Intra-Industry Trade in Manufactured Goods: A Case of India

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Abstract

Since the second world war, it was observed that trade between two countries could not be explained entirely by the classical and neoclassical models of trade that emphasised inter-industry trade. It was found that trade between countries was increasingly dominated by intra-industry trade (IIT), where countries exchanged products that fell in the same category. In this paper, we try to determine the extent of IIT between India and its top fifteen trading patterns. Unlike other papers, we do not simply calculate aggregate IIT for all merchandise trade. Instead, we focus on manufactured products and divide them into ten categories based on their technological content. Our analysis reveals that while India's IIT has increased in recent years, it is not the dominant form of trade between India and its most important partners. When we look at the factors that determine IIT, we find that India's comparative advantage and trade agreements play a positive and significant role in increasing IIT. Lastly, an analysis of the category Medium Technology Manufactures - Process reveals that this sector has potential for higher IIT and gains from it if India can enhance its efficiency and increase its size.

Keywords: Intra-industry trade, Technological content, Trade Partners

JEL Codes: F12, F14, F15

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Section 1: Introduction

For a long time, trade between any two countries was explained by the Ricardian/Heckscher-Ohlin (HO) models, which theorised trade to be driven by differences in technology or factor endowment. The classical and neo-classical models emphasised inter-industry trade, where each country would specialise in the production of a particular commodity (the assumption here was that all processes required for the production of a commodity would be performed in the country) and would then exchange it with its trading partner. However, in the post-war period, it was observed that trade between economies was no longer the cheese for wine type as believed by theorists. Instead, the exchange between commodities comprised of goods that belonged to the same category. This pattern of exchange was termed as intra-industry trade (Balassa, 1966).

Initial research in intra-industry trade (IIT) focussed on the trading patterns of developed economies. Economists such as Verdoorn (1960) and Balassa (1963) observed the changes in patterns of trade in European countries after the formation of Benelux and the European Economic Community (EEC). They found that developed countries showed an increasing proportion of intra-industry rather than inter-industry trade. This pattern was repeatedly observed in most developed countries.

The same pattern, however, was not observed in developing countries. Few researchers found evidence of IIT between developing countries and between developed and developing countries. The notion that developing countries primarily engaged in inter-industry trade stemmed from two beliefs: the inability of developing countries to exploit economies of scale and the significant differences in factor endowment between countries, especially in the North and the South, constrained IIT. Despite such beliefs, some economists showed the presence of IIT in trade in manufactures between developing countries (Balassa 1979). IIT was found to be high between developing countries and between developed and developing countries. This paper found that regional integration in the form of trade blocs and bilateral agreements played an essential role in increasing IIT. Moreover, in recent years, there have been a large number of studies that show theoretically and empirically the existence of IIT between developing countries and their trading partners (Manrique 1987; Globerman, 1992)

This paper explores the nature of trade between one of the largest developing countries, India, and its 15 most significant trading partners - Bangladesh, Belgium, China, Germany, Hong Kong, Italy, Malaysia, Nepal, Netherlands, Saudi Arabia, Singapore, United Arab Emirates, United Kingdom, United States and Vietnam. These countries were chosen because over half of India's trade is accounted for by them. The objective is to identify the factors that drive IIT in India. However, unlike the other studies in the area, we do not simply calculate IIT for all manufacturing products. Instead, we stick to merchandise trade in chemicals and manufacturing products, and we categorise these products into groups based on their technological content. The categorisation of these products is done using the Lall Classification, which classifies products into ten separate groups. We

conduct this exercise to understand better the type of goods in which India exhibits higher IIT and the factors that influence IIT in different categories.

The paper is structured as follows. In section 2, we look at the literature on IIT, focusing on studies done in the Indian context. In section 3, we describe the methodology adopted for empirical analysis. Next, in section 4, we provide a background for India's trade, specifically IIT. In sections 5 and 6, we delve into the empirical analysis and the discussion of the results. Section 7 concludes the paper.

Section 2: Literature Review

Beginning with Verdoorn (1960), several studies found that countries increasingly exhibited specialisation within the same category of goods being traded (Balassa, 1963; Kojima, 1964; Grubel, 1967); this pattern of trade was termed intra-industry trade (Balassa, 1963). These findings were contrary to traditional theories of trade, which predicted that countries would specialise in different goods (depending on their comparative advantage or factor endowments) and trade with each other to enjoy gains from trade. Even before Verdoorn (1960), Leontief (1936) had indicated that the HO theorem failed to explain the trade pattern of countries with similar factor endowments. The advent of studies on IIT further extended support to his point. The book by Grubel and Lloyd, "Intra-Industry trade", published in 1975, dealt with aggregation and measurement of IIT and provided additional impetus to studies in this field.

