. While India's import values are at a fair level, India's export values to East Asian countries, particularly to China, are quite small given their basic conditions such as economic size and geographical distance. This indicates that India has not yet closely connected to East Asian countries and has huge room to expand machinery trade by participating in IPNs in East Asia.

5. International Competitiveness of Services Trade

This section looks at the international competitiveness of India's services trade from the perspective of IPNs. The WTO defines (i) ICT services[12] and (ii) other business services[13] as a proxy of intermediate commercial services.[14] Thus, we analyse not only patterns of trade in total services but also trade in these two services subsectors. Figure 5 presents the values of services exports and imports for the ASEAN+6 countries with the world in 2005, 2010, and 2019. Services trade by the ASEAN+6 countries expanded rapidly from 2005 to 2019. ICT trade, notably ICT exports, grew outstandingly, reflecting a drastic expansion in China and India. While total services trade by the ASEAN+6 in 2019 is about three times as large as that of 2005 for both exports and imports in nominal terms, their ICT services trade is close to six times the 2005 levels. Other business services trade, particularly the corresponding exports, expanded more than threefold. India still has the largest values in 2019 amongst the ASEAN+6 in these intermediate commercial services sectors, followed by China. These figures suggest how these intermediate commercial services, particularly those exports, became active in India, compared with the rest of the services sectors.

[12] ICT services consist of (i) telecommunications services, which encompass the broadcast or transmission of sound, images, data, or other information by telephone, telex, telegram, radio and television cable transmission, radio and television satellite, electronic mail, facsimile, and so forth, including business network services, teleconferencing, and support services; (ii) computer services, consisting of hardware- and software-related services and data-processing services; and (iii) information services, including news agency services, such as the provision of news, photographs, and feature articles to the media as well as database services.

[13] Other business services comprise (i) research and development (R&D) services, which consist of services associated with basic and applied research, and experimental development of new products and processes; (ii) professional and management consulting services, including (a) legal services, accounting, management consulting, managerial services, and public relations services; and (b) advertising, market research, and public opinion polling services; and (iii) technical, trade-related, and other business services, including (a) architectural, engineering, and other technical services; (b) waste treatment and depollution, agricultural, and mining services; (c) operating leasing services; (d) trade-related services; and (e) other business services not included elsewhere (n.i.e.).

[14] See WTO (2019) for the definition of intermediate commercial services.

Figure 5: Values of Services Trade by ASEAN+6 Countries

($ million)

AUS = Australia, BRN = Brunei, CHN = China, HKG = Hong Kong, IDN = Indonesia, IND = India, JPN = Japan, KHM = Cambodia, KOR = Rep. of Korea, LAO = Lao PDR, MMR = Myanmar, MYS = Malaysia, NZL = New Zealand, PHL = Philippines, SGP = Singapore, THA = Thailand, VNM = Viet Nam.

Notes: The country abbreviation on the bar is shown only for some countries. EX and IM denote exports and imports, respectively. Hong Kong is included here, although 'ASEAN+6' in this paper does not include it.

