Int. J Sup. Chain. Mgt Vol. 5, No. 2, June 2016

Intra-Industry Trade in Manufacturing Supply Chain: An Empirical Assessment of the India-ASEAN Case

Anupama D. Masali[#1]

[#]*Faculty of Economics, Chulalongkorn University*
Phayathai Road, Bangkok 10330, Thailand
[1]anupama.chula@gmail.com

***Abstract*— The purpose of the paper is to examine the patterns and to assess the determinants of India's intra-industry trade (IIT) in manufacturing supply chain with six major ASEAN economies from the inception of formal economic arrangements in 1993 to the year 2013. ASEAN-India trade in manufacturing supply chain increased considerably over the past two decades but studies examining the nature and the patterns are few. The paper contributes to the literature as the first to exclusively examine the hitherto uninvestigated India's IIT in manufacturing supply chain with individual ASEAN countries over two decades. The paper provides a novel examination by juxtaposing six country pairs within a frame, thus enabling an emphasis on the contrasts across six diverse ASEAN countries in the manufacturing supply chain. The findings have significant implications for the current inadequate 'top-down' approach and the missing complementary 'bottom-up' approach to deepen ASEAN-India regional economic integration.**

***Keywords*—** *Intra-Industry Trade, Regional Economic Integration, ASEAN-India economic relations, International Trade in Manufacturing supply chain*

1. Introduction

Bilateral trade in manufacturing supply chain between India and the Association of South East Asian Nations (here after ASEAN) increased at a compound annual growth rate (CAGR) of 16% and 19% during 1993-2003 and 2003-2013, respectively. Whereas the CAGR registered with the world was 11% and 17% [1]. However, the growth patterns and the determinants of India's share of intra-industry trade (IIT) in manufacturing supply chain with ASEAN remain uninvestigated in previous research works. Intra-industry trade refers to simultaneous export and import of similar goods. IIT in differentiated products takes place as a result of consumers' preferences for variety and increasing economies of scale [2].

The main purpose of this paper is to contribute an empirical assessment of India's IIT in manufacturing supply chain with ASEAN over two decades (1993-2013). The twin objectives of the paper are to examine the patterns and to assess the determinants of India's IIT in the manufacturing supply chain with the six economies of ASEAN, viz., Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam.

Prior to 1990, ASEAN-India trade flows did not have the same dynamism as now. Other than differing political orientations, most of the South Asian countries in general and India in particular restricted their imports due to shortage of foreign exchange. However, during the early 1990s, the partnership received institutional stimulus as ASEAN and India actively sought mutual cooperation driven by the growing importance of ASEAN in the region, initiation of market reforms in India and her adoption of Look East Policy. As a result of subsequent bilateral Comprehensive Economic Partnership Agreements (CEPAs) with individual ASEAN member countries and the signing of ASEAN-India Free Trade Agreement (FTA) in goods in 2009, trade flows increased manifold.

It is important from an economic and policy point of view to have an empirical understanding of the evolving India-ASEAN IIT. The questions this paper attempts to answer are: What is the nature of this significant growth in India-ASEAN merchandise trade over the past two decades? What change, if any, can be observed in product composition? Did the technology gap shrink? What was the impact of the ASEAN-India Free Trade Agreement (AIFTA) on IIT?

The broader findings of the paper are: (a) No set patterns in India's IIT in manufacturing supply chain with individual ASEAN countries; (b) There are significant variations in the observed patterns and determinants of India's bilateral IIT with the six ASEAN member countries and they vary among the four product groups.

The paper is structured as follows. Section 2 reviews the previous works on IIT in India and ASEAN countries. Section 3 examines the patterns in IIT in manufacturing sectors 5, 6, 7 and 8 (SITC Revision 3) by constructing Grubel Lloyd Index (GLI) at 3-digit level. The

determinants of India's IIT with six ASEAN countries are obtained using Random-Effects Generalized Least Squares (GLS) regression, separately. Section 4 presents and discusses the empirical results, and conclusion in Section 5.

2. India-ASEAN Intra-Industry Trade in Manufacturing Supply Chain

Previous empirical literature on bilateral trade between India and ASEAN countries are sparse. Among them, studies particularly addressing bilateral IIT are nil. This paper is the first to exclusively examine the hitherto uninvestigated India's IIT in manufacturing supply chain with individual ASEAN countries over two decades. The analysis juxtaposes six country pairs within a single frame, enabling an emphasis on the contrasts across six diverse ASEAN countries.