The initial studies on IIT were largely empirical with little theoretical backing, which was iin the beginning provided by Krugman (1979). Krugman (1979) shows that trade in similar but different commodities between countries was induced by two factors, economies of scale in production and consumer's love for variety, which also gave rise to gains from trade (GFT) from IIT. Subsequent studies by him found that as countries become similar in their endowment, IIT between them increases (Krugman, 1981). Linder (1961) had put forth a similar hypothesis which suggested that similarity in demand patterns would increase the volume of reciprocal trade between economies in differentiated goods. Lancaster (1980), too, argues that countries with the same factor endowments would exhibit pure IIT. As the extent of similarity between endowments reduces, IIT would reduce. Helpman (1981) measured similarity as an absolute difference in income between countries and showed the negative correlation between similarity and bilateral IIT.

Since Krugman, theoretical and empirical work has tried to determine factors other than similarity (in factor endowment or incomes) that influence IIT. Factors such as the size of the economies (Helpman, 1987), regional integration (Balassa, 1979), comparative advantage in production were also said to play an essential role, as were gravity variables such as distance between the economies (Helpman, 1987).

Given this background of literature on IIT, we now turn to the literature on India's pattern of trade. Several studies have repeatedly examined the presence of IIT between India and its trading partners, the distinctiveness of the patterns and the determining factors.

First and foremost, trade liberalisation has proved to be an essential factor in increasing IIT. Veeramani (2002) showed that trade liberalisation in India since the 1990s has been biased towards IIT. He argues that this increase in IIT is a manifestation of resource re-allocation within industries. Similarly, Burange and Chaddha (2008) found that reducing trade barriers and efficient allocation of resources gave rise to specialisation within unique varieties of goods and hence increased IIT. A recent paper by Aggarwal and Chakraborty (2019) finds that multilateral reforms and trade liberalisation have enhanced India's IIT at aggregate and sectoral levels.

Coming to the impact of free trade agreements, the evidence so far unilaterally dictates that FTAs and RTAs have enhanced IIT in India. Aggarwal and Chakraborty (2019), Das and Dubey (2014) find that India's signing of FTAs and bilateral agreements with trade partners have been instrumental in driving IIT. Varma and Ramakrishnan (2014) show that South Asian Free Trade Area (SAFTA) and agreements with Association of South East Asian Nations (ASEAN) members have not only influenced manufacturing IIT but has also increased the extent of IIT in agri-food products. The studies argue that further integration will help in sustaining such trade flows. Next, studies have tried to examine whether the rising IIT results from an increase in exports or imports. Veeramani (2002) shows that rising exports by India have contributed to the increase in IIT. In an examination of the Indian textile industry, Bhadouria and Verma (2012) show that IIT in textiles has gone down since the start of the 21st century due to increased net exports. On the other hand, Bagchi (2017) found that it is the rise in imports that has been responsible for rising IIT.

Examining the more traditional factors driving IIT, such as similarity and factor endowment, the literature shows interesting results. According to the theory on IIT, India's IIT should be higher with other developing countries due to similarity in income and factor endowments. However, Veeramani (2002) and Srivastava and Medury (2011) find that India has a higher proportion of IIT with developed economies, i.e., highly dissimilar economies. They attribute this finding to a higher share of vertical IIT in India's trade.

Lastly, factors such as distance, India's increasing income and economic size, efficiency, relative comparative advantage (RCA) are also said to play a positive and significant role (Srivastava and Medhury, 2011; Bagchi, 2017, Aggarwal and Chakraborty, 2019). An increase in income and size of the economy increase the demand for products giving rise to IIT, whereas RCA indicates efficiencies in production which influences the supply of products.

Section 3: Methodology

In this paper, we aim to study the patterns of IIT between India and its top 15 trading partners. These 15 partners are Bangladesh, Belgium, China, Germany, Hong Kong, Italy, Malaysia, Nepal, Netherlands, Saudi Arabia, Singapore, United Arab Emirates, United

Kingdom, United States and Vietnam. We calculate IIT between India and its partner countries using the Grubel-Llyod Index. The formula used is as follows

$$IIT_j = \frac{\sum_i (X_i^j + M_i^j) - \sum_i |X_i^j - M_i^j|}{\sum_i (X_i^j + M_i^j)}$$

Where i represents the industries at the three digit level from groups 5 to 8 in SITC Rev 3, and j is the partner country.

In the formula, $|X_i^j - M_i^j|$ measures the inter-industry trade in each industry, which is then removed from the total trade, $(X_i^j + M_i^j)$ between the economies. Thus, what we are left with is the intra-industry trade in the industry. The economy-wise measure of IIT is then obtained by averaging each industry measure across the n industries. The weights used are the relative shares of industry exports and imports. The most essential feature of the measure is that it was derived by matching the value of exports and imports in each industry and then averaging these measures (Llyod, 2002). Studies have shown that the index is an appropriate measure in studies that aim to explain comparative advantage, specialisation and predict patterns of trade. However, there are arguments that this index is downward biased since it does not adjust for aggregate trade imbalances, which tend to be large, mainly when applied to bilateral flows (Grubel and Llyod, 1975). Despite this shortcoming, the index remains a popular measure of IIT used in studies.