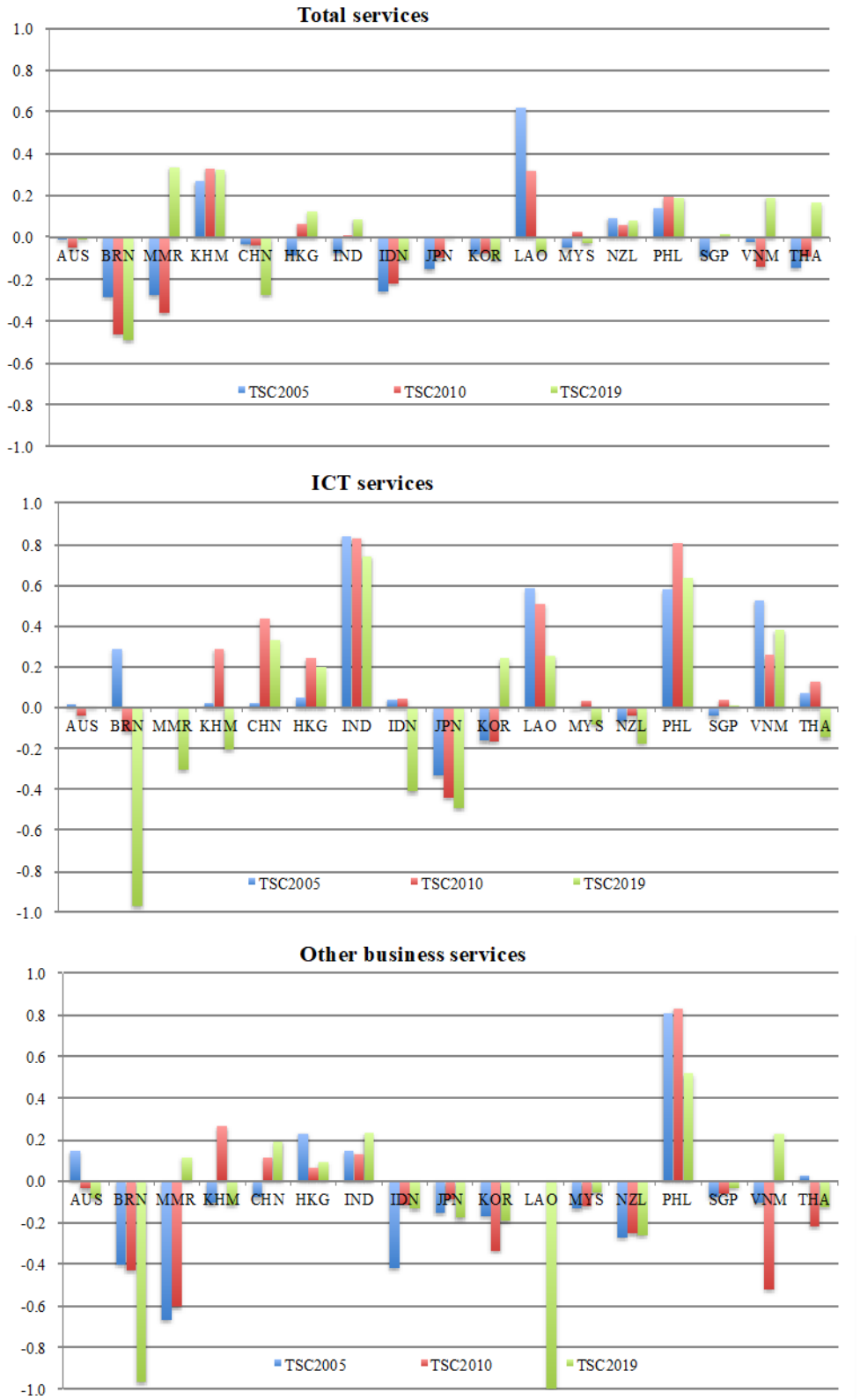
Source: Authors' calculation, using data from WTO Data portal (n.d.), https://data.wto.org/.

Figure 6 displays the trade specialisation coefficients (TSCs) for the ASEAN+6 countries in 2005, 2010, and 2019. The TSC for sector *i* is calculated for each country as follows:

$$TSC_i = (EX_i - IM_i)/(EX_i + IM_i)$$

where EX and IM express exports and imports, respectively. The TSC for the ICT sector is the highest for India amongst the ASEAN+6 countries, followed by the Philippines. Combined with India's 40% share of ICT services exports by ASEAN+6 countries in 2019, the high TSC for India suggests that it has competitiveness in this sector. Although the TSC for the Philippines is also high in this sector, trade size per se is still small (Figure 5). On the other hand, the TSC for the other business services sector is by far the highest for the Philippines amongst the ASEAN+6 countries, followed by India with the second largest TSC in 2019 in this sector. As the TSC for total services for India is small, India has competitiveness in these intermediate commercial services sectors – not services sectors in general.

