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WHICH FACTORS INFLUENCE INDIA'S BILATERAL INTRA-INDUSTRY TRADE? CROSS-COUNTRY EMPIRICAL ESTIMATES

Sakshi Aggarwal

Debashis Chakraborty

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Which Factors Influence India’s Bilateral Intra-Industry Trade? Cross-Country Empirical Estimates

Sakshi Aggarwal[1] and Debashis Chakraborty[2*]

* Corresponding author

1 *Doctoral Student, Indian Institute of Foreign Trade (IIFT),* sakshi230391@gmail.com
2 *Associate Professor, Indian Institute of Foreign Trade (IIFT),* debchakra@gmail.com

Abstract

India has undertaken a series of industrial and trade policy reforms since 2001. Among the key industrial policies introduced, the ‘Make-in-India’ and ‘Atmanirbhar Bharat Abhiyan’ initiatives are worth mention, while various trade facilitation measures, tariff reforms, deepening participation into preferential agreements and easing of FDI norms etc. can be cited as the major trade policy related reforms. The stream of reforms helped the country to witness a rise in simultaneous export and import within same product groups over the last two decades, which is termed as intra-industry trade (IIT) in the literature. Given the rising trend in IIT level, the present paper intends to analyse the key factors that influence the aggregate bilateral IIT between India and major trading partners over 2001-19 in a panel data framework. The empirical results indicate that India’s IIT with major trade partners is positively influenced by difference in income and technology levels, product differentiation, difference in manufacturing orientation and product standards, enhanced trade facilitation, while being negatively influenced by geographical distance. Given the positive relationship between difference in technology level and product standards, it can be argued that India’s IIT with the partner countries is majorly Vertical Intra-industry Trade (VIIT) type in nature. In light of recent preferential trade initiatives of the country, it is concluded that India needs to focus on domestic efficiency enhancing measures as well as improving trade facilitation channels.

Keywords: Intra-Industry Trade, LPI, EPI, Panel Data, India
JEL Classification: F13, F14

Which Factors Influence India's Bilateral Intra-Industry Trade? Cross-Country Empirical Estimates

1. Introduction

The global manufacturing trade flows have increasingly witnessed simultaneous exports and imports within industrial classifications from the sixties. While initially the phenomenon was prevalent in the developed countries, it has subsequently emerged as a common feature in the trade flows of the developing countries as well (Balassa, 1979; Havrylyshyn and Civan, 1985; Sawyer *et al*., 2010). A rich empirical literature exists on this two-way trade pattern, which is known as 'intra-industry trade' (IIT) in the literature. The existing literature has attempted to explain the emergence of IIT in terms of several economic drivers, namely: scale economies and product diversity (Krugman, 1979, 1981; Zhang and Clark, 2009; Clark, 2010; Zahavi and Lavie, 2013), product differentiation (Azhar and Elliott, 2006; Ando, 2006; Bertschek *et al.,* 2015), economic growth and distance (Stone and Lee, 1995; Taeji and Oh, 2001; Thorpe and Zhang, 2005; Holmes and Stevens, 2014). While the initial focus of the IIT literature has been on limitations of various measurement techniques and identification of biases (Grubel, 1967; Grubel and Lloyd, 1975; Aquino, 1978; Greenaway and Milner, 1983; Fontagné and Freudenberg, 1997), the focus subsequently moved to decomposition of the two-way trade further, namely in Horizontal IIT (HIIT) and Vertical IIT (VIIT). HIIT has been a common phenomenon among countries having similar income and endowment levels (Helpman and Krugman, 1985; Bhattacharyya, 2002), VIIT has been associated with differences in product quality, reflected through diverging technology and income scenario across partners (Shaked and Sutton, 1984; Greenaway *et al.*, 1995; Kyoji *et al*., 2003; Kim and Niem, 2011; Răzvan and Camelia, 2015). The existing literature provides ample evidence on both HIIT and VIIT type in global canvas (Blanes and Martín, 2000; Bagchi and Bhattacharyya, 2019; Aggarwal and Chakraborty, 2020b; Drelich-Skulska and Bobowski, 2021).

It has been observed that the two-way trade between countries from all the economic spectrum has shown an upward trend over the last two decades (World Bank, undated a). The rising trend in IIT can be explained by a series of recent developments: manufacturing tariff reforms resulting from the multilateral commitments under World Trade Organisation (WTO) (WTO, 2007), preferential tariff reforms under the regional trade agreements (RTAs) (Sawyer *et al*., 2010; Kim and Lee, undated), growth of the international production networks (IPNs) (Bobowski, 2018; Interakumnerd and Techakanont, 2015; Tewari *et al*., 2015), introduction of newer trade facilitation initiatives, e.g., synchronization of rules of origin (ROOs) and customs cooperation (Fukunaga and Isono, 2013; Chakraborty and Mukherjee, 2016; Aggarwal and Chakraborty, 2017, 2019) and so on.

India, a leading developing country, embraced an import-substitution led growth model from the 1950s onward, resulting in lower trade orientation during the next three decades (Panagariya, 2004; Virmani, 2005). However, faced with several economic challenges, from 1991 onwards the country adopted the outward-oriented growth model, and undertook a series of tariff and trade procedural reforms (Joshi and Little, 1996; Panagariya, 2004). The pace of the liberalization drive got further fuelled through the country's multilateral reform commitments under WTO from 1995 onwards on one hand and by the preferential tariff reforms vis-à-vis many Asian partner countries on the other (Goldar, 2005; Krishna, 2019). The deepening trade relationship with the trade partners in general and the East and Southeast

Asian RTA partners in particular, has led to a rise in India's bilateral IITs over the period (Ramakrishnan and Varma, 2014).

The rise in IIT level can be considered as a crucial consideration for the policymakers for the following reason. The existing literature notes that inter-industry trade involves a certain degree of manufacturing sector restructuring (e.g., sectoral employment transition towards exporting sectors from the import-competing ones), as a corollary of deepening specialization in sectors characterized by comparative advantage and vice versa. On the other hand, prevalence of IIT in a sector involves a lower probability of structural changes in the post-reform period (Brulhart and Elliott, 2002; Hamilton and Kniest, 1991). The lower adjustment costs in the sectors with higher IIT indices can be explained by reallocation of resources among firms within the same industry (Brulhart *et al*., 2006) and the consequent intra-sector readjustment-related advantages (e.g., lower labour re-training cost). From this standpoint, policymakers may face a strong incentive to facilitate IIT in its trade pattern. Given this perspective, there is a need to analyse the determinants of India's IIT with key trade partners.

The current analysis explores the determinants of India's composite merchandise IITs involving select trade partners over 2001-19. First, the literature on determinants of IIT is briefly recounted, followed by the evidence in the Indian context. The proposed empirical relationship and the data are discussed next. Finally based on the obtained estimates, certain policy conclusions are noted at the end.

2. Literature Review

2.1 IIT Measurement and Global Evidence

A rich literature has evolved on the measurement of bilateral IIT indices over the period (Grubel, 1967; Grubel and Lloyd, 1975; Aquino, 1978; Greenaway and Milner, 1983; Greenaway *et al*., 1995). The Grubel-Lloyd Uncorrected (GLU) index was proposed first for this purpose and the formula for computing trade overlap for country *j* in relation to industry *i* is noted in the following:

$$GLU = \frac{\sum_i (X_{ij} + M_{ij}) - \sum_i |X_{ij} - M_{ij}|}{\sum_i (X_{ij} + M_{ij})} \times 100$$

where, X_{ij} and M_{ij} represent the export and import figures of the home country with country *j* at a decided level of HS classification (e.g., HS 4-digit) respectively. For instance, for computing the aggregate IIT index, the calculation may be conducted over all the HS 4-digit codes, namely: HS 0101 to HS 9999. On the other hand, for computing the sectoral IIT index, say for the pharmaceutical sector (HS 30), the codes used for computation would be ranging over HS 3001 to 3006. '*j*' can either correspond to a bilateral trade partner (say, Thailand) or rest of the world (ROW).