The data for imports and exports for the study was collected from World Integrated Trade Solution (WITS). Unlike other studies that have looked at the manufacturing sector or specific sectors of an economy, we focus on the products from Standard International Trade Classification, Revision 3 (SITC Rev. 3.) groups 5 to 8. Group 5 consists of Chemicals, Groups 6 and 8 comprise all manufactured goods, whereas Group 7 is made up of machinery and transport equipment. Groups 0 to 4 are ignored since they represent natural resource-based, primary products (such as live animals, ores, milk products) in which IIT depends on the resource endowment of countries rather than the ability to develop and expand manufacturing and production capacity.

Additionally, to better understand India's trade pattern, we divide these products into ten technological groups. The categories are Primary Products, Resource-based Manufactures (RBM): Agro, RBM: Other, Low Technology Manufactures (LTM): Textile, Garments and Footwear, LTM: Other Products, Medium Technology Manufactures (MTM): Automotive, MTM: Process, MTM: Engineering, High Technology Manufactures (HTM): Electronic and Electrical (E&E) and HTM: Other. The categorisation of products into the groups was provided by Sanjay Lall and is often known as the Lall classification. The Lall classification is applied at the third digit of SITC Rev. 3.

By dividing products into these categories and analysing the categories individually, we can determine the differences in which factors influence the trade patterns in each type of product and thus have specific policy recommendations for them. The technological classification has been used to provide a deeper insight into the sophistication level of India's manufacturing which in turn indicates its knowledge base and skill level. For instance, higher IIT in high technological products with high income countries would

indicate a similarity in the production processes between India and technologically advanced countries. This would imply that India has a deep knowledge base. On the other hand, higher IIT in low technology products would imply that India is largely dependent on labour-intensive, low skill products and has the potential to acquire knowledge and move into the production of more sophisticated products.

The time period chosen for the analysis is 1988 to 2015. This time-period captures the pre- and post-liberalisation periods, as well as the period during which India began entering into regional trade agreements and started experiencing their repercussions .

Section 4: Background Statistics

In table 1, we show some details of India's trade. We find that India's trade with the world has grown quite rapidly. The growth in exports and imports has been close to or over ten per cent in each period. When we look at the share of India's top 15 trading partners in exports and imports, we find that over half of India's exports are destined for these locations. Similarly, over 40 per cent of India's imports originate in these countries.[3] An interesting trend here is that after the global financial crisis of 2008 the share of India's exports to these countries has declined, whereas India's imports from these same countries have increased. When we focus only on groups 5 to 8, we find the same growth patterns. However, the share of the top 15 countries in these commodities is much higher. Over 60 per cent of total trade in these commodities has been concentrated among India's top 15 trading partners in recent years.

Table 1: India's Trade Statistics

	Year	**All Products**		**Groups 5 to 8**	
		Exports	Imports	Exports	Imports
Trade with World (US$ Millions)	1988	13,815	19,350	9,832	11,542
	1995	31,649	36,592	23,343	20,555
	2005	100,352	140,861	72,538	69,734
	2015	264,381	390,744	187,543	198,250
Compound Annual Growth Rate (Per cent)	1988-1995	12.6	9.5	13.1	8.6
	1995-2005	12.2	14.4	12.0	13.0
	2005-2015	10.2	10.7	10.0	11.0
Share of the 15 countries (Per cent)	1988	41.1	38.8	45.1	34.5
	1995	56.6	43.8	61.1	49.8
	2005	64.0	36.3	64.0	60.8
	2015	58.9	46.6	60.2	66.3

Source: WITS and Author's calculations using data from WITS (Accessed on 19 December, 2020)

Of the 15 countries in consideration, India has trade agreements (either directly or through a more comprehensive group agreement) with five of them, Bangladesh, Nepal,

[3] Crude oil forms a large part of these imports.

Singapore, Vietnam and Malaysia. All agreements were either signed or came into force after 2005.

As seen from table 2, IIT for the products under consideration has increased for all ten categories since 1990 except HTM E&E. India has the lowest IIT in LTM textiles whereas proportion of IIT is the highest in RBM Other followed by MTM Engineering. Primary products have seen the highest increase in IIT since 1990. We also find that no two groups follow the same pattern. Moreover, the increase in IIT has not been consistent. There have been sudden ups and downs, especially around crisis periods such as the Asian Financial Crisis and the Global Financial Crisis (GFC). For instance, IIT in MTM Automotive declined after the GFC while it increased in HTM other. Lastly, we see that out of the ten categories, IIT is the dominant form of trade for approximately 7 of them in 2015 compared to just 2 in 1990.

Table 2: India's IIT with the World (by technological groups)

Year	1990	2000	2010	2015	Change (1990-2015)
Primary	19.23	34.23	39.18	64.51	233.3
RBM Agro	23.02	49.26	58.69	55.58	141.4
RBM Other	72.23	75.82	82.23	82.3	13.9
LTM Textiles	9.85	9.39	22.04	22.68	130.3
LTM Other	42.11	57.94	53.38	57.75	37.1
MTM Process	20.98	57.08	44.63	47.62	127
MTM Engineering	39.96	52.26	61.01	70.02	75.2
MTM Auto	55.66	59.51	48.85	54.31	-2.4
HTM E&E	41.15	39.64	41.74	26.98	-31.4
HTM Other	31.68	42.62	46.25	48.18	52.1

Source: Author's calculations using data from WITS (Accessed on 19 December, 2020)

When we look at the mean IIT between India and its top 15 trading partners (table 3), we see that mean IIT has increased for all groups except MTM Auto. Just as in India's IIT with the world, the lowest IIT is in LTM Textiles while the highest is in RBM Other. We find that the average proportion of IIT with these 15 countries is much lower than India's IIT with the world. Moreover, these numbers indicate that a large proportion of India's trade with its major trading partners can still be categorised as inter-industry rather than intra-industry trade.