The growth trends in India's IIT with ASEAN countries are to be analyzed with reference to the key characteristics. First, India and ASEAN countries, excluding Singapore, are developing economies. Second, the scale and size of manufacturing vary among these countries. Third, the ASEAN-India economic integration is not deep enough, in that, the coverage of policies and institutions is limited.

Findings from earlier literature on evidences of increasing IIT in India's manufacturing can be summarized as follows. First, India's IIT in manufacturing supply chain is more with developed countries than with developing countries [3], [4]. These empirical evidences are, thus, inconsistent with the observation that IIT in developing countries is more with each other than with the less similar industrial countries [5]. Second, trade liberalization in 1991 led to higher levels of IIT in India [6]. Third, the dynamic effects of free trade agreements (FTAs) include actuation of economies of scale and variety in the long-term [7]. Accordingly, Ref. [8] shows that under Regional Comprehensive Economic Partnership (RCEP), a proposed ASEAN+6 FTA under negotiation, can stimulate and sustain IIT in the region, specifically with India's active presence and deeper integration in the region. Fourth, IIT intensity is higher in manufacturing industries with greater scope for product differentiation [9].

The manufacturing supply chain can be defined as a system of related firms in the manufacturing process from the raw materials in manufacturing to the point of consumption. Manufacturing supply chain in India has been studied mainly at a firm level. However, there are very few studies that have used a supply chain perspective in the framework.

Most of bilateral IIT between China and India in 2003 occurred in manufacturing sectors 5, 6 and 7 [10]. In 2003, among 22 Asian countries highest levels of IIT was observed in ASEAN and high-income countries of East Asia, followed by China and India, particularly in manufacturing sectors [11]. Evidences show that IIT and regional economic integration mutually reinforce each other. For instance, IIT promoted economic integration within East Asia and among ASEAN countries [12] [13]. The ASEAN Free Trade Area (AFTA) promoted IIT across all categories of goods [14].

3. Methodology and Data

3.1. The Patterns of India's IIT in Manufacturing supply chain with ASEAN, 1993-2013

The paper focuses on analysis of IIT in manufacturing supply chain. Accordingly, product groups 5, 6, 7 and 8 covering manufactured goods as per Standard International Trade Classification (SITC) Revision 3 (see Table 1) are considered.

Table 1. Major categories of the SITC Revision 3 classification system

Product Group	Product Description
0	Food and live animals
1	Beverages and tobacco
2	Crude materials, inedible, except fuels
3	Mineral fuels, lubricants and related materials
4	Animals and vegetables oils, fats and waxes
5	Chemicals and related products
6	Manufactured goods classified chiefly by materials
7	Machinery and transport equipment
8	Miscellaneous manufactured articles
9	Commodities and transactions not classified elsewhere in the SITC

The paper uses Grubel-Lloyd Index (GLI) to measure the level and analyze the patterns of India's IIT in manufacturing supply chain with six ASEAN countries over two decades (1993-2013), treating each country pair separately. The GLI is given by

$$GLI_k = 1 - \frac{|X_k - M_k|}{X_k + M_k} \qquad (1)$$

where X_k = exports of product group k and M_k = imports of product group k. The value of GLI lies between 0 (pure inter-industry trade) and 1 (pure intra-industry trade).

Since the GLI is prone to aggregation bias [15], the extensively used 3-digit level aggregation is chosen to analyze the patterns of IIT. At 3 digit level, product group

5 – Chemicals and related products, 6 - Manufactured goods classified chiefly by materials, 7 – Machinery and transport equipment and 8 – Miscellaneous manufactured articles, consist of 33, 52, 50 and 31 groups, respectively, adding up to altogether 166 groups. The six country pairs are India-Indonesia (IDN), India-Malaysia (MYS), India-Philippines (PHL), India-Singapore (SGP), India-Thailand (THA) and India-Vietnam (VNM). Each pair consists of 3486 observations. Thus, the dataset includes a total of 20,916 observations over 21 years.

3.2. The determinants of India's IIT in Manufacturing supply chain with ASEAN, 1993-2013

To assess the determinants of India's IIT in manufacturing supply chain with the six ASEAN countries individually, the following random-effects generalized least squares (GLS) regression model is estimated for each of the six country pairs, separately, as shown below.