However, it was subsequently observed that when the IIT index between countries with dissimilar economic profiles are being computed, there can be a possibility of underestimation due to the *trade imbalance* effect. Keeping this perspective in mind, the Grubel-Lloyd Corrected (GLC) index has been conceptualized in the following manner:

$$GLC = \frac{\sum_i (X_{ij} + M_{ij}) - \sum_i \left| X_{ij} - M_{ij} \right|}{\sum_i (X_{ij} + M_{ij}) - \left| \sum_i X_{ij} - \sum_i M_{ij} \right|} \times 100$$

A rich literature reporting IIT scenario across both developed (Caetano and Galego, 2007; Gabrisch, 2009; Ito and Okubo, 2012; Thorpe and Leitão, 2013; Botrić, 2013; Jambor, 2014; Jambor *et al*., 2016) and developing (Kandogan, 2003; Akram and Mahmood, 2012; Yoshida, 2013; Chin *et al*., 2015, 2016) countries has evolved over the period. It is usually observed that IIT growth is associated with rise in economic development and expanding manufacturing efficiency leading to product differentiation, coupled with declining trade barriers (Zhang *et al.*, 2005; Aggarwal and Chakraborty, 2020b). While composite IIT in developed countries is usually higher than developing countries, rising IIT levels are noticed even in the lower-income countries at disaggregated technology-intensive sectors (Aggarwal and Chakraborty, 2019; Baiardi and Bianchi, 2019)

During eighties and nineties, with significant deepening of two-way trade relationship between developed and developing countries, the qualitative differences between the exported and imported varieties in the trade overlaps became apparent. The research on the qualitative aspects of IIT patterns underlined the need to segregate the computed indices in relevant sub-categories, namely: HIIT and VIIT. Newer methodologies were proposed for this purpose (Abd-el-Rahman, 1991). Horizontal IIT refers to both-way trade in similar quality products. Conversely, VIIT has been marked by differences in product quality (e.g., technology embodied, labour productivity), with high-income and better-endowed countries specializing in superior quality products during the exchange (Shaked and Sutton, 1984; Flam and Helpman, 1987; Motta, 1992; Greenaway *et al*.,1994).

Over the period, a major section of the literature evolved, which has attempted to analyse various country-industry-specific determinants that influence IIT in line with gravity model framework (Lee, 1989; Cole and Elliott, 2003; Baldwin and Taglioni, 2011). In the initial period IIT literature revolved around determinant analysis using cross-section datasets (Hufbauer, 1970; Greenaway and Milner, 1983), but the focus subsequently evolved towards recognizing factors driving IIT in a cross-country framework (Stone and Lee, 1995; Zhang *et al*., 2005; Türkcan and Ates, 2010; Lapinska, 2016). Evidence from literature indicates that various country-specific determinants such as income level difference, technology profile difference, FDI inflows orientation, distance, contiguity, language, participation in RTAs etc. are among some of the major independent variables used by existing studies (Manrique, 1987; Lee, 1989; Clark, 1993; Veeramani, 2002; Bhattacharyya, 2005; Xing, 2007; Sawyer *et al*., 2010; Türkcan and Ates, 2010; Varma and Ramakrishnan; 2014; Lapinska, 2016; Hayakawa *et al*., 2017).

In late nineties, this branch of literature noted that the intensity of IIT may be positively correlated with the difference in per capita income between the trading partners, the underlying assumption being that the relative capital abundance is reflected in relative income per capita (Veeramani, 2002). Geographical proximity was identified as an important determinant, bearing a negative relationship as lower transportation and information costs increases the IIT level (Lee, 1989; Saslavsky and Shepherd, 2012; Shahbaz *et al*., 2012; Aggarwal and Chakraborty, 2017; Roy, 2017). FDI flows was found to promote IIT, especially if the foreign affiliates were set up to take advantage of the factor endowments of the host country, associated with long run export intensions (Lee, 1989; Hu and Ma, 1999; Sawyer *et al*., 2010; Türkcan and Ates, 2010; Botrić, 2013; Burange *et al*., 2017). However, if FDI flows were instead intended for capturing the local market of the host country, to be primarily used as a substitute of trade, then a negative association between such foreign investments and IIT has been observed (Caves, 1981, Veeramani, 2007). A section of the literature on determinants of IIT has been presented in the summarized form in Annex 1.[1]

After the Hong Kong Ministerial Meeting (2005) of the WTO, the discussions on trade facilitation reforms were initiated, which motivated countries to proactively improve both the gateway (e.g., port and customs handling reforms, entering into Mutual Recognition Agreements (MRAs)) and behind-the-border (e.g., improving transport infrastructure, including the same for multimodal transport, enhancing quality of logistical support in the hinterland, transparency of regulations) measures multilaterally, unilaterally as well as regionally (WTO-OECD, 2019; Peterson, 2020). With the corresponding reduction in transaction costs, the trade facilitation reforms can be highly effective in promoting export diversification in general and in the developing countries in particular (Ayoki, 2017). In the empirical trade literature, the stage of trade facilitation reforms in a country can be proxied by Logistic Performance Index (LPI), which covers several crucial transaction cost related parameters in a country (e.g., Customs efficiency, infrastructure, logistic quality, timeliness). As the reduction in trade costs (including transaction costs) can generate ample opportunities for trade in general and two-way trade in particular (Bergstrand and Egger, 2006; Dennis and Shepherd, 2011; Saslavsky and Shepherd, 2012; Martí et al., 2014; Puertas et al., 2014; Chakraborty and Mukherjee, 2016; Martí and Puertas, 2017, 2019), the relationship between trade facilitation and cross-border intra-firm trade and in turn, IIT is emerging as a major research area (Lanz and Miroudot, 2011).

2.2 IIT Evidence in Indian Context

In the pre-reform period, India's bilateral composite IIT remained modest, as impots were restricted through high tariff barriers. Pant and Barua (1986) reported a marginal rise in India's IIT indices at sectoral level over the preceding two decades, barring the exception of a few product segments. In the post-reform period, a rising trend has been noticed in bilateral and sectoral IITs, in line with declining trade barriers (Bhattacharyya, 1991, 1994; Kantawala, 1997; Veeramani, 1999). The rising trend in IIT continued in the new millennium as well (Veeramani, 2001, 2002, 2003, 2007; Chakraborty, 2002; Chakraborty and Chakraborty, 2005; Banerjee and Bhattacharyya, 2004; Burange and Chaddha, 2008; Davidson, 2012; Kumar and Ahmed, 2014; Singh, 2014; Kaur *et al*., 2016; Kelkar and Burange, 2016; Aggarwal and Chakraborty, 2017; Burange *et al*., 2017; Bagchi and Bhattacharyya, 2019; Aggarwal *et al*., 2022). Interestingly, a major section of the literature has reported the dominance of vertical IIT in India's trade pattern (Veeramani, 1999, 2001; Srivastava and Medury, 2011; Aggarwal and Chakraborty, 2020b). However, the analysis of Aditya and Gupta (2019), through application of a machine learning algorithm, i.e., Support Vector Machines (SVM), underlined the relevance of HIIT in India's trade pattern.

[1] A brief note on determinants of inter-industry trade, another vibrant branch of trade literature, deserves mention in this context. As countries become similar in terms of factor endowments as well as income levels, inter-industry trade loses its significance, and consequently the relevance of horizontal IIT rises. In other words, dissimilarity in Per Capita GDP level increases inter-industry trade. In addition, common language, capital stock, FDI, labour force characteristics, factor conditions (e.g., cropland) etc. are among the prominent determinants of inter-industry trade (Amiti, 1998; Cole and Elliot, 2003; Kandogan, 2003; Xu and Zhou, 2019). In contrast, the main determinants of IIT involves differences in capital-labour ratio or technology level, difference in PCGDP or income levels, difference in fertile land-labour ratio etc, (Cole and Elliot, 2003).

The Indian trade and domestic policies have undergone interesting transitions over the last two decades. In the aftermath of the failure of the Doha Round of WTO (2001), it was apparent that the Indian expectations on WTO reforms led market access would not be fulfilled. The realization compelled India to submit several reform suggestions to the WTO in association with other developing countries, e.g., Brazil (Ismail, 2020). Moreover, in order to facilitate industrial consolidation and trade opportunities, the country came out with the National Manufacturing Policy in 2011 (GoI, 2011). In addition, to promote trade in general and facilitate participation in the Asian production networks in particular, the country joined a number of Asia-centric RTAs since 2005 (Nag and Chakraborty, 2006). For instance, India-Singapore Comprehensive Economic Cooperation Agreement (CECA) in 2005, India-ASEAN FTA and India-South Korea Comprehensive Economic Partnership Agreement (CEPA) in 2010, India-Japan CEPA and India-Malaysia CECA in 2011 can be mentioned. As a result of these reforms, the average tariff barriers in India have come down considerably (Nag *et al*., 2021). To reach a higher product quality plane, in 2014 the country came out a comprehensive set of policies covering a wide range of sectors under the 'Make-in-India' programme (GoI, undated a). The set of policies launched under this initiative include both fiscal and financial instruments as well as import duty reforms to augment competitiveness of existing players on one hand and measures like R&D support and establishment of testing laboratories and design centres to create new capacities on the other (Chakraborty *et al*., 2019). In addition, the country undertook a series of trade facilitation related (GoI, 2020b) and FDI-easing reforms (Rao and Dhar, 2018), all of which, through rising exports and imports, influenced the sectoral and aggregate IIT patterns. In 2020, the country launched 'Atmanirbhar Bharat Abhiyan' to insulate the economy from external shocks on one hand and ensure sustained growth on the other (GoI, undated b). Interestingly, the country has taken a conscious call of not joining the mega-regional bloc Regional Comprehensive Economic Partnership (RCEP) in 2019, which include several low-cost developing countries, faced with adverse trade consequences (Ray Chaudhuri and Chakraborty, 2021; Ray Chaudhuri *et al*., 2022). However, the country has actively engaged with developed countries through RTAs since then, and recently completed agreements with UAE (February 2022) and Australia (April 2022). It is expected that the RTA negotiations with UK and the EU will be concluded in the coming future.