Table 3: Mean IIT between India and its top 15 trade partners

Group	1990	2000	2010	2015	Change (1990-2015)
Primary	13.2	22.2	27.3	28.8	118.2
RBM	16.4	28.1	23.7	23.8	45.1
RBM Other	12.0	34.1	46.3	39.4	228.3
LTM Textiles	8.7	13.4	13.5	17.7	103.4
LTM Other	18.0	34.2	29.2	27.9	55
MTM Auto	32.2	28.3	18.4	29.6	-8.1
MTM Engineer	9.3	26.8	30.7	33.1	255.9
MTM Process	11.1	26.6	27.5	28.8	159.5
HTM E&E	15.8	31.2	30.7	27.2	72.2
HTM Other	16.9	29.2	28.7	27.9	65.1

Source: Author's calculations using data from WITS (Accessed on 19 December, 2020)

Section 5: Empirical Analysis

The brief literature review in section 2 gave us an overview of the factors that theoretically and empirically affect IIT. This section uses these factors to determine their impact on India' IIT with its partners in different product categories based on their technology. For this purpose, we employ the gravity model wherein we model IIT as a function of the distance between the two countries and the sizes of the two economies. We expect the coefficient of the distance variable to be negative and the size of the two economies to be positive. Next, we include a measure of dissimilarity, measured as the absolute difference between per capita between the two economies. As per the theory, dissimilarity should have a negative coefficient. However, past literature on India indicates that dissimilarity may also be positive. We also include the variables that measure the RCA of India and its partner country in the industry. If RCA is positive, then IIT is trade creating and enhances efficiency. We expect it to be positive. Lastly, we include dummy variables that indicate whether India has an FTA with the partner country. We also allow for country fixed effects to capture country-specific factors that might be influencing IIT.

$$IIT_j^k = \alpha + +\beta_1 Dissimilarity + \beta_2 Log(GDP_j) + \beta_3 Log(GDP_{India}) + \beta_4 Distance + \beta_5 FTA + \beta_6 RCA_j^k + \beta_7 RCA_{India}^k + Country\ Fixed\ Effects + \varepsilon$$

Where j is the partner country, and k represents the technological grouping.

Table 4: Description of Variables

Variable	Definition/Formula	Expected coefficient
Dissimilarity	The absolute difference in the log of GDPPC of countries	Negative
Size of Partner Country's Economy	Log GDP of Partner Country	Positive
Size of India's Economy	Log GDP of India	Positive
Distance (in '000s km)	Distance between capitals of countries	Negative
FTA dummy	Takes the value 1 if the two countries have an FTA	Positive
RCA of Partner Country (in group k)	$RCA = \frac{Share\ of\ k\ in\ total\ exports\ of\ the\ country}{Share\ of\ k\ in\ total\ world\ exports}$	Positive
RCA of India (in group k)		Positive

We estimate this equation for each of the ten technological groupings (k). Since our dependent variable, IIT, measured using the Grubel-Llyod Index, is a continuous variable bounded between 0 and 1, we employ the fractional Probit response model for panel data using QMLE. This estimation technique, developed by Papke and Wooldridge (2008), has two merits over the traditional OLS regression estimates. First, if the dependent variable takes the value 0, we do not encounter the missing data problem. Second, we can estimate the marginal effects of the independent variables on the dependent variable. All variables were checked for stationarity and stationarized before running the regression.

The results from the regression analysis and the estimated marginal effects are shown in tables 5 and 6, respectively.

The estimates from our regression analysis show some interesting results. First, we find that income dissimilarity has a positive coefficient, however, it is not significant. Just like income similarity, the size of the economies, India's or the partner country's, does not influence IIT. The only exception to these is the group MTM Process. Another result that is contrary to theoretical predictions is the coefficient of the distance variable. The distance coefficient is consistently positive and significant for all groups. The impact of India's FTAs on IIT reveals mixed results. While the coefficient is significant for 6 out of the ten groups, the impact is harmful to two of them, MTM Process and HTM E&E. Coming to the impact of the partner's country RCA on IIT, and we find that in the cases where the coefficient is significant, it is mainly negative. On the other hand, India's RCA is significant for most groups, and it is positive for all of them except RBM other and LTM textiles.