$$IIT_{India,IDN,t} = \beta_0 + \beta_1 DGDP + \beta_2 DPCGDP + \beta_3 R\&D + \beta_4 SMT + \beta_5 AIFTA + u_i \quad (2)$$

$$IIT_{India,MYS,t} = \beta_0 + \beta_1 DGDP + \beta_2 DPCGDP + \beta_3 R\&D + \beta_4 SMT + \beta_5 AIFTA + u_i \quad (3)$$

$$IIT_{India,PHL,t} = \beta_0 + \beta_1 DGDP + \beta_2 DPCGDP + \beta_3 R\&D + \beta_4 SMT + \beta_5 AIFTA + u_i \quad (4)$$

$$IIT_{India,SGP,t} = \beta_0 + \beta_1 DGDP + \beta_2 DPCGDP + \beta_3 R\&D + \beta_4 SMT + \beta_5 AIFTA + u_i \quad (5)$$

$$IIT_{India,THA,t} = \beta_0 + \beta_1 DGDP + \beta_2 DPCGDP + \beta_3 R\&D + \beta_4 SMT + \beta_5 AIFTA + u_i \quad (6)$$

$$IIT_{India,VNM,t} = \beta_0 + \beta_1 DGDP + \beta_2 DPCGDP + \beta_3 R\&D + \beta_4 SMT + \beta_5 AIFTA + u_i \quad (7)$$

where the dependent variable is India's IIT in manufacturing supply chain. IDN, MYS, PHL, SGP, THA and VNM stand for Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam respectively. The time period 1993-2013 is represented by 't'.

The independent variables DGDP and DPCGDP stand for difference in GDP and per capita GDP. DGDP and DPCGDP are the proxy for market size and level of economic development, respectively, of India and the ASEAN member country under consideration. The more similar the trading partners are in terms of market size and level of economic development, the higher the extent of IIT between them [16]. Larger markets, with potential for economies of scale, enable production of differentiated goods. Whereas similar level of economic development facilitate and create demand for differentiated goods, driven by consumers' love of variety [17] and the individual preferences for particular variety [18].

The difference in GDP and PCGDP is captured by the relative inequality measure [19] as shown below:

$$Ineq\_GDP = 1 + \frac{[wln(w)+(1-w)\,ln(1-w)]}{ln2} \quad (8)$$

Where

$$w = GDP_i/GDP_i + GDP_j$$

i and j are India and ASEAN member country under consideration.

Similarly,

$$Ineq\_PCGDP = 1 + \frac{[wln(w)+(1-w)\,ln(1-w)]}{ln2} \quad (9)$$

where

$$w = PCGDP_i/PCGDP_i + PCGDP_j$$

i and j are India and ASEAN member country under consideration.

The value of the measure lies between 0 and 1. The relative inequality increasing as the value tends towards 1. Thus, a negative relationship is expected between the dependent variable IIT and the independent variables inequality in GDP (DGDP) and per capita GDP (DPCGDP).

Technological similarity among trading partners leads to higher levels of IIT [20]. Technological similarity in manufacturing shows in the level of R&D intensity. R&D intensity controls degree of product differentiation. In the regression specification, total trade in high technology products is used as a proxy for R&D intensity, thus, a positive relationship is expected between the two. The extent of IIT is relatively higher in manufactured product categories [21].

The scope for product differentiation is relatively higher in manufactured goods. Thus, the share of merchandise trade is used as an independent variable and a positive association with IIT is expected. ASEAN-India Free Trade Agreement (AIFTA) is used as a proxy for regional integration. As regional integration facilitates successive reduction in tariff and non-tariff barriers, the trade costs tend to be low. Thus, AIFTA is expected to be positively associated with IIT.

To treat the problems of heteroscedasticity and autocorrelation in the panel data, the paper uses both the fixed effects and the random-effects models. The coefficients obtained in each of the models show negligible difference (see Appendix A for results of fixed-

effects model). Due to the efficiency of random-effects model over fixed-effects model, the former is chosen to estimate the determinants of IIT.

The panel data for 21 years (1993-2013) is used for the regression. In that, 166 product groups as cross-section units at 3-digit level of SITC Rev. 3 are studied over a 21 time-series units. The export and import data to calculate GLI, share of merchandise trade, share of high-technology products are obtained from UN Comtrade database via World Integrated Trade Solutions (WITS). The description of high technology products follows [22]. The data for GDP, per capita GDP are obtained from UNCTAD database. AIFTA is represented by dummies, that is, 0 for years prior to AIFTA (1993-2009) and 1 for years since AIFTA came into effect (2009-2013).