Figure 6: TSC for Services Trade for the ASEAN+6 Countries



TSC = trade specialisation coefficient.
Note: See Figure 5 for country abbreviations and note for Hong Kong.
Source: Authors' calculation, using data from WTO Data portal (n.d.), https://data.wto.org/.

ICT services will continue to be a strength for India. With disruptive innovation, ICT services have explosively expanded their scope of business in the past decade. Several unicorn companies have emerged, and the third unbundling has steadily progressed. One of the frontiers of ICT services is the digital transformation of traditional industries, including manufacturing. The rejuvenation of traditional industries would generate a massive number of jobs for multi-layered people in value chains. Such potential demand seems to exist in India and East Asia. India's ICT services could play a key role in upgrading and transforming East Asian ICT into a new dimension.

6. Required Policy Package

How to participate in IPNs has already been well documented in detail (ERIA 2010, 2015; Kimura, 2018). To initiate fragmentation of production, ideas, in addition to goods, must become mobile by reducing service link costs (Jones and Kierzkowski, 1990) or communication costs (Baldwin, 2016). To meet this requirement, physical connectivity such as high-grade logistics infrastructure and institutional connectivity – including overall trade liberalisation and facilitation – should be enhanced. In addition, it is necessary in parallel to construct efficient industrial agglomeration in order to develop a thick layer of internal production networks in the open setting. To join Factory Asia, India still has a few bottlenecks in both physical and institutional connectivity. It was a pity that India walked away from the negotiations for the Regional Comprehensive Economic Partnership, as it could have been a trigger for India to be engaged in substantial policy reform. The current forum on the Supply Chain Resilience Initiative by Australia, India, and Japan may be developed as a starting point for India's entry to Factory Asia.[15]

To exploit the potential of the ICT services sector, the linkage with traditional industries, particularly manufacturing, will be important. India may accelerate poverty alleviation by creating a massive number of jobs for relatively poor people. Such development in ICT services would also expand the scope of economic collaboration with ASEAN and East Asia.

[15] See Governments of Australia, India, and Japan (2020).

References

Ando, M. (2006), 'Fragmentation and Vertical Intra-Industry Trade in East Asia', North American Journal of Economics and Finance, 17(3), pp.257–81.

Ando, M. and F. Kimura (2005), 'The Formation of International Production and Distribution Networks in East Asia, in T. Ito and A.K. Rose (eds.) International Trade in East Asia, NBER-East Asia Seminar on Economics, Volume 14. Chicago: University of Chicago Press, pp.177–213.

APO (2020), APO Productivity Databook 2020. Tokyo: Asian Productivity Organization.

Baldwin, R. (2016), The Great Convergence: Information Technology and the New Globalization. Cambridge, MA and London: The Belknap Press of Harvard University Press.

ERIA (2010), The Comprehensive Asia Development Plan. Jakarta: Economic Research Institute for ASEAN and East Asia.

ERIA (2015), The Comprehensive Asian Development Plan 2.0 (CADP 2.0). Jakarta: Economic Research Institute for ASEAN and East Asia.

Fally, T. (2015), 'Structural Gravity and Fixed Effects', Journal of International Economics, 97(1), pp.76–85.

Gaulier, G. and S. Zignago (2010), 'BACI: International Trade Database at the Product-Level. The 1994-2007 Version', CEPII Working Paper, No. 2010-23. Paris: Centre d'Etudes Prospectives et d'Informations Internationales.

Governments of Australia, India, and Japan (2020), 'Australia–India–Japan Economic Ministers' Joint Statement on Supply Chain Resilience', 1 September. https://www.meti.go.jp/press/2020/09/20200901008/20200901008-1.pdf (accessed June 30, 2021).

Head, K. and T. Mayer (2014), 'Gravity Equations: Workhorse, Toolkit, and Cookbook', in G. Gopinath, E. Helpman, and K. Rogoff (eds.) Handbook of International Economics, Volume 4. Amsterdam: Elsevier B.V., pp.131–95.