Several studies have attempted to analyse the underlying factors influencing India's IIT scenario. A section of the literature focused on either bilateral or regional trade partners of India. Akram and Mahmood (2012) analysed industry-specific determinants of IIT between India and Pakistan by using 3-digit International Standard of Industrial Classification (ISIC) data. The empirical analysis emphasized the role of institutional factors and economies-of-scale in production on bilateral IIT. Analysing India-Bangladesh bilateral IIT at 3-digit SITC level, Kumar and Ahmed (2014) underlined the need for expanding the export basket. Focusing on India-Thailand trade, Kaur *et al*. (2016) identified the need for tariff and non-tariff barriers (NTB) reforms and greater focus on trade facilitation channels, that otherwise lowers the current level of bilateral IIT. Singh (2014) focused on India-ASEAN trade and noted that systemic reforms may enhance IIT levels. Another section of the literature has focused on identifying the determinants of India's cross-sector IIT with rest of the world (ROW). The empirical results of Aggarwal and Chakraborty (2019) observed India's sectoral IITs with ROW to be vertical in nature. The analysis further observed that rise in productive efficiency and growing product diversity in the presence of trade facilitation reforms and preferential arrangements can majorly influence IIT.

The literature on determinant analysis of IIT involving partners across development spectrum and RTA partnership profile in the Indian context is however relatively scarce. Aggarwal and Chakraborty (2017) explored the determinants of India's aggregate bilateral IITs over 2001-15, and attributed the rising IIT to factors like technology difference, income difference, geographical distance, trade facilitation etc. Bagchi and Bhattacharyya (2019) analysed the determinants of India's horizontal and vertical IITs with partners across development spectrum and noted the importance of similarity in relative factor endowments, RTA partnership, relative depreciation of trading partner's real exchange rate and distance on the same. The present analysis intends to contribute to this growing literature.

3. Methodology and Data

Before conducting the regression analysis, the following steps have been undertaken. First, based on their importance in India's trade basket, top twenty-five partner countries have been identified for the analysis.[2] The evolving significance of the selected economies in India's trade basket has been shown with the help of Table 1. The sample period has been divided in four phases, namely: 2001-05, 2006-10, 2011-15 and 2016-19 respectively. While in the first period, India primarily relied on the multilateral route for export promotion, in the second period a conscious move towards entering into RTA partnerships has been noticed. The third period is characterized by deepening of India's RTA partnerships (e.g., India-ASEAN FTA, India-Japan CEPA, India South Korea CEPA, India-Malaysia CECA). However, during the last phase the regionalization drive faced a jolt, as India opted out from the ongoing RCEP negotiations in 2019 (Chakraborty *et al*, 2019). The aggregate export share of the sample countries has declined from 68.41 percent to 59.31 percent over 2001-05 to 2011-15 period, but subsequently increased to 64.84 percent during 2016-19. A slightly different pattern has emerged on the import front. The collective shares of the selected countries have risen from 55.77 percent to 65.15 percent over the study period, barring a minor decline during 2011-15. The details on the position of the sample countries in India's export and import baskets can be observed from Table 1.

Second, the composite IIT index for India with the rest of world (ROW) over 2001-19 is calculated by following both the GLU and GLC methods, which is shown with the help of Figure 1. Third, India's bilateral composite IIT indices involving the twenty-five selected economies are computed over the period of analysis (i.e., 2001-19) using the GLC method, which are used in the regression model (1) as the dependent variable.

$$LIIT_{it} = \alpha_0 + \beta_1 LDPCGDP_{it} + \beta_2 LD\left(\frac{K}{L}\right)_{it} + \beta_3 LWDIST_{it} + \beta_4 L(LPI_i LPI_j) + \beta_5 BORDER + \beta_6 LANGUAGE + \beta_7 Tariffline + \beta_8 Standard\ Difference + \beta_9 Manuf\ Share + \varepsilon_{it} \quad \ldots\ldots (1)$$

where,

α	represents the *constant* term
βs	are *coefficients*
L	represents logarithmic transformation of the variables

[2] Only major trading partners like Iraq, for whom some of the independent variables are not available from the key secondary data sources, have been dropped.

IIT_{it}	represents aggregate bilateral IIT (GLC) between India and trade partner *i* for year *t*
$DPCGDP_{it}$	represents difference of Per Capita GDP between India and trade partner *i* for year *t*
$D(K/L)_{it}$	represents difference of Capital-Labour ratio between India and trade partner *i* for year *t*
$WDIST_{it}$	represents income-weighted distance between India and trade partner *i* for year *t*
LPI_iLPI_j	represents an interaction term of the Logistics Performance Index (LPI) of India and trade partner *i* for year *t*
BORDER	represents a dummy variable which takes a value of 1 if India shares a common border with trade partner *i* and 0 otherwise
LANGUAGE	represents a dummy variable which takes a value of 1 if India and the trade partner *i* uses English as a common language and 0 otherwise
$Tariffline_{it}$	represents the Indian export products at HS 8-digit level to trade partner *i* for year t
$Standard\ Difference_{it}$	represents absolute difference between India's Environmental Performance Index (EPI) and trade partner *i* for year t
$Manuf\ Share_{it}$	represents absolute difference in share of manufacturing sector in India's GDP and trade partner *i* for year t
ε_{it}	represents the error term

In the following, the selection of the independent variables for the current analysis has been briefly discussed. Following the framework developed by Linder (1961), which underlines the similarity in demand patterns among countries at similar development levels, difference in Per Capita GDP (*DPCGDP*) has been included in the analysis. It is expected that growing divergence in per capita income of trade partners would lead to a greater qualitative disparity in demand patterns, with possible consequences on IIT (Bojnec and Ferto, 2016; Lapinska, 2016; Hayakawa *et al*., 2017). Moreover, greater difference in technology-intensity across countries can result in trade of vertically differentiated products characterized by dissimilar unit production costs, and in turn result in VIIT-type bilateral IIT (Andersen, 2003; Falvey, 1981; Fontagné *et al.*, 2006; Shaked and Sutton, 1984). To account for that, difference in Capital-labour Ratio (*DKL*) of India and selected countries has been included in the analysis. The IIT resulting from grater divergence of per capita income and technology-intensity among the trading partners would be predominantly VIIT in nature. If India's bilateral trade with partner countries is dominated by VIIT, then with rise in difference in Per Capita GDP and Capital-labour Ratio, a rising trend in IIT may be witnessed.

With possible rise in per capita transportation costs, bilateral IITs can be negatively related to geographical distance (Saslavsky and Shepherd, 2012; Shahbaz *et al*., 2012; Aggarwal and Chakraborty, 2017; Roy, 2017). While the existing empirical literature has considered simple geographical distance for measuring the associated trade cost, this approach suffers from a major limitation. As the distance considered by this approach remains time-invariant, the real influence of distance, *i.e*., trade costs, on trade flows might be missed. The current paper, in line with recent literature (Sawyer *et al*., 2010; Türkcan and Ates, 2010; Aggarwal and Chakraborty, 2017, 2019), instead considers weighted distance (*WDIST*) between countries as an independent variable:

$$\text{WDIST}_{it} = \frac{DIST_i * GDP_{it}}{\sum_{i=1}^{25} \text{GDP}_{it}}$$

where, $DIST_i$ indicates the distance in km. between the capital cities of the two nations (i.e., India and trading partner *i*). GDP_{it} represents the GDP of partner *i* in year *t*.