4. Results

4.1. Trade Patterns in Manufacturing supply chain

Figure 1 shows patterns in India's IIT with six ASEAN countries in four product groups under manufacturing sector (SITC Revision 3). The four product groups, at 2-digit level, are described as follows: Product Code 5 – Chemicals and related products such as organic and inorganic chemicals, dyeing, tanning and coloring materials, medicinal and pharmaceutical products, essentials oils, plastics; Product Code 6 - Manufactured goods classified chiefly by materials such as leather, rubber, cork and wood manufacturing supply chain, paper and related articles, textiles, non-metallic minerals, iron and steel, non-ferrous metals; Product Code 7 – Machinery and transport equipment such as power generating, metalworking, general industrial and electrical machinery, telecommunications and related equipment, road vehicles; Product Code 8 – Miscellaneous manufactured articles such as prefabricated buildings, furniture, travel goods, footwear, professional and scientific instruments, photographic apparatus among others.

An explanation of Figure 1 can be drawn from comparison of compound annual growth rate (CAGR) of India's average trade-weighted IIT with six ASEAN member countries between 1993-03 and 2003-13 as shown in Table 2. It can be observed (a) Product group 5: the CAGR decreased in case of all except MYS and VNM. (b) Product group 6: the CAGR decreased in case of all except IDN and VNM. (c) Product group 7: the CAGR decreased in case of all except MYS and SGP. (d) Product group 8: the CAGR decreased in case of all except PHL. The variation in growth patterns is inconsistent and idiosyncratic across six ASEAN member countries.

During 1993-2003 Indian exports of manufactured goods to ASEAN were dominated by resource based and intermediate goods, whereas, imports from ASEAN were dominated by capital goods. However, evidently, since 2003 the product composition has been changing with a considerable growth in India's export share of capital goods.

Table 2. Compound Annual Growth Rates (in %) of India's Average Trade-Weighted Intra-Industry Trade in Manufacturing supply chain with ASEAN, 1993-2013

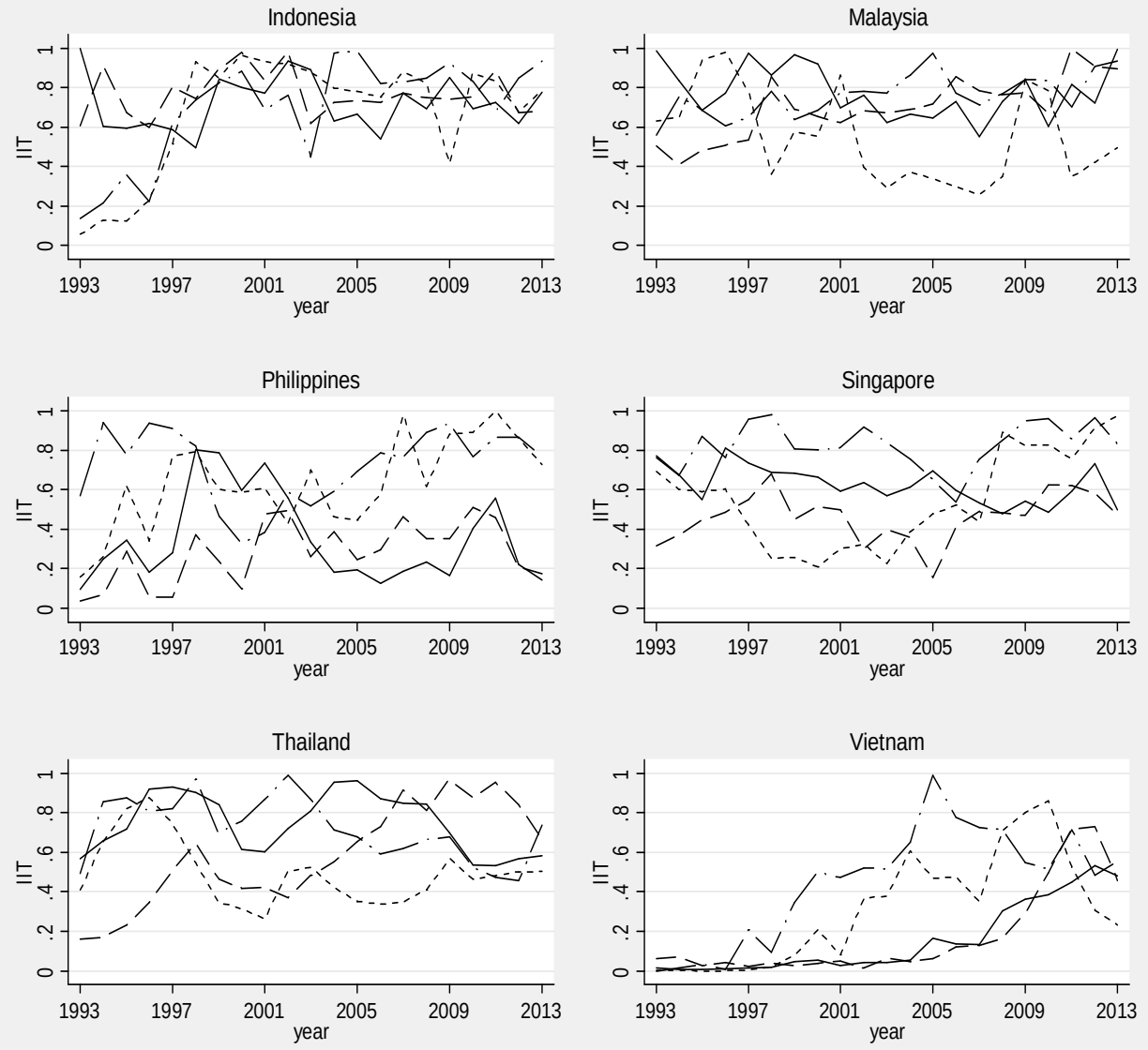
Prod. Code	IDN		MYS		PHL	
	1993-03	2003-13	1993-03	2003-13	1993-03	2003-13
5	(1.12)	(1.37)	(4.50)	4.80	13.36	(8.13)
6	0.19	0.95	2.94	2.88	22.24	(4.10)
7	31.84	(1.10)	(7.42)	5.43	16.15	0.41
8	12.54	7.61	3.30	1.93	(0.93)	4.06
	SGP		THA		VNM	
	1993-03	2003-13	1993-03	2003-13	1993-03	2003-13
5	(3.03)	(1.32)	3.60	(3.25)	10.85	27.37
6	2.31	1.70	11.64	3.25	0.16*	21.83
7	(10.62)	15.82	2.53	(0.40)	69.69*	(4.82)
8	0.94	(0.08)	5.79	(1.59)	50.97	0.68