Head, K., T. Mayer, and J. Ries (2010), 'The Erosion of Colonial Trade Linkages After Independence', Journal of International Economics, 81(1), pp.1–14.

Hummels, D., J. Ishii, and K.-M. Yi (2001), 'The Nature and Growth of Vertical Specialization in World Trade', Journal of International Economics, 54(1), pp.75–96.

Johnson, R.C. and G. Noguera (2012), 'Accounting for Intermediates: Production Sharing and Trade in Value Added', Journal of International Economics, 86(2), pp.224–36.

Jones, R.W. and H. Kierzkowski (1990), 'The Role of Services in Production and International Trade: A Theoretical Framework', in R.W. Jones and A.O. Krueger (eds.) The Political Economy of International Trade: Essays in Honor of Robert E. Baldwin. Oxford: Basil Blackwell, pp.31–48.

Kimura, F. (2018), 'Unbundling Regimes and Development Strategies in ASEAN: Old Issues and New Challenges', Journal of Southeast Asian Economies, 35(1), pp.13–21.

Kimura, F. and A. Obashi (2010), 'International Production Networks in Machinery Industries: Structure and Its Evolution', ERIA Discussion Paper Series, No. 09. Jakarta: Economic Research Institute for ASEAN and East Asia.

Santos Silva, J.M.C. and S. Tenreyro (2006), 'The Log of Gravity', Review of Economics and Statistics, 88(4), pp.641–58.

UIBE (n.d.), UIBE GVC Indicators. http://rigvc.uibe.edu.cn/english/D_E/database_database/index.htm (accessed 31 January 2021).

Wang, Z., S.-J. Wei, X. Yu, and K. Zhu (2017), 'Measures of Participation in Global Value Chains and Global Business Cycles', NBER Working Paper, No. 23222. Cambridge, MA: National Bureau of Economic Research.

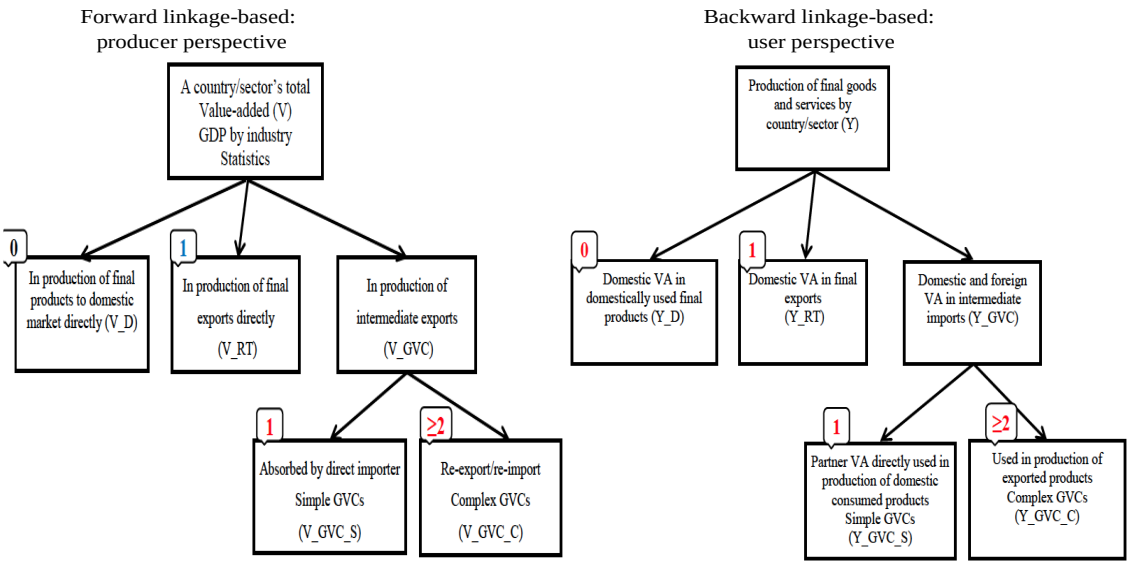
WTO (n.d.), Global Value Chains, GVC Indicator Database. https://www.wto.org/english/res_e/statis_e/miwi_e/miwi_e.htm (accessed 31 January 2021).