Following the existing literature, two dummy variables have been included in the analysis. First, a Border dummy is incorporated in the model which takes the value of 1 if India enjoys land border with a trading partner and 0 otherwise. A common border implies proximity, and the associated lower trade cost may cause rise in IIT. Second, presence of English as the common language between India and the trade partner is represented by a dummy of 1 if and 0 otherwise. The commonality of language (i.e., presence of a common communication medium) is expected to promote commercial exchange, which in turn may positively influence IIT.

The contributions of the current analysis to the literature are the following. First, over the period reduction in trade costs (e.g., better port and customs operations) have emerged as a crucial policy priority of the countries. The existing empirical literature confirms the positive influence of trade facilitation on exports (Iwanow and Kirkpatrick, 2007; Djankov *et al*., 2010; Puertas *et al*., 2013) and competitiveness (UNCTAD, 2016). The relationship between trade costs and IIT has been extensively documented in the literature (Bergstrand and Egger, 2006; Baldwin and Taglioni, 2011; Marti and Puertas, 2017, 2019). In the recent period India has implemented several trade facilitation measures, covering both gateway and behind-the-border concerns, all of which have contributed in lowering the trade costs (Banerjee, 2017; Dasgupta and Sinha, 2016; De, 2014). It has been observed that introduction of trade facilitation measures would improve the competitiveness of the country in global market (Sahoo *et al*., 2017). The present analysis considers World Bank's LPI index as an indicator of trade facilitation (Saslavsky and Shepherd, 2012). In order to understand the cumulative effect of understanding the trade facilitation measures in both the partner countries on bilateral IIT indices, an interaction term of the LPI of both trade partners has been included in the model. As improvements in LPIs are reflected in higher scores, the interaction term is expected to facilitate bilateral IIT pattern.

Second, two variables have been incorporated in the proposed model to understand preparedness of the Indian manufacturing sector in getting integrated with the partners through the IIT route. On one hand, the number of exported commodities from India at HS 8-digit level to respective partner countries (country i) has been considered as a key variable (Tariffline) in the analysis. The idea is that greater product diversification and fragmentation of production, reflected in export of more HS 8-digit products from India, is likely to facilitate IIT-type trade among partner countries (Interakumnerd and Techakanont, 2015). If India is on a different technology plane vis-à-vis the partner country, the changes in the 'tariffline' variable can take different forms. If country i happens to be a developing country and reside on a lower quality plane as compared to India, the number on products exported from India at HS 8-digit level to the partner may increase over time. Conversely, while trading with a developed country, a corresponding rise in number of high-tech products may not be forthcoming. However, India may be able to export relatively lower value products, depending on demand dynamics. On the other hand, the absolute difference of manufacturing sector's share in India's GDP and partner country is also considered in the model. The manufacturing production orientation in an economy can be considered as a proxy of industrial development, which is a crucial factor influencing IIT (Soós, 2013). If two countries are at a comparable level of industrial development, then quality parity would prevail across sectors, and the IIT can be explained by HIIT-type. On the other hand, greater difference in manufacturing orientation may put them on different quality planes and result into VIIT-type trade.

Third, stringency of environmental management policies influence market structure both at home and abroad, which in turn may influence emission patterns and thereby trade flows (Gürtzgen and Rauscher, 2000). Over the period, the sustainable supply chain management has emerged as a crucial determinant of international business decisions (Sánchez-Flores et al, 2020). If two countries are placed symmetrically in environmental governance scale, it will be relatively easier for exporters to comply with other country's technical standards, leading to higher IIT levels. It is acknowledged in the literature that difference in environmental standards can affect IIT patterns (Cole and Elliot, 2003; Aggarwal *et al*., 2022). This is a crucial question for India, as the country is set to intensify its RTA collaborations with a number of developed countries. The current analysis considers the Environmental Performance Index (EPI) as a proxy of environmental regulatory frameworks in a country. Hence, absolute difference in India's EPI and the partner countries has been included as an independent variable.

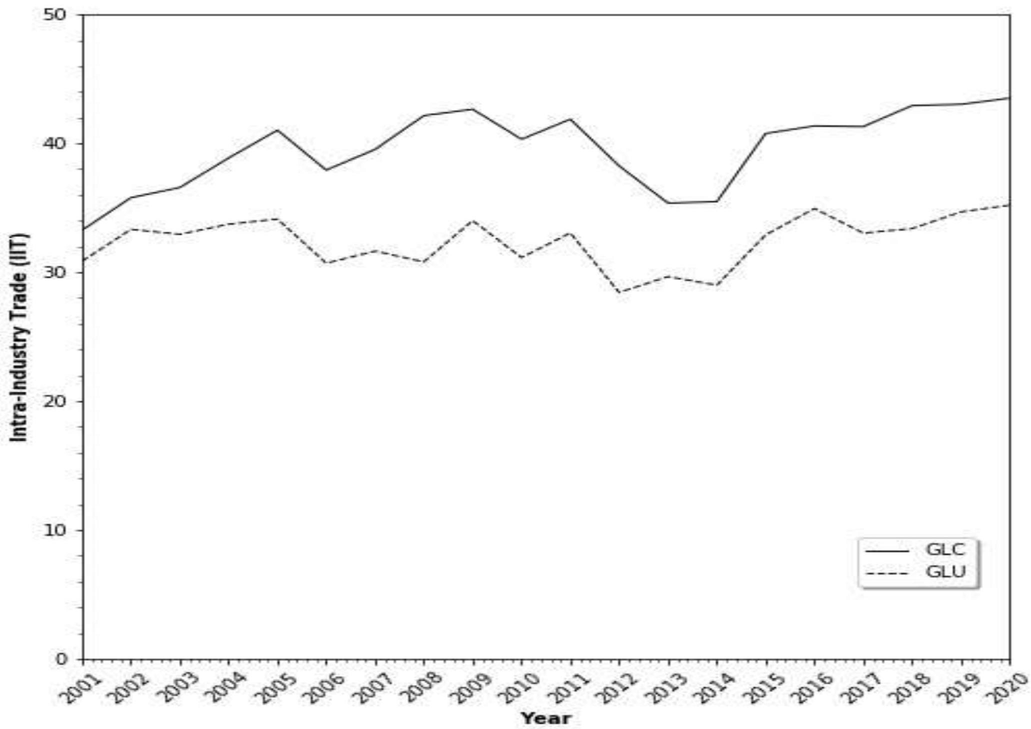
Annex 2 provides a detailed account of the independent variables considered in the current analysis.

4. Empirical Results

Before proceeding to the regression analysis with bilateral IIT indices, India's aggregate IIT with the ROW over 2001-19 has been computed by using both GLU and GLC methods. The aggregate IIT indices for India have been reported in Figure 1. While the country's aggregate IIT witnessed a rise over 2001-05, the corresponding numbers oscillated during 2005-14 period. Interestingly, during 2014-19, a generally rising trend in the IIT series has been witnessed. It is observed that, the GLC index has increased from 33.25 to 43.49 over 2001 to 2019, underlining growing importance of trade overlap in the Indian context. On the whole, a modest rise in India's aggregate IIT has been noted, in spite of the fact that the country undertook a series of reforms (e.g., reduction in tariff, several trade facilitation reforms) and significant deepening of the country's participation in the Asian production networks (Dollar *et al*., 2019; Nag *et al*., 2021; GoI undated c).

The shares of the selected partner countries in India's export and import baskets have been shown with the help of Table 1, from which the two-way bilateral trade flows at the aggregate level becomes evident. In line with the standard literature, the GLC index is used for the regression analysis (Bergstrand and Egger, 2006; Aggarwal and Chakraborty, 2017). India's average aggregate IITs with the partner countries are reported in Table 2. For interpreting the IIT indices through a developmental prism, the high-income and middle-income partners are reported in the upper and lower panels, respectively. The average composite IIT values are reported for the following periods, namely: 2001-05, 2006-10, 2011-15 and 2016-19 respectively. Finally, in the last two columns the trade relationship of India with the partner countries, as reflected through participation in common RTAs, has been underlined. It is to be noted that while India's RTA journey initially focused on identifying developing country partners, recent negotiations with developed countries indicate a structural shift in the thought process (Cyrill, 2022).