Source: Author's calculations using data from the UN Comtrade via WITS; Note 1: *CAGRs are for 1994-03 and 1997-03 respectively; Note 2: "()" = Negative number; Note 3: Product Code 5 – Chemicals and related products; Product Code 6 - Manufactured goods classified chiefly by materials; Product Code 7 – Machinery and transport equipment; Product Code 8 – Miscellaneous manufactured articles.

For instance, in 2013, Indian exports were led by capital goods such as machinery and transport equipment in case of PHL (45.33%), SGP (54.37%) and IDN (33.87%). Whereas resource based goods such as leather, rubber, cork and wood, paper and related articles, textiles, non-metallic minerals, iron and steel, non-ferrous metals among others held a major share of Indian exports to MYS (36.71%), THA (55.60%) and VNM (52.90%). Indian imports, in 2013, from all six countries, as usual, were dominated by machinery and transport equipment. The shares of IDN, MYS, PHL, SGP, THA and VNM stood at 35.72, 51.09, 79.65, 47.26, 48.34 and 77.24 percent, respectively.

These trends suggest that traditional trade pattern continues in product groups 5 – chemicals and related products and 6 - manufactured goods classified by materials. However, the visible increase in simultaneous exports and imports in product group 7 - machinery and transport equipment, thus, indicates a shift from trade driven by comparative advantage specialization to that of economies of scale, though at a slower rate.

Second, as the trading partners become technologically similar, IIT improves and vice-versa [23]. India's



Source: Author's calculations using data from the UN Comtrade via WITS.

Note 1: Product Code 5 – Chemicals and related products; Product Code 6 - Manufactured goods classified chiefly by materials; Product Code 7 – Machinery and transport equipment; Product Code 8 – Miscellaneous manufactured articles.

Figure 1. Patterns of India's Average Trade-Weighted Intra-Industry Trade in Manufactures with ASEAN, 1993-2013

technological standards differ from that of ASEAN member countries. The technological dissimilarity is implied by the share of medium and high-tech activities in manufacturing export since 1990 to 2012. In 2012, the share stood at 28, 31, 59, 73, 69, 60 and 44 percent for India, IDN, MYS, PHL, SGP, THA and VNM, respectively [24].

4.2. Determinants of the trade

Table 3 shows that the coefficient for relative GDP inequality index is, as expected, negative and significant in case of MYS, PHL and negative and insignificant in case of SGP. But it is positive and significant in case of THA, VNM and positive and insignificant in case of IDN. An explanation for positive and significant effect of relative inequality in GDP on India's IIT with THA and

VNM could be influenced by the exports and imports of third party countries, such as Japan and South Korea, which have considerable presence in India, Thailand and Vietnam and also are the key players in the Asian International Production Networks (IPNs). These countries having their production bases in ASEAN countries and hold a big market share in India, make use of the FTAs signed by India with other countries [25].