Table 5: Regression Output

	Primary	RBM	RBM Other	LTM Textiles	LTM Other	MTM Auto	MTM Engineering	MTM Process	HTM E&E	HTM Other
Absolute difference in income	2.44	3.57	-0.6	0.45	2.34	3.02	1.98	**4.27****	-1.75	0.53
	(2.29)	(3.28)	(2.72)	(1.72)	(2.2)	(4.5)	(2.81)	**(1.96)**	(2.31)	(4.53)
Size of Partner country's Economy	-2.81	-4	-0.48	-2.15	-2.12	-5.22	-2.85	**-5.09****	1.21	-2.58
	(2.41)	(3.3)	(2.78)	(1.87)	(2.25)	(4.66)	(2.84)	**(2.02)**	(2.35)	(4.57)
Size of India's Economy	3.89	4.74	2.99	1.51	1.81	2.25	3.14	**6.08*****	0.74	-0.43
	(2.43)	(3.38)	(2.77)	(1.82)	(2.33)	(4.69)	(2.84)	(1.95)	(2.3)	(4.57)
Distance (in 1000 kms)	0.24	**0.36****	**0.45*****	**0.45*****	**0.61*****	**0.92*****	**0.76*****	0.04	**0.32****	**0.79*****
	(0.16)	(0.17)	(0.09)	(0.1)	(0.13)	(0.12)	(0.11)	(0.11)	(0.13)	(0.09)
FTA	**0.48*****	-0.02	0.12	**0.26*****	0.11	0.27	**0.19***	**-0.20*****	**-0.25****	**0.38*****
	(0.12)	(0.09)	(0.09)	(0.08)	(0.1)	(0.17)	(0.1)	(0.08)	(0.11)	(0.11)
RCA	**-0.01*****	-0.08	0.09	0.01	-0.1	**-0.48***	0.14	**0.31****	**-0.13***	0.01
	(0)	(0.22)	(0.14)	(0.01)	(0.13)	(0.29)	(0.14)	(0.12)	(0.07)	(0.03)
RCA-India	**0.30*****	**0.60***	**-0.24*****	**-0.12***	**0.38*****	0.02	**1.33*****	**0.80*****	**1.14*****	-0.16
	(0.1)	(0.32)	(0.04)	(0.07)	(0.07)	(0.3)	(0.15)	(0.13)	(0.35)	(0.14)
Constant	**-2.48*****	**-2.72*****	**-1.21*****	**-2.10*****	**-3.20*****	**-3.39*****	**-3.92*****	**-2.12*****	**-2.02*****	**-4.01*****
	(0.36)	(0.48)	(0.28)	(0.34)	(0.27)	(0.32)	(0.24)	(0.28)	(0.31)	(0.27)
BIC	460.76	481.86	526.84	351.3	504.22	465.19	483.33	498.34	496.55	474.9
N	344	352	352	352	352	336	352	352	352	352
Country Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
***** p<0.01, **p<0.05, *p<0.1** **Values in parentheses represent standard errors**										

Table 6: Marginal Effects calculated using the regression output

	Primary	RBM	RBM Other	LTM Textiles	LTM Other	MTM Auto	MTM Engineering	MTM Process	HTM E&E	HTM Other
Absolute difference in income	0.67	1.03	-0.19	0.08	0.72	0.87	0.57	**1.28****	-0.52	0.15
	(0.63)	(0.94)	(0.89)	(0.31)	(0.67)	(1.3)	(0.81)	**(0.59)**	(0.69)	(1.28)
Log (GDP-Partner)	-0.77	-1.15	-0.16	-0.38	-0.65	-1.51	-0.82	**-1.53****	0.36	-0.73
	(0.66)	(0.95)	(0.9)	(0.33)	(0.69)	(1.34)	(0.82)	**(0.61)**	(0.71)	(1.29)
Log (GDP-India)	1.07	1.37	0.97	0.27	0.55	0.65	0.91	**1.83*****	0.22	-0.12
	(0.67)	(0.97)	(0.9)	(0.32)	(0.71)	(1.35)	(0.82)	**(0.59)**	(0.69)	(1.29)
Distance (in 1000 kms)	0.07	**0.10****	**0.15*****	**0.08*****	**0.19*****	**0.27*****	**0.22*****	0.01	**0.09****	**0.22*****
	(0.05)	(0.05)	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)	(0.02)
FTA	**0.13*****	0	0.04	**0.05*****	0.04	0.08	**0.06***	**-0.06****	**-0.08****	**0.11*****
	(0.03)	(0.03)	(0.03)	(0.01)	(0.03)	(0.05)	(0.03)	(0.02)	(0.03)	(0.03)
RCA	**-0.00*****	-0.02	0.03	0	-0.03	**-0.14***	0.04	**0.09****	**-0.04***	0
	(0)	(0.06)	(0.04)	(0)	(0.04)	(0.08)	(0.04)	(0.04)	(0.02)	(0.01)
RCA-India	**0.08*****	**0.17***	**-0.08*****	**-0.02***	**0.12*****	0.01	**0.38*****	**0.24*****	**0.34*****	-0.04
	(0.03)	(0.09)	(0.01)	(0.01)	(0.02)	(0.09)	(0.04)	(0.04)	(0.1)	(0.04)
***** p<0.01, **p<0.05, *p<0.1**										
Values in parentheses represent standard errors										

Section 6: Discussion

The results which show that India's IIT is higher with countries whose income (and thus demand patterns) are different are in line with the results of Veeramani (2002) and Srivastava and Medury (2011). However, the coefficient of the difference in income is not significant.