Figure 1: India's Overall IIT with ROW (2001-2019)



Source: Authors' computation

From the computed indices it is observed that India's IIT dynamics with *developed* economies has displayed an interesting trend. First, the IIT indices with the prominent EU members (e.g., Germany, France) has generally increased, which is likely to continue once the ongoing EU-India Bilateral Trade and Investment Agreement (BTIA) negotiations are concluded (BS, 2021). India has been consistently asking the EU to come to the negotiating table, dropping the preconditions on tariff reforms and other concerns (Sen, 2022). However, given the fact that EU is entering into preferential trade relationship with an emerging economy for the first time, the process is getting delayed (Khorana, 2020). Second, despite not having a formal RTA link with India, USA has witnessed deepening of bilateral IIT relationships. The recent discussions on entering into an FTA with USA needs to be noted in this wider context (Dhasmana, 2021). Third, IIT indices with Switzerland and Hong Kong have declined, underlining a reduction in trade overlap, which can be explained by India's growing inter-industry type trade with these economies. In particular, the rising technology-intensive imports from Hong Kong has been alleged to be coming from mainland China through a strategic re-routing (Suneja, 2020). Fourth, with respect to Australia and Qatar, the trade also has been observed to be generally inter-industry type. While India has opted out of the RCEP agreement involving Australia in 2019, with Qatar only the Framework Agreement (FA) of the India-Gulf Cooperation Council (GCC) FTA has been signed. However, the country has finalized the bilateral trade deal with Australia in April 2022, with considerable trade and IIT-related implications (GoI, 2022). Fifth, India's IIT with exiting high-income Asian trade partners, namely: Singapore, Japan and South Korea, have increased in the postbloc period, indicating emergence of deeper two-way trade patterns after preferential tariff reforms.

India's aggregate IIT with the *developing partners* also showed an interesting outcome. First, the rise in bilateral IIT indices with most of the countries can be related to trade preferences originating from RTA-led reforms, e.g.: Bangladesh, Sri Lanka (South Asian Free Trade Area – SAFTA), Brazil (India-Mercosur Preferential Trade Agreement), Indonesia, Malaysia, Thailand and Vietnam (India-ASEAN FTA). Second, the IIT scenario involving non-RTA partners, i.e., China, South Africa, Nigeria and Iran are however displaying diverging dynamics. The low value of IIT involving Iran can be explained by continuation of economic sanctions, which has an influence on the commodity composition of bilateral trade (Wani et al, 2019). The low values of IIT with African partners like South Africa and Nigeria can possibly be justified by presence of both tariff and non-tariff barriers on bilateral trade flows (Kareem, 2017). The IIT with China has increased over the period even in the absence of an RTA, aided by rising income levels and geographical proximity. However, it has been observed that in several sectors characterized by two-way trade flows (e.g., electrical equipment (HS 85)), China enjoys a trade surplus vis-à-vis India in all 4-digit tariff headings over the last decade (Aggarwal and Chakraborty, 2019). Consequently, the bilateral trade deficit has worsened for India (Dhar, 2019) and the widening of the export-import gap may have possible influence on future IIT scores (Dwesar and Kesharwani, 2019). It has been argued that the growing trade deficit with the partners in general and with China in particular, has considerably influenced the Indian decision to pull-out of the RCEP negotiations in the recent period (Nag *et al*., 2021).

The empirical analyses have been conducted next. In order to avoid spurious results, there is a need for controlling of non-stationarity in the balanced panel data analysis involving the 25 selected countries over 2001-19 (Baltagi, 2005; Pesaran, 2015; Bagchi and Bhattacharyya, 2019). Table 2 reports the Harris-Tzavalis Test for all the variables in the current analysis (Harris and Tzavalis, 1999), which shows that all the series are stationary in nature. To check endogeneity for the explanatory variables two-stage least squares (2SLS) method has been applied. It is observed that Wald Chi-square test statistic of 72.41 (Prob: 0.00) is statistically significant. The null hypothesis of the Durbin and Wu-Hausman tests is that the variable under consideration can be treated as exogenous. The observed Durbin score of 0.1873 (Prob 0.5897) and Wu-Hausman statistic of 0.1653 (Prob 0.5298) are not significant, so null hypothesis of exogeneity is not rejected. Therefore, the analysis indicates that explanatory variables for the current analysis are not endogenous.

The panel data analysis has been conducted in STATA (version 14), along with the standard diagnostic tests. First, the Hausman test is conducted, and the test statistic of 3.15 (Prob 0.3694) is not significant indicating the presence of an underlying random effect model. Second, the LM Test undertaken for detecting the presence of first order autocorrelation results in the chi-square test statistic of 126.87 (Prob: 0.0000), which is statistically significant. Third, Breusch-Pagan / Cook-Weisberg test for heteroscedasticity leads to the Chi-square test statistic is 48.21 (Prob 0.0000). Fourth, estimated mean variance inflation factor (VIF) is 4.08, which is within the tolerance limit of multicollinearity. The results indicate that there is need to take note of the existence of heteroscedasticity and first order autocorrelation (AR1) in the model. Finally, to check whether residuals are cross-sectionally uncorrelated, Pesaran (2004) Cross-section Dependence (CD) test has been conducted in R. It is observed from the F-statistic of 5.12 (Prob: 0.00) that the null hypothesis of spatial independence is rejected at 5% level. As standard fixed or random effects estimators will be biased and inconsistent in this scenario, the analysis follows the Panel Corrected Standard Errors (PCSE) method which allows for accurate estimation of variability (Beck and Katz, 1995).

From the PCSE regression results summarized in Table 3, a few observations emerge on variables used more commonly in the literature. First, higher per capita income difference with trade partners results in higher aggregate bilateral IITs. Second, rising difference in technology (i.e., K/L) enhances bilateral IIT levels. It can be argued that the coefficients of DPCGDP and D(K/L) jointly signify presence of VIIT, i.e., the products being exported and imported simultaneously vis-à-vis select trade partners are possibly from different quality spectrum. Third, rising trade cost is not conducive for higher IIT. Fourth, enjoying a common land border with a partner country can facilitate trade in general and IIT in particular. The result can be understood in light of the growing bilateral IIT index value with India's neighbours, namely: Bangladesh, China and Sri Lanka. Fifth, as reflected from the negative coefficient of language dummy, IIT of India is found to be relatively higher with non-English speaking partners, which can be supported from the case of both Asian neighbours (e.g., China, Japan, South Korea), as well as prominent EU countries (e.g., Germany, France).

A few interesting observations can be noted from the variables proposed in the current analysis as well. First, the LPI interaction term is greater than unity, indicating the importance of augmenting trade facilitation framework (e.g., customs efficiency and port infrastructure) in enhancing IIT (Dasgupta and Sinha, 2016; De, 2020). Second, broad-based export basket at HS 8-digit tariff line level enhances IIT, due to rising trade potential in general and export diversification in line with domestic resource endowment and higher efficiency on the other (Aggarwal and Chakraborty, 2019). Third, it is observed that the higher difference in share of manufacturing sector in GDP (Manuf Share) in both the partner countries lead to higher IIT levels. Finally, the difference in product standards facilitates India's IIT with partners. The result can be explained by the fact that India's bilateral IIT is relatively higher with developed countries (e.g., UK, France, Germany, Japan, USA), who are characterized by better EPI levels on one hand, and higher difference in PCGDP and D(K/L) on the other. Hence, it can be understood that the products which are being simultaneously exported and imported would be characterized by not only qualitative difference, but by production standard compliance related difference as well. In other words, the unit price of the traded products would be different, underlining the dominance of VIIT-type trade in India's trade overlap (Bagchi and Bhattacharyya, 2021).

5. Conclusion

The Indian trade policies over the last two decades has focused on enhancing efficiency, through encouragement to outward-orientation and deepened linkages with the Asian production networks (Anukoonwattaka and Mikic, 2011). Several steps have been implemented to facilitate this objective. First, India has joined a number of Asia-centric RTAs over the study period, e.g.: South Asian Free Trade Area (coming to effect from 2006), ASEAN-India Free Trade Agreement (FTA) (2010), India-South Korea Comprehensive Economic Partnership Agreement (CEPA) (2010), India-Japan CEPA (2011) and Indo-Malaysia CECA (2011). The tariff concessions granted through these agreements have facilitated higher manufacturing trade by India with the partners in general and IIT-type trade in particular. Second, India has witnessed a higher growth path over the last decade, consequently reflecting the growth-led import (GLI) phenomenon (Maitra, 2020). Third, the growing domestic market has been increasingly opened to the foreign MNCs (often from the developed countries) through a series of reforms including eased entry norms and upper limits on FDI flows, leading to technology transfer and spillover effects within the manufacturing sector (Behera, 2015). The growing trade opportunities, coupled by rising income level and manufacturing consolidation has resulted in higher export and import flows, in turn leading to higher IIT level in the country.