Table 3. Random-Effects GLS Regression Results for India's Intra-Industry Trade in Manufacturing supply chain with ASEAN, 1993-2013

	(1) IDN	(2) MYS	(3) PHL	(4) SGP	(5) THA	(6) VNM
DGDP	1.061	-6.539***	-4.480*	-3.267	7.237***	8.764***
	(0.65)	(-4.36)	(-2.53)	(-1.87)	(3.51)	(3.90)
DPCGDP	-1.214	-7.491***	-7.654***	-6.725*	6.784**	-30.32***
	(-0.62)	(-5.25)	(-3.43)	(-2.00)	(2.91)	(-5.14)
R&D Intensity	-7.22e-08	7.48e-08*	-0.000000503	-2.01e-08	-0.000000206	-0.000000533***
	(-1.10)	(2.53)	(-1.88)	(-0.88)	(-1.84)	(-4.64)
Mechandise Trade	5.01e-09	-3.50e-08***	0.000000116	-2.32e-09	-2.05e-08	0.000000226***
	(0.33)	(-3.85)	(1.36)	(-0.47)	(-1.55)	(4.62)
AIFTA Dummy	-0.00640	0.0310	0.0140	-0.00946	0.0000306	0.00000208
	(-0.22)	(1.48)	(0.52)	(-0.43)	(0.00)	(0.00)
Constant	0.223	6.566***	2.769**	7.428*	-3.628**	-5.625***
	(0.59)	(5.12)	(2.85)	(2.08)	(-2.92)	(-3.84)
Observations	3308	3401	3112	3431	3345	2875

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

The coefficient for relative per capita GDP inequality index is, as expected, negative in all cases except THA and significant in all cases except IDN. Over the past two decades relative inequality in India and ASEAN 6' per capita GDP has been converging at a varying degree. For instance, the inequality in per capita GDP between India and IDN, MYS, PHL, SGP, THA, VNM has been decreasing at a CAGR of -5.88, -1.29, -8.67, -0.33, -2.39, -7.18 percent respectively. However, positive effect of relative inequality in per capita GDP of India and THA could be due to the influence of trade share of third party countries.

The coefficient for R&D intensity, proxied by trade in high-technology products, is unexpectedly negative in all cases except MYS and insignificant in all cases except MYS and VNM. India's total trade in high technology products during 1993-04 with IDN, MYS, PHL, SGP, THA and VNM grew at a CAGR of 26, 34, 46, 26, 26 and 36 percent, respectively. However, during 2005-13 it declined to 18, 6, 7, 3, 17 and 48 percent respectively. Evidently, the sharp decline in all cases except VNM could have contributed to the idiosyncratic growth trends in IIT.

The coefficient for share of merchandise trade is, as expected, positive in case of IDN, SGP and VNM and negative in case of MYS, PHL and THA, whereas, it is significant only in case of MYS and VNM. The CAGR of India's total merchandise trade with IDN, MYS, PHL and SGP declined approximately by CAGR of -4.07, -8.02, -3.91, -4.80 percent from 1993-06 to 2007-13, whereas it in case of THA and VNM it increased by 0.30 and 7.33 percent respectively. India's highest declining growth rate with MYS and the highest increasing growth rate with VNM in merchandise trade during the past two decades (1993-2013) explain the resulting coefficients.

The coefficient for ASEAN-India Free Trade Agreement (AIFTA), a proxy for regional integration, as expected, is positive in case of MYS, PHL, SGP, VNM and negative in case of IDN and THA, however, it is insignificant in all cases. Since there will be a considerable time-lag between the signing of the FTA and realizing the benefits, it might be too early to see the impact on the bilateral IIT.

An explanation for the contrasts across six ASEAN countries lies in variations in the structures of these economies. India and ASEAN are expected to have higher bilateral IIT as IIT in developing countries is more with

each other than with the less similar industrial countries [26]. However, the structural dissimilarities in manufacturing and levels of economic development have largely favored comparative advantage driven specialization. For instance, the varying size distribution in manufacturing supply chain which influences demand for manufactured goods, skill formation, technology absorption etcetera [27] is likely to have shaped the nature of India's merchandise trade.

5. Conclusion

The analysis of India's IIT with six ASEAN member countries, conducted separately and comparatively, is important in understanding the contrasts in the intensity and nature of bilateral IIT in the manufacturing supply chain trade relationship between India and ASEAN countries.