Table 6: Mean IIT by country groups (1988-2015)

	Developed countries – High Income	Developing countries – Neighbouring	Developing countries – Other
Primary	23.5	15.9	22.5
RBM	28.4	13.6	22.7
RBM Other	36.9	15.4	34.3
LTM Textiles	7.9	26.8	23.9
LTM Other	32.8	14	24.1
MTM Auto	30.1	14.2	20.3
MTM Engineering	31.4	7.6	31.6
MTM process	28	20.8	17.3
HTM E&E	33.1	7.4	25.2
HTM Other	27.8	12.6	21.4

Source: Author's calculations using data from WITS (Accessed on 19 December, 2020)

From table 7, we see that India has higher IIT with developed countries in all groups other than Textiles. This indicates that India's IIT leans more towards vertical IIT than horizontal. This is because it is generally assumed that countries with similar incomes have similar technological capacities and demand patterns. Thus, their trade is more horizontal (trade in similar but differentiated products). On the other hand, higher-income countries are more technologically advanced with different demand patterns. Thus, trade with these countries would be more vertical, i.e., trade in the same product group but products at different production stages. Nevertheless, it is important to remember that the coefficient of difference in income is insignificant. The effect is significant only for one group, MTM Process, indicating that India is the supplier of parts and components to high-income economies in the MTM category.

The coefficient of the distance variable further lends support to the vertical IIT hypothesis. The distance variable is consistently positive and significant across all product categories, except MTM-Process. The countries close to India included in the sample (Nepal, Bangladesh and China) fall in the same income category, whereas the countries that lie further away are higher-income economies. But the marginal effect of changes in the distance is small.

The insignificant coefficients of the GDP variables indicate that the countries' size (India and Partner) has no impact on IIT. The only exception in this case is MTM-Process for which increase in the size of India’s economy has a positive effect while the increase in

partner country's size has a negative effect. The marginal effects of these variables for MTM-Process is also fairly large.

When we try to determine the impact that competitiveness has on IIT between India and its partner countries, we find that the coefficient of India's RCA is significant for 8 out of the ten categories. Moreover, of the eight categories, it is positive for all except RBM-Other and LTM-textiles. Thus, we find that an increase in India's comparative advantage increases its IIT. The positive coefficient of India's RCA shows that Indian trade is efficiency-enhancing. The marginal effect of RCA is, in fact, highest in medium and high technology manufactures, indicating that India has the potential to increase its skill and efficiency levels in these products and benefit from added IIT. There is also potential for developing new skills. The two products for which RCA is negative (RBM-Other and LTM-Textiles) fall on the lower end of the skill spectrum and are largely labour-intensive. Moreover, the marginal effect of an increase in RCA is also smaller for them. The negative coefficient thus hints at a lack of labour in the high-income economies. Thus, these results suggest that India should focus on increasing its RCA in higher technology commodities.

Coming to the impact of partner countries' comparative advantage on IIT, we find that it is small and insignificant in most cases. However, out of the four groups for which it is significant, it is negative for three out of four of them (only exception – MTM Process). The result indicates that an increase in the comparative advantage of partner countries reduces their IIT with India, implying that India lacks either the technological capacity or the capacity to acquire technological know-how to compete with its partner countries. However, the marginal effects are quite small.

Lastly, we look at the impact of India's FTA on IIT. The coefficients for FTA are significant for 6 out of the ten income categories. However, it is negative for 2 out of the 6 categories – MTM Process and HTM E&E. This negative coefficient implies that the agreements signed by India have not increased IIT in these categories but have instead had a trade diverting effect. However, for all other categories, FTA has been beneficial as IIT is welfare increasing (exploits economies of scale and allows for increased variety in consumption). Thus, contrary to the argument that India's FTAs have not been beneficial as they have resulted in an increased trade deficit, we do find that the signing of FTAs has been welfare enhancing.

What is happening with MTM process?

Having discussed all our variables, we would like to focus on one product group that has consistently emerged as an exception in our discussion, MTM Process. This category is primarily made up of chemicals (paints, pigments, perfumes, soaps) and plastic products (tubes, plates, sheets). It also includes a few other products such as railway vehicles, trailers, and steel pipes and tubes.

Our results indicate that India and its partner countries' RCAs have a positive effect on IIT. Thus, an increase in efficiency by either country (India or partner) increases IIT in this category. When we look at India's RCA in the MTM process, we see that India does not

have a comparative advantage in this category. Nevertheless, the RCA values have gradually been increasing. The value of RCA was 0.4 in 1988 and has increased to 0.8, even reaching a value of 1 in some years. Thus, India has potential in this sector, and an improvement in efficiency will bring about added benefits in increasing IIT.