The current objective of India is to evolve as the global manufacturing hub, both through the consolidation of the domestic sectors and attracting the majors global MNCs (IBEF, undated). To promote the industrialization drive further, the 'Make-in-India' initiative was launched in 2014, and several key sectors with varying degree of capital-intensity were identified for improving production and export opportunities (GoI, undated). It has been observed that while the trade-related reform measures (e.g., import tariff reforms, FDI inflow reforms) have facilitated domestic production and exports, imports have also increased alarmingly in sectors characterized by two-way trade, leading to trade deficits (Chaudhuri, 2015) and labour market disruptions (Aggarwal and Chakraborty, 2020a). The protection of economic interests in general and the urge for consolidation of manufacturing sectors in particular have motivated the country to announce the 'Atmanirbhar Bharat Abhiyan' (Self-Reliant India) in May 2020, with significant potential ramifications on the industrial sector (GoI, 2020a). The policy implications of the current paper needs to be understood in this broader perspective.

Two key policy observations emerge from the analysis. First and foremost, tariff reforms in India, both undertaken unilaterally and through RTA routes, have led to rise in both-way trade flows with partner economies across product categories. Based on the relationship with independent variables, the IIT-trade involving India seems to be vertical in nature, which has also been noted in existing empirical analyses (Veeramani, 2001; Srivastava and Medury, 2011; Bagchi and Bhattacharyya, 2019, 2021; Aggarwal and Chakraborty, 2019, 2020b). However, the current analysis adds to the existing literature by exploring the relationship between IIT and difference in standards (as proxied by EPI) as well. The positive relationship between the two underlines that India might be on a lower quality plane, particularly vis-à-vis the high-income trade partners, given the technology difference. Some of the high-income countries are already partnering with India through RTAs (e.g., Australia, Japan, South Korea), while several others are in the process of entering into preferential trade relationship in coming future (e.g., EU, US). It is expected that given the continuing policy orientation and trade promotional measures, India's trade and IIT with the partner countries would increase in coming days. However, if the country continues to rely on export-oriented growth strategy from the lower quality plane, then the problem of sectoral as well as aggregate trade deficit may continue and even worsen in the future. Hence, the industrial policy measures must be geared to secure productivity growth, innovation and realization of scale economies, which in turn can facilitate qualitative improvement.

Second, India has introduced several trade facilitation measures, including both 'gateway' and 'behind-the-border' policies in the recent period (GoI, 2020b). Apart from honouring the multilateral obligations under the Trade Facilitation Agreement signed at the WTO Ministerial meeting at Bali (2013), the country has also followed two other routes for this purpose. One on hand, trade facilitation measures implemented through the RTAs have improved the border hassles scenario and facilitated bilateral trade flows with partner countries (RBI, undated). On the other hand, India has joined key standard-setting forums, e.g., United Nations Economic Commission for Europe (UNECE) WP.29, which is the designated global platform for harmonization of vehicle regulations (Chakraborty *et al.*, 2020). These platforms, through mutual recognition of standards, ensure hassle-free trade between partners, and hence IIT-type trade as well. It is observed from the LPI index data for various years that the developed countries are placed in better trade facilitation plane vis-à-vis India, and hence two-way trade with such partners is likely to get promoted. However, it has been observed that a significant proportion of India's trade takes place with relatively low-income countries in Asia and Africa, and there is considerable scope for strengthening the economic infrastructure and trade facilitation measures in these countries (Sakyi *et al*., 2018). It will therefore be a crucial initiative by India to coordinate with the low-income countries in Asia and Africa for improving their trade facilitation framework, e.g., through the Exim Bank lines of credit (Exim, 2020). In addition, the institutional linkages with trade partners from all development spectrum needs to be prompted through initiatives like both generic and sector specific MRAs. Then the country's long-term objective of emerging as the global manufacturing production hub will be fulfilled, along with deeper IPN participation.

Table 1: Average Shares of Selected Trade Partners in India's Trade Basket

No.	Partner Country	Export Share (%)				Import Share (%)			
		2001-05	**2006-10**	**2011-15**	**2016-19**	**2001-05**	**2006-10**	**2011-15**	**2016-19**
1	Australia	0.90	0.75	0.87	0.92	2.93	3.63	2.49	2.79
2	USA	18.50	12.51	12.98	16.76	6.38	6.41	4.87	5.74
3	China	4.41	6.46	4.67	4.74	5.30	10.66	12.52	14.37
4	Indonesia	1.47	1.61	1.67	1.39	2.26	2.38	3.20	3.48
5	Japan	2.97	2.11	1.95	1.87	3.22	2.53	2.37	2.59
6	Korea	1.24	1.89	1.43	1.92	2.86	2.76	2.88	2.87
7	Iran	1.14	1.22	1.18	1.12	0.43	3.80	2.28	2.19
8	South Africa	1.01	1.46	1.62	1.45	2.51	1.70	1.63	1.69
9	UK	4.78	3.80	3.06	3.08	4.11	1.88	1.35	1.74
10	Qatar	0.20	0.29	0.30	0.59	0.34	1.29	3.00	2.54
11	Malaysia	1.43	1.53	1.50	1.66	2.23	2.24	2.19	2.38
12	Thailand	1.25	1.06	1.12	1.38	0.77	0.98	1.22	1.56
13	Sri Lanka	1.77	1.51	1.66	1.72	0.24	0.19	0.15	0.28
14	Germany	3.82	3.14	2.54	2.81	3.83	3.81	2.97	3.06
15	Switzerland	0.73	0.36	0.40	0.42	4.91	4.71	5.59	4.61
16	Netherlands	2.06	3.05	2.64	2.69	0.77	0.66	0.55	0.84
17	Singapore	3.53	4.46	4.02	4.09	2.47	2.62	1.66	1.74
18	Hong Kong	4.95	3.96	4.24	4.31	1.60	1.69	1.73	1.87
19	Vietnam	0.62	0.95	1.65	1.57	0.06	0.15	0.53	0.62
20	Bangladesh	2.22	1.43	1.73	1.84	0.09	0.11	0.13	0.23
21	Brazil	3.02	2.48	2.03	1.68	0.57	0.66	1.00	1.05
22	Belgium	0.72	1.40	1.83	2.27	4.90	2.08	2.22	2.89
23	Italy	2.66	2.27	1.63	1.75	1.34	1.40	1.02	1.09
24	Nigeria	0.93	0.79	0.89	0.95	0.10	2.93	2.96	2.08
25	France	2.08	1.85	1.70	1.86	1.55	1.68	0.80	0.85
	Total	**68.41**	**62.34**	**59.31**	**64.84**	**55.77**	**62.95**	**61.31**	**65.15**

Source: Authors' computation from ITC (undated)

Table 2: Harris-Tzavalis Panel Unit Root Test

Variables	Rho	Z
LIIT	0.6779	-6.0590***
LDPCGDP	0.5480	-7.1026***
LD(K/L)	0.2742	-9.8640***
Border	0.0000	-28.9726***
LWDIST	0.3751	-8.1152***
L(LPIi*LPI_j)	0.7170	-4.7358***
Language	0.0000	-28.9726***
Tariffline	0.3334	-17.7039***
Standard Difference	0.6587	-6.7062***
Manuf Share	0.7811	-2.5720***

Source: Author's estimation
Notes: *** denotes the statistical significance at 1 percent.

Table 3: PCSE Regression Results on Determinants of India's Bilateral Intra-Industry Trade

Independent Variables	Dependent Variable: LIIT								
	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**	**Model (5)**	**Model (6)**	**Model (7)**	**Model (8)**	**Model (9)**
Constant	0.615***	0.288***	-2.135***	0.306***	-3.295***	0.250**	-3.347***	-2.729***	0.398***
	(0.077)	(0.112)	(0.214)	(0.110)	(0.275)	(0.125)	(0.290)	(0.285)	(0.114)
LDPCGDP	0.092***	0.140***		0.154***		0.135***			0.002
	(0.022)	(0.026)		(0.027)		(0.031)			(0.043)
LD(K/L)	0.128***	0.165***	0.026*	0.166***	0.067***	0.169***	0.061***	0.047**	0.169***
	(0.035)	(0.045)	(0.025)	(0.041)	(0.027)	(0.041)	(0.025)	(0.022)	(0.039)
Border		0.416***		0.352***	0.470***	0.274***	0.394***	0.426***	0.289***
		(0.039)		(0.031)	(0.028)	(0.024)	(0.025)	(0.026)	(0.030)
LWDIST			-0.115***		-0.087*	-0.016*	-0.114***	-0.134***	-0.061***
			(0.020)		(0.021)	(0.020)	(0.021)	(0.020)	(0.018)
L(LPIi*LPI_j)			3.410***		4.423***		4.387***	3.652***	
			(0.241)		(0.282)		(0.284)	(0.288)	
Language				-0.180***	-0.239***	-0.215***	-0.267***	-0.259***	-0.212***
				(0.042)	(0.036)	(0.044)	(0.036)	(0.039)	(0.046)
Tariffline						0.001***	0.001***	0.001***	0.001***
						(0.001)	(0.001)	(0.001)	(0.001)
Standard Difference								0.009***	0.017***
								(0.002)	(0.003)
Manufacturing Share									0.006**
									(0.004)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	500	500	500	500	500	500	500	500	500
R-squared	0.572	0.621	0.689	0.673	0.692	0.724	0.741	0.806	0.844
F-Statistics	82.48	84.68	85.21	85.07	85.89	86.28	87.42	91.75	92.97

Source: Author's estimation

Note: Figure in the parenthesis shows the autocorrelation and heteroscedasticity-corrected standard errors of the estimated coefficient.
∗∗∗, ∗∗, and ∗ implies estimated coefficient is significant at 0.01, 0.05, and 0.10 level, respectively.