WTO (2019), 'WTO 'Trade in Value-Added and Global Value Chains' Profiles: Explanatory Notes'. https://www.wto.org/english/res_e/statis_e/miwi_e/explanatory_notes_e.pdf (accessed 31 January 2021).

Yotov, Y.V., R. Piermartini, J.-A. Monteiro, and M. Larch (2016), An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model. Geneva: World Trade Organization.

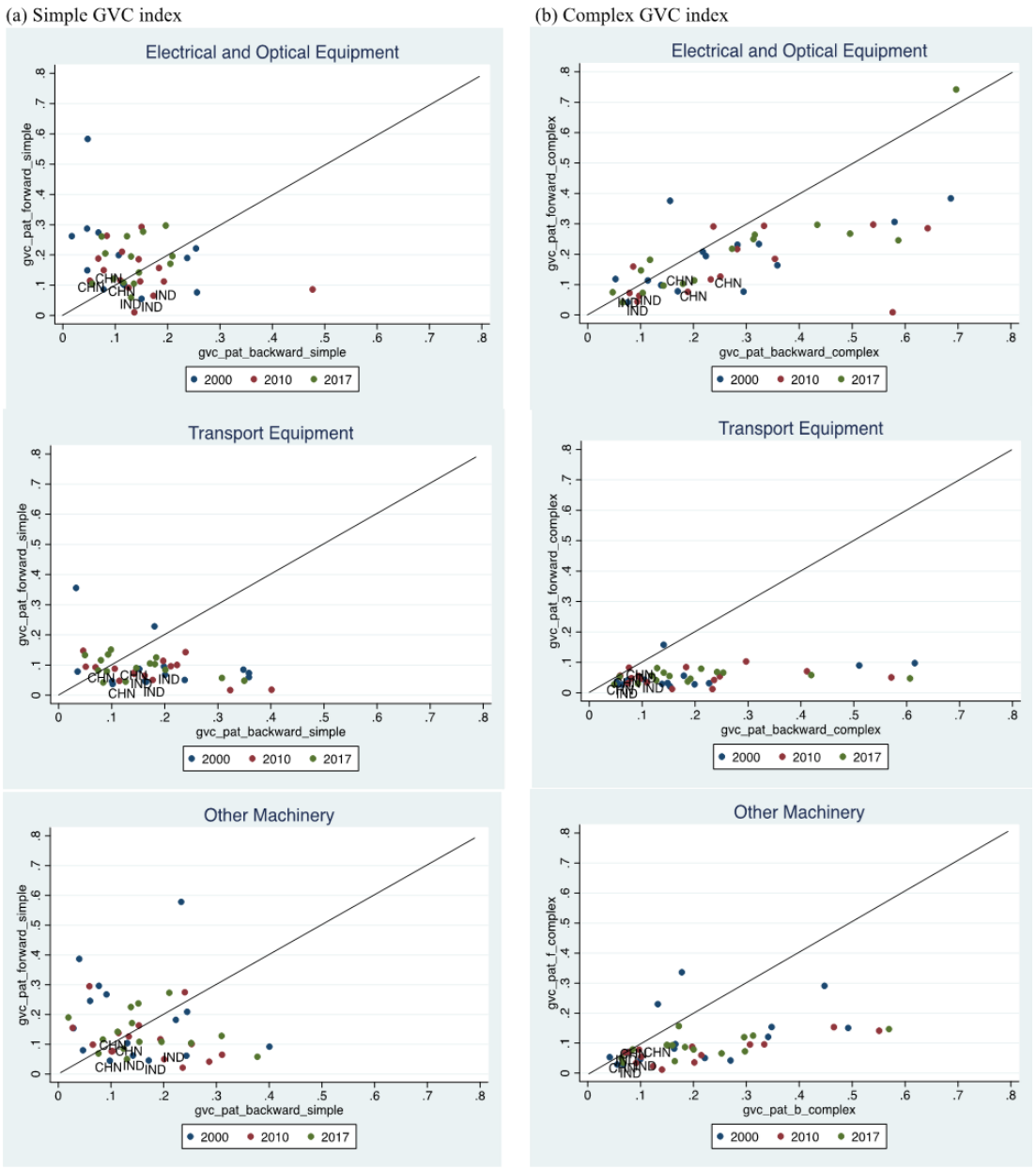
Appendix

Figure A1: GVC Indices – Concept



GDP = gross domestic product, VA = value added.
Source: Wang et al. (2017).

Figure A2: Simple and Complex GVC Indices for ASEAN+6 Countries



CHN = China, IND = India.
Note: gvc_pat_forward and gvc_pat_backward denote a forward linkage-based GVC index and a backward linkage-based GVC index, respectively.
Source: Authors, using UIBE GVC index database (WTO, n.d.; UIBE, n.d.).

Table A1: Country List for Gravity Exercise

Afghanistan	Cambodia	Gambia	Latvia	Pakistan	Sudan
Albania	Cameroon	Georgia	Lebanon	Panama	Suriname
Algeria	Canada	Germany	Lesotho	Papua New Guinea	Swaziland
Andorra	Central African Rep.	Ghana	Liberia	Paraguay	Sweden
Angola	Chad	Greece	Libya	Peru	Switzerland
Antigua and Barbuda	Chile	Grenada	Luxembourg	Philippines	Taiwan
Argentina	China	Guatemala	Macao	Poland	Tajikistan
Armenia	Colombia	Guinea	Macedonia	Portugal	Thailand
Australia	Comoros	Guinea-Bissau	Madagascar	Qatar	Togo
Austria	Congo	Guyana	Malawi	Rep. of Korea	Tonga