Next, we see that an increase in the size of the partner country reduces IIT while an increase in India's size increases IIT. The significant marginal effects of the two variables indicate that the group is susceptible to changes in the sizes of the economies. We believe that this trend is because the share of this sector in India is small. We study the plastics sctor in somewhat greater detail. Processing capacity has been growing at about 11% a year over the last 5 years, considerably faster than the growth in consumption about 7 percent a year.and production of 4% a year (Plastindia.2018) Considerable investment has taken palce in the industry and the technology is modern as there are considerable imports. The industry is heavily concnetrated, with the three largest firms accounting for over 60% of the output and the largest firm over 40% of the output (Plastindia, 2018). India's trade in plastics is mostly in Asia. China accoumts for almost of India's imports whereas Asia as a whole accounts for over 40 % of exports (Plastindia, 2018). If we look at the share of plastics and rubber in manufacturing output, we find that the share has hovered around 15-18 per cent since 1988. However, the sector's share (only SITC 5-8)[4] in exports is minimal. In 1988, it accounted for only 3 per cent of India's exports, and it grew to approximately 7 per cent by 2015. However, the trade agreements that india has signed with Asian countrie should give a filip to trade in plastics. Domestic demand is also expected to grow rapidly led by automotive componenets, consumer durables and electronic items, pushed bu government;s digital india policy, and packaging as the pandemic is leading to increasing purchases from eplatforms which require more packaging.

On the other hand, the share of imports was high initially, hovering between 9-11 per cent between 1988 and 1991. Although it came down to 5 per cent in the early 2000s, it has increased to approximately 8 per cent in recent years. Thus, as partner economies grow, India's sector becomes even smaller relatively. On the other hand, as India and its sector grow, the size of the sector becomes more comparable to other countries. This story is further corroborated by the sign and the marginal effect of the similarity variable, which is positive and large. As the economies become similar and more comparable, the IIT is likely to increase between the economies.

The relatively small size of the sector also explains why the results indicate that the group is susceptible to trade diversion. The production concentration suggests monopolistic inefficiencies that should encourage trade and the trade agreements with Asian countries might have resulted in trade diversion. But growth prospects suggest that there might be trade creation.
Therefore, an analysis of this category reveals that this sector has potential for higher IIT and gains from it if India can enhance its efficiency and increase its size.

[4] The group has 28 products at the 3rd digit in total of which 26 are from SITC groups 5-8. The two products thus excluded from our study in this group are products 266 (Synthetic fibres suitable for spinning) and 267 (Other man-made fibres suitable for spinning).

Section 7: Conclusion

The paper sought to examine India's IIT with its top 15 partner countries. For this purpose, the products from SITC Rev. 3 groups 5 to 8 were divided into ten categories based on their technological content. The analysis of India's IIT in these categories showed that although IIT has increased in recent years and is the dominant form of trade with the world, India's trade with its top 15 partners still largely falls under the category of inter-industry trade. India has the highest IIT in Resource-based manufactures, whereas IIT is the lowest in low technology-intensive textiles.

The empirical analysis conducted to determine the factors of IIT revealed that India's RCA plays a significant role in increasing IIT for technological categories. We also find that India's FTAs have been IIT enhancing. Thus, in contrast to the notion that India has not benefitted from its FTAs, we find that IIT has increased with FTA partners. Thus, there are benefits to be derived from trade agreements. Moreover, contrary to theory and previous empirical findings in this area, we find that India's IIT increases with distance. However, this result, we believe, indicates the dominance of India's IIT with developed countries that located far away and lower IIT with its developing neighbours.
Lastly, a particular focus on medium technology process-based manufactures reveals that the existence of potential to be exploited in this category. An increase in efficiency and overall growth in the Indian economy can benefit this sector. However, the sector is susceptible to trade diversion from FTAs due to its relatively small size.

Thus, the paper provides some insightful results about the nature of India's IIT and the factors that play an essential role in driving it. This paper is a vital addition to the literature on IIT in India, mainly because of its innovative way of categorising products. However, it is essential to remember that while the classification of goods into technological categories using the Lall classification is widely accepted and used, it is subjective. Also, the nature of goods constantly changes due to technological changes. Hence, several products may be wrongly categorised.

An important point to note here is that the study does not consider the role of multinationals or FDI in IIT. In recent years, MNCs and FDI have been instrumental in driving the extent of IIT between countries. As more and more MNCs outsource or offshore their production processes, there is an increase in IIT due to trade in parts and unfinished goods. This IIT is, more often than not, vertical. Despite the importance of MNCs and FDI, these factors have been ignored since they use different indices to measure the share of IIT that is vertical and horizontal. Such distinction between the two types would give us more insight into the factors determining IIT and lead to better policy recommendations.

References

Aditya, A., & Gupta, I. (2019). Intra-industry Trade of India. Is It Horizontal or Vertical? *Economic and Political Weekly, 54*(25).