Annex 1: Literature on determinants of Intra-Industry Trade

Year	Author	Objective	Dataset	Dependent Variable	Explanatory Variable	Estimation Technique
1980	R. Loertscher and F. Wolter	Analyze the country and industry-specific determinants of intra-industry trade in OECD countries	Dataset: 1971 – 1973	IIT	Product differentiation, Scale economies, Transaction costs, Level of aggregation, Distance, Product group, Development stage differential, Average Market size, Market size differential, Custom union dummy, Language group dummy, Border trade dummy	OLS
1981	R.E. Caves	Analyze the determinants of IIT in USA	Dataset: 1953 – 1970	IIT	Product heterogeneity, Standard deviation of rates of profit, R&D, Ratio of market planning to total costs, Ratio of selling-related costs to total costs, Advertisement expenditure, FDI, Cost disadvantage ratio, Scale economies, Distance, Average trade weighted tariff, Minimum efficient plant scale	PCA, OLS, Logit
1982	L. Lundberg	Analyze the determinants of IIT in Swedish Manufacturing industries	Dataset: 1970 – 1977 on the 4 digit-level of ISIC	IIT	Share of wage costs in value added, Average wage, R&D, Energy intensity, Share of technical personnel in labour force, Share of sales personnel in labour force, Share of labour force employed in big plants	OLS
1987	G.G. Manrique	Examine pattern of trade between US and 7 NICs	Dataset: 1965-1976	IIT	Tariff, Product heterogeneity, Four-firm concentration ratio, Product differentiation, Scale economies, R&D, Average wage	OLS, GLU
1989	Y.S. Lee	Identify the determinants of IIT among the Pacific Basin countries	Dataset: 1970, 1980	IIT, HIIT, VIIT	Difference in per capital income, Difference of capital-labour ratio, Effective tariff rates, Distance, FDI, Product differentiation, Economies of scale, R&D	Aquino Index, Logit
1990	J.H. Bergstrand	Identify the determinants of IIT in select SITC industry groups of OECD countries	Dataset: 1976	IIT	Average GDP, Average per capita GDP, Average tariff level, Capital-labour endowment ratio, Adjacency dummy	WLS, Logit
1993	D.P. Clark	Investigate the industry-specific determinants of IIT in US	Dataset: 1980, 1984, 1986	IIT	Minimum efficient scale, Advertising-to-sales ratio, Consumer goods ratio, Capital-to-labour ratio, Sectoral dispersion index, Inventory ratio, Number of tariff-line level products,	OLS

					Value of industry shipments, Four-firm concentration ratio, Ad-valorem tariff rate, non-tariff barrier	
1993	K.S. Hughes	Identify key determinants of IIT for the largest OECD economies	Dataset: 1980-1987 at 4-digit data based on ISIC	IIT, LIIT	Product heterogeneity, Five-firm concentration ratio, R&D, Share of technical personnel in total employment, Share of operative staff in total employment, Scale economies	OLS, Fixed effects
1994	P. Chow, M. Kellman and Y. Shachmurove	Examines the intra-industry trade of the four East Asian Newly Industrialized Countries (Hong Kong, Singapore, South Korea and Taiwan) with European markets, Japan and the United States	Dataset: 1965-1990	IIT	Product differentiation, Scale economies, GNP, Influence of MNCs, Income similarity	OLS
1994	J.G. Hirschberg, I.M. Sheldon & J.R. Dayton	Analyze the determinants of IIT in food processing sector for a sample of 30 countries	Dataset: 1964-1985	IIT	GDP per capita, GDP Size, Exchange Rate, Distance, Border, FTA	Tobit
1995	P.K.M. Tharakan and B. Kerstens	Analyse the nature of IIT in toy industry in EC countries	Dataset: 1970-1987	IIT	FDI, Average weighted tariff, Similarity of income distribution in the countries, Propensity of product to be vertically differentiated, Propensity of product to be horizontally differentiated, Country dummy	Logit
1999	L. Nilsson	Examines country determinants of the EU countries IIT with the developing countries	Dataset: 1980-1992 at the SITC 4-digit level	IIT	Absolute difference in GNP per capita, Average GNP per capita, Absolute difference in GNP, Average GNP, Distance, Binary variable for NIC countries	OLS, Non-linear least squares
2001	C. Veeramani	Analyze intensity of IIT across countries and sections to understand trade liberalization on IIT	Dataset: 1987-88, 1994-95 and 1998-99	IIT	Per capita income difference, Technology gap, Human capital endowment difference, Income distribution similarity, Market size, Market size difference, level of trade restriction, Inward FDI	Probit and Tobit regression, GLU
2002	C. Veeramani	Analyze trends and country-specific factors affecting India's IIT	Dataset: 1988, 1995, 2000	IIT	Per capita income difference, Differences in the pattern of income distribution, Market size, Distance, Categorical aggregation	OLS, Tobit, GLU, Brülhart Index
2003	M.A. Cole and R.J.R. Elliott	Examine the impact of environmental regulations on trade patterns	Dataset: 1995	IIT	Difference of capital-labour ratio, Difference of fertile land-to-labour ratio, Difference in per capital income, Stringency of environment	Panel regression, Two stage least-squares, OLS,

					regulations, Border dummy	Fixed-effects
2004	S. Banerjee and R. Bhattacharyya	Explore the relationship between IIT and the level of economic development of India	Dataset: 1971-2000	IIT	Size of manufacturing sector, Capital-labour ratio, GNP per capita, Tariffs, FDI	OLS, Granger causality
2004	H. Lee and C. Sohn	Analyze the nature of MIIT in South Korea	Dataset: 1991-2001	IIT	GDP, Per capita GDP, Distance, Trade Openness, Difference in GDP, Difference in per capita GDP	Nonlinear-least-squares estimation of logistic function
2005	D. Chakraborty and P. Chakraborty	Assess India's export performance and attempts to analyse various features of India's export basket	Dataset: 1994-2002	Exports	GDP, Index of industrial production, Competitiveness of Indian exports	Grubel and Lloyd, Aquino Index, Log linear method
2005	R. Bhattacharyya	Analyze the pattern of IIT in Republic of Korea	Dataset: 1963-1995	IIT, VIIT, HIIT	GDP, Manufacturing as a proportion of GDP, Capital-output ratio, Final consumption expenditure of households, Total trade volume, Foreign investment, Custom's duty as a proportion of import value	GLU, Granger causality
2006	J.H. Bergstrand and P. Egger	Analyze the determinants of IIT in the explicit presence of trade costs	Dataset: 1990-2000	IIT	Similarity in GDP, Bilateral sum of GDP, Difference in bilateral labour ratio, Bilateral homogeneous transport costs, Difference in differentiated and homogeneous goods transport costs	GLC, OLS
2007	C. Veeramani	Analyze the industry-specific determinants of IIT in Indian manufacturing industries	Dataset: 1994-95, 1998-99 and 2005-06	IIT	Product differentiation, Minimum efficient plant scale, Industrial concentration, FDI, Ratio of gross value added to value of output, Industry group dummies	Tobit
2007	I. Mezo	Analyze the pattern of trade among the EU 15 and the 10 countries	Dataset: 1995-2003	Intra Industrial trade	Exports and Imports	GLU
2007	Y. Xing	Analyze the dynamic changes of China's IIT with Sino-US countries	Dataset: 1990-2004	IIT	FDI, Difference in GDP, Trade balance, Trade openness	Fixed-effects, Random-effects
2008	L.G. Burange and S.J. Chaddha	Growth in India's IIT with respect to different economies	Dataset: 1987-2006	IIT	Exports and Imports	GLU, MIIT
2009	D. Bernatonyte	Investigates the extent of IIT between Lithuania and the EU and its role in export specialization	Dataset: 2001-2007	IIT	Exports and Imports	GLU