Azerbaijan	Costa Rica	Haiti	Malaysia	Rep. of Moldova	Trinidad and Tobago
Bahamas	Côte d'Ivoire	Honduras	Maldives	Romania	Tunisia
Bahrain	Croatia	Hong Kong	Mali	Russian Federation	Turkey
Bangladesh	Cyprus	Hungary	Malta	Rwanda	Uganda
Barbados	Czechia	Iceland	Mauritania	Saint Kitts and Nevis	Ukraine
Belarus	Dem. Rep. of the Congo	India	Mauritius	Saint Lucia	United Arab Emirates
Belgium	Denmark	Indonesia	Mexico	Saint Vincent and the Grenadines	United Kingdom
Belize	Djibouti	Iraq	Mongolia	Samoa	United States
Benin	Dominica	Ireland	Morocco	Sao Tome and Principe	United Rep. of Tanzania
Bermuda	Dominican Rep.	Israel	Mozambique	Saudi Arabia	Uruguay
Bhutan	Ecuador	Italy	Myanmar	Senegal	Uzbekistan
Bolivia	Egypt	Jamaica	Namibia	Seychelles	Vanuatu
Bosnia Herzegovina	El Salvador	Japan	Nepal	Sierra Leone	Viet Nam
Botswana	Equatorial Guinea	Jordan	Netherlands	Singapore	Yemen
Brazil	Estonia	Kazakhstan	New Zealand	Slovakia	Zambia
Brunei Darussalam	Ethiopia	Kenya	Nicaragua	Slovenia	Zimbabwe
Bulgaria	Fiji	Kiribati	Niger	Solomon Isds	
Burkina Faso	Finland	Kuwait	Nigeria	South Africa	
Burundi	France	Kyrgyzstan	Norway	Spain	
Cabo Verde	Gabon	Lao PDR	Oman	Sri Lanka	

Source*:* Authors, using the BACI database of CEPII, constructed by Gaulier and Zignago (2010), and the Gravity database of CEPII, constructed by Head, Mayer, and Ries (2010) and Head and Mayer (2014).

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