The findings can be summarized as follows: (a) There is no set pattern in India's IIT in manufacturing supply chain with the six ASEAN member countries. (b) There are significant variations in the observed patterns and determinants of India's bilateral IIT with the six ASEAN member countries while they vary among the four product groups. The structural variations in manufacturing sectors and levels of economic development of these countries, explain the idiosyncratic nature of results.

The distinct patterns and determinants of IIT have significant implications for the regional economic integration policies and strategies. India-ASEAN regional economic integration has followed a top-down approach. Signing of the FTA in goods, 2009 and in services and investment, 2014, are major step towards reducing the bilateral trade costs. Yet, coverage of policies and institutions such as trade facilitation is critical for deeper integration.

Evidently, the manufacturing sectors of India and each of the ASEAN member countries under consideration are diverse in terms of type of size structure - equality, duality and skewness in size distributions of large, medium and small firms [28] and their capacity for technology absorption, competitiveness of product groups under manufacturing supply chain et cetera. Thus, the strategies towards regional economic integration should be consistent with structural diversities. The bottom-up approach, which is a key characteristic of East Asian economic integration, to regional integration can facilitate cooperation in the manufacturing supply chain over such structural diversities and complement the current top-down initiatives.

The limitations of the analysis are as follows. First, the study assesses IIT in manufacturing supply chain for six diverse country pairs, juxtaposing the findings in a single frame. Hence, it is beyond the scope of this paper to examine country-specific finer details. Second, the GLI is sensitive to level of product disaggregation. Thus, assessment of India's IIT with individual ASEAN member countries at higher levels of product disaggregation is likely to reveal more refined aspects of IIT. These are the possible directions for future research work. Moreover, due to the limitation of data availability, this research cannot assess the whole manufacturing supply chain but only intra industry. Hence, future research may attempt to collect primary data at the supply chain level to study the whole supply chain.

Acknowledgments

The author would like to thank Daniel Ray Lewis for his constructive comments and suggestions.

References

[1] Asia Regional Integration Center Database, Asian Development Bank. Doi: https://aric.adb.org/macroindicators

[2] Helpman, E., and Krugman P. R., Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy. Cambridge MA: MIT Press, 1985.

[3] Das, G.G., Growth and Pattern of Intra-Industry Trade in Manufactures in India's Overall Trade: A Quantitative Analaysis. Indian Journal of Economics & Business, Vol. 4, No. 1, 161-184, 2005.

[4] Veeramani, C., Intra-Industry Trade of India: Trends and Country-Specific Factors. Weltwirtschaftliches Archiv/Review of World Economics, 138, 509–533. Doi: http://www.esocialsciences.org/Download/repecDownload.aspx?. 2002.

[5] Havrylyshyn, O. and Civan E., Intra-Industry Trade among Developing Countries. Journal of Development Economics, Vol. 18, Nos. 2-3, 253-271, 1985.

[6] Veeramani, C., Trade Liberalisation, Multinational Involvement, and Intra-Industry Trade: Panel Data Analysis of India's Manufacturing Sector. Working Paper no. 143. Indian Council for Research on International Economic Relations. Doi: http://www.etsg.org/ETSG2004/Papers/veeramani.pdf, 2004.

[7] Plummer, M. G., Choeng, D. and Hamanaka, S., Methodology for Impact Assessment of Free Trade Agreements, Asian Development Bank, ISBN: 978-92-9092-197-4 (print), 2001.

[8] Das, R.U. and Dubey J. D., Mechanics of Intra-Industry Trade and FTA Implications for India in RCEP. RIS Discussion Paper # 190, March 2014. Doi: http://dx.doi.org/10.2139/ssrn.2430185, 2014.

[9] Veeramani, C., Industry-Specific Determinants of Intra-Industry Trade in India. Indian Economic Review New Series, Vol. 42, No. 2,211-229. Doi: http://www.jstor.org/stable/29793889 , 2007.

[10] Wu, Y. and Z. Zhou, Changing bilateral trade between China and India. Journal of Asian Economics 17 (2006) 509-518. Doi: http://dx.doi.org/10.1016/j.asieco.2006.04.007, 2006.

[11] Sawyer, W.C., Sprinkle, R.L. and Tochkov, K., Patterns and determinants of intra-industry trade in Asia. Journal of Asian Economics 21(2010) 485-493. Doi: http://dx.doi.org/10.1016/j.asieco.2010.04.001, 2010.

[12] Cortinhas, C., Intra-industry trade and business cycles in ASEAN. Applied Economics, 39, 893–902, 2007.

[13] Sohn, C.-H., & Zhang, Z., How intra-industry trade is related to income difference and foreign direct investment in East Asia. Asian Economic Papers, 4, 143–156. Doi: http://www.mitpressjournals.org/doi/pdfplus/10.1162/asep.2005.4.3.143 , 2005.