Aggarwal, S., & Chakraborty, D. (2019). Which Factors Influence India's Intra-Industry Trade? Empirical Findings for Select Sectors. *Global Business Review*. https://doi.org/10.1177/0972150919868343

Bagchi, S. (2017). Is Intra-industry Trade Gainful? Evidence from Manufacturing Industries of India. *India Studies in Business and Economics Globalisation of Technology,* 229-251. doi:10.1007/978-981-10-5424-2_10

Balassa, Bela. 1963. "An Empirical Demonstration of Classical Comparative Cost Theory." *The Review of Economics and Statistics* 231-238.

Balassa, Bela. 1966. "Tariff Reductions and trade in manufactures among industrial countries." *American Economic Review* 466-473.

Balassa, Bela. 1979. "Intra-industry trade and the integration of the developing countries in the world economy." In *On the Economics of Intra-Industry Trade: Symposium 1978*, by Herbert Giersch, 245-270. Mohr.

Bhadouria, P. S., & Verma, N. (2012). Intra-industry trade in textile industry: The case of India. *International Journal of Economics and Business Research, 4*(1/2), 199. doi:10.1504/ijebr.2012.044253

Burange, L. G., & Chaddha, S. J. (2008). India's Revealed Comparative Advantage in Merchandise Trade. *Artha Vijnana: Journal of The Gokhale Institute of Politics and Economics, 50*(4), 332. doi:10.21648/arthavij/2008/v50/i4/115413

Das, R. U., & Dubey, J. (2014). Mechanics of Intra-Industry Trade and FTA Implications for India in RCEP. *SSRN Electronic Journal*. doi:10.2139/ssrn.2430185

Globerman, Steven. 1992. "Weltwirtschaftliches Archib." *Weltwirtschaftliches Archiv* 487-497.

Grubel, HG 1967. "Intra-Industry Specialisation and the Pattern of Trade." *Canadian Journal of Economics and Political Science,* 374-388.

Grubel, HG, and PJ Llyod. 1975. *Intra-Industry Trade.* London: The Macmillian Press Ltd.

Helpman, E. 1981. "International trade in the presence of production differenciation, economies of scale and monopolistic competition." *Journal of International Economics* 305-340.

Helpman, E. 1987. "Imperfect competition and international trade: Evidence from fourteen industrial countries." *Journal of the Japanese and International Economies* 62-81.

Kojima, K. 1964. "The Pattern of International Trade Among Advanced Countries." *Hitotsubashi Journal of Economics* 16-34.

Krugman, Paul. 1979. "Increasing Returns, Monopolistic Competition, and International Trade." *Journal of International Economics* 469-479.

Krugman, Paul. 1981. "Intra-Industry specialisation and the gains from trade." *Journal of Political Economy* 959-973.

Helpman, E. 1987. "Imperfect competition and international trade: Evidence from fourteen industrial countries." *Journal of the Japanese and International Economies* 62-81.

Lall, Sanjaya. 2000. "The Technological Structure and Performance of Developing Country Manufactured Exports, 1985-98." *Oxford Development Studies* 337-369.

Lancaster, K. 1980. "Intra-industry trade under perfect monopolistic competition." *Journal of International Economics* 151-176.

Leontief, W. W. (1936). Quantitative Input and Output Relations in the Economic Systems of the United States. *The Review of Economics and Statistics, 18*(3), 105. doi:10.2307/1927837

Linder, S.B. 1961. *An Essay on Trade and Transformation.* New York: John Wiley.

Lloyd, P. J., & Yi, H. (2005). *Frontiers of research in intra-industry trade*. Basingstoke: Palgrave Macmillan.

Manrique, G. (1987). Intra-Industry Trade between Developed and Developing Countries: The United States and the NICs. *The Journal of Developing Areas, 21*(4), 481-494. Retrieved from https://www.jstor.org/stable/4191595.

Papke, L. E., & Wooldridge, J. M. (2008). Panel data methods for fractional response variables with an application to test pass rates. *Journal of Econometrics, 145*(1-2), 121-133. doi:10.1016/j.jeconom.2008.05.009

Plastindia 2018, Empowering Growth Annual Report, 2018, Plastindia Foundation, Mumbai, India.

Srivastava, A., & Medury, Y. (2011). An Overview of India's Intra-Industry Trade. *Asia-Pacific Journal of Management Research and Innovation, 7*(1), 153-160. Retrieved from https://doi.org/10.1177/097324701100700112.

Varma, P., & Ramakrishnan, A. (2014). An Analysis of the Structure and the Determinants of Intra-industry Trade in Agri-food Products: Case of India and Selected FTAs. *Millennial Asia, 5*(2), 179-196. doi:10.1177/0976399614541193

Veeramani, C. (2002). Intra-Industry Trade of India: Trends and Country-Specific Factors. Review of World Economics (Weltwirtschaftliches Archiv). 138. 509-533. 10.1007/BF02707952.

Veeramani, C. (2007). Industry-Specific Determinants of Intra-Industry Trade in India. *Indian Economic Review, 42*(2), new series, 211-229. Retrieved March 14, 2021, from http://www.jstor.org/stable/29793889

Verdoorn, P.J. 1960. "The Intra-Bloc Trade of Benelux." In *EAG Economic Consequences of the Size of Nations*, by J Robinson. London: Macmillan.

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