[14] Sawyer, W.C., Sprinkle, R.L. and Tochkov, K., Patterns and determinants of intra-industry trade in Asia. Journal of Asian Economics 21(2010) 485-493. Doi: http://dx.doi.org/10.1016/j.asieco.2010.04.001, 2010.

[15] Greenaway, D. and Milner C., Intra-Industry trade: current perspectives and unresolved issues. Weltwirtschaftliches Archiv 123: 39-57, 1987.

[16] Helpman, E., and Krugman P. R., Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy. Cambridge MA: MIT Press, 1985.

[17] Krugman, P.R., Increasing returns, monopolistic competition, and international trade. Journal of International Economics 9: 469-479, 1979.

[18] Lancaster K., Intra-Industry trade under perfect monopolistic competition. Journal of International Economics 10: 151-175, 1980.

[19] Balassa, B., Intra-Industry trade among exporters of manufactured goods. In D. Greenaway and P.K.M. Thakaran (eds.), Imperfect Competition and International Trade: The Policy Aspects of Intra-Industry Trade. Sussex: Wheatsheaf, 1986b.

[20] Broll, U. and Gilroy B. M., Intra-Industry Trade and Differences in Technology. Scottish Journal of Political Economy, Vol. 35, No. 4, 398-403. doi: https://mpra.ub.uni-muenchen.de/18710/1/MPRA_paper_18710.pdf, 1988.

[21] OECD, Intra-Industry and Intra-Firm Trade and the Internationalisation of Production. OECD Economic Outlook 71. Doi: https://www.tilburguniversity.edu/static/uvtpresentation/.../oecd-paper.pd , 2002.

[22] Hatzichronlgou, T., Revision of the High-Technology Sector and Product Classification. OECD Science, Technology and Industry Working Papers, 1997/02. OECD Publishing. Doi: http://dx.doi.org/10.1787/134337307632, 1997.

[23] Broll, U. and Gilroy B. M., Intra-Industry Trade and Differences in Technology. Scottish Journal of Political Economy, Vol. 35, No. 4, 398-403. doi: https://mpra.ub.uni-muenchen.de/18710/1/MPRA_paper_18710.pdf, 1988.

[24] United Nations Industrial Development Organisation (UNIDO) Database, 2011.

[25] Economist, India: A new dawn for Japanese Companies. An Economist Intelligence Unit Report. Doi: www.economistinsights.com/.../india-new-dawn-japanese-companies, 2015.

[26] Havrylyshyn, O. and Civan E., Intra-Industry Trade among Developing Countries. Journal of Development Economics, Vol. 18, Nos. 2-3, 253-271, 1985.
[27] Majumdar, D. and Sarkar, S., Manufacturing Enterprise in Asia. NY: Routledge Publications, 2013.
[28] Majumdar, D. and Sarkar, S., Manufacturing Enterprise in Asia. NY: Routledge Publications, 2013.

Appendix A

Table 4. Fixed-Effects Regression Results for India's Intra-Industry Trade in Manufacturing supply chain with ASEAN, 1993-2013

	(1) IDN	(2) MYS	(3) PHL	(4) SGP	(5) THA	(6) VNM
DGDP	1.002	-6.640***	-4.567**	-3.296	7.171***	8.785***
	(0.62)	(-4.44)	(-2.59)	(-1.89)	(3.49)	(3.93)
DPCGDP	-1.306	-7.589***	-7.799***	-6.769*	6.704**	-30.64***
	(-0.67)	(-5.33)	(-3.51)	(-2.01)	(2.89)	(-5.21)
R&D Intensity	-7.31e-08	7.55e-08*	-0.000000513	-2.03e-08	-0.000000205	-0.000000538***
	(-1.12)	(2.56)	(-1.93)	(-0.89)	(-1.84)	(-4.70)
Mechandise Trade	5.58e-09	-3.53e-08***	0.000000121	-2.24e-09	-1.99e-08	0.000000229***
	(0.37)	(-3.89)	(1.43)	(-0.46)	(-1.50)	(4.71)
AIFTA Dummy	-0.00613	0.0314	0.0138	-0.00951	-0.00156	0.000504
	(-0.22)	(1.50)	(0.51)	(-0.43)	(-0.06)	(0.02)
Constant	0.247	6.658***	2.830**	7.481*	-3.580**	-5.630***
	(0.66)	(5.20)	(2.93)	(2.10)	(-2.89)	(-3.86)
Observations	3308	3401	3112	3431	3345	2875

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001