2009	C. Veeramani	Analyze the effects of trade barriers and multinationals on the intensity of IIT in a panel of Indian manufacturing	Dataset: 1988 - 1999	IIT	Trade barrier, Product differentiation, Involvement of multinationals in the domestic industry, Minimum efficient scale, Sector dummy	GLU, Random effects
2010	K. Türkcan and A. Ates	To examine patterns of trade in US auto industry	Dataset: 1989-2006	IIT	Average market size, Difference in market size, Difference in per capita GDP, FDI, Weighted Distance, Exchange Rate	GLU, Random-effects, PCSE
2010	W.C. Sawyer, R.L. Sprinkle and K. Tochkov	Examine the level of IIT for 22 countries in Ease, Southeast, South and Central Asia	Dataset: 2003	IIT	Difference in per capita GDP, Education spending, R&D, FDI, Share of manufactured exports in total merchandise exports, Trade openness, Distance, FTA dummy	Tobit, GLU
2010	D.P. Clark	Trade association between scale economies and IIT levels in US	Dataset: 2002	IIT	Minimum efficient scale	GLU, Chi-square test of independence
2011	A. Dennis and B. Shepherd	Analyze the impact of trade facilitation on export diversification	Dataset: 2005	Export Diversification	Entry Cost, Export Cost, Tariff, Distance, GDP per capita	OLS, Tobit, Fixed-effects, Negative binomial model
2011	R. Baldwin and D. Taglioni	Analyze the determinants factors explaining trade in the advanced countries	Dataset: 2000 – 2007	IIT	GDP, Trade costs, Distance, Contiguity, Common Language, Time dummies	OLS
2012	T. Ito and T. Okubo	New aspects of IIT in EU Countries	Dataset: 1988-2010	IIT	Exports and Imports	GLU
2012	D. Saslavsky and B. Shepherd	Analyze the importance of LPI on terms of trade in developing countries	Dataset: 2007	Trade Costs	LPI, Distance, Language, Contiguity, Colony, GDP	Poisson and gamma pseudo-maximum likelihood estimation, OLS
2012	M. Shahbaz, N.C. Leitão and M.S. Butt	Analyze the determinants of IIT between Pakistan and its trading partners	Dataset: 1980-2006	Log IIT	Difference in GDP, Lowest value of GDP per capita, Highest value of GDP per capita, Average GDP per capita, Distance, FDI, Trade Imbalance	OLS, Fixed-effects, Random-effects, GLU
2013	V. Botrić	Analyze the determinants of IIT between Western Balkan countries and old European Union Member States	Dataset: 2005-2010	IIT	Border, Distance, Export cost, Export time, GDP per capita, Gross fixed capital, Employment	Panel GLS method
2013	Y. Yoshida	International fragmentation and Vertical Specialization in Asia	Dataset: 1988-2006	IIT	GDP, prefecture GDP, difference in GDP per capita, prefecture intensive margin, prefecture	GLU, Fixed-effects,

					extensive margin	Random-effects
2014	N. Banik and K.C. Das	Examine the effect of IIT on location substitution effect in China	Dataset: 2000-2009	Total value of final manufactured exports	Primary, intermediate and machinery imports, GDP	GMM, Two stage least-squares
2014	R. Puertas, L. Martí and L. García	Examine the relative importance of logistic performance in export competitiveness in EU	Dataset: 2005 – 2010	Exports	LPI, Product competitiveness, Tariff	Two - Stage Heckman Model
2014	P. Varma and A. Ramakrishnan	Analyze the structure and determinants of trade in agri-food products between India and members of its FTA	Dataset: 2003-2011 at 4-digit level of HS - Classification	IIT	Difference in per capita GDP, Average GDP, Difference in GDP, Difference in Agricultural land, Distance, Difference in population, FTA dummy	OLS, Tobit, Log Likelihood
2014	S. Bano	Investigate trade intensities between New Zealand and China	Dataset: 1980-2012	Export Intensity Index and Import Intensity Index	Exports, Imports, World exports, World imports	GLU, Aquino Adjusted measure
2014	S. Kumar and S. Ahmed	Deeper trade integration between India and Bangladesh	Dataset: 1975-2010	IIT	Exports and Imports	GLU, MIIT
2014	M.L. Singh	Relationship of IIT between India and ASEAN	Dataset: 1997-2010	IIT	Institution proxied by OMI, lag (OMI)	PCA, VECM, GLU, Cointegration
2015	Ö.T. Doruk	Analyze the effect of R&D expenditure on IIT in Turkey	Dataset: 1990 - 2010	IIT	R&D	GMM, Panel Unit Root Test
2015	S. Kumar and S. Ahmed	Examine the determinants of export and import flows of countries in the South Asia	Dataset: 1985-2011	IIT	GDP, Population, Tariff, Distance, Relative factor endowments, SAFTA dummy, Border Dummy, Language dummy	OLS, Random effects
2015	S. Marius-Răzvan, S. Camelia	Examine the determinants of IIT in the motor vehicle parts and accessories sector from Romania	Dataset: 1995 - 2012	IIT	GDP per capita, Relative country size, R&D, Difference in physical capital endowments, lagged (IIT)	Panel GMM
2016	J. Lapinska	Country specific determinants of intra – industry exchange between Poland and its EU trading partners	Dataset: 2002-2011	IIT	Difference in GDP, FDI, Share of processed products in total trade volume, Degree of trade imbalance, Language, Distance, GDP	Pooled OLS, Fixed-effects, Random-effects
2016	G. Kaur, J.K. Dhami, V. Sarin	To study the impact of BIMSTEC on India and	Time Series Data: 1997-2014 (2-digit	IIT	Exports and Imports	GLU

		Thailand trade relations	HS level classification)			
2017	S. Aggarwal and D. Chakraborty	Examine the patterns and determinants of aggregate bilateral IIT between India and major trading partners	Dataset: 2001-2015	IIT	Difference in GDP per capita, Difference in capital-labour ratio, Weighted distance, interaction term of LPI, Border dummy, Language Dummy, FTA dummy	GLC, FGLS
2017	L.G. Burange, P. Thakur and H.K. Kelkar	Investigate a causal relationship between FDI and IIT in the manufacturing sector of India	Dataset: 1992-2013	IIT, FDI	IIT, FDI	Granger Causality, VECM, Cointegration
2017	K. Hayakawa, T. Ito and T. Okubo	Investigate the attributes of country-pairs that affect IIT stability	Dataset: 1994-2010	IIT	GDP, Per capita GDP, Language, Distance	OLS
2017	J. Roy	Analyse the impact of trade intensity and IIT on environmental quality	Dataset: 2000 – 2005	IIT	Difference in per capita GDP, Difference in capital-labour ratio, Distance, Language, Contiguity	OLS
2018	X. Feng	Explores the effect of IIT in skill premium in China's manufacturing	Dataset: 2001 – 2008	Skill Premium	IIT, Output, Capital, Skill intensity	OLS, Fixed effects
2019	V. Hoang	Investigate Vietnam agricultural IIT and trade dynamics	Dataset: 1997 - 2014	IIT	Exports, Imports, Trade Balance	OLS
2019	S. Aggarwal and D. Chakraborty	Examine the patterns and determinants of India's bilateral IIT in seven sectors with major trading partners	Dataset: 2001-2015	IIT	Difference in per capita GDP, Difference in capital-labour ratio, Weighted distance, LPI, Tariffline, ALP, Border dummy, Language dummy, FTA dummy, FTA*LPI	FGLS

Source: Compiled by authors

Annex 2: Source of Data used in the Empirical Model

Sl. No.	Variable	Variable Description and Data Source	Data Type
1	IIT	Grubel-Lloyd Corrected index, calculated by using import and export data taken from Trade Map (ITC, undated).	Computed by authors
2	DPCGDP	Difference in *Per Capita GDP* calculated from World Development Indicator (WDI) database (World Bank, undated b).	Computed by authors
3	D(K/L)	Measured by difference in K/L ratio, where the *Capital* and *Labour Stock* data are taken from Federal Reserve Economic Database (FRB, undated) and WDI (World Bank, undated b) respectively.	Computed by authors
4	WDIST	Constructed from direct distance between India and partner's capital (Distance Calculator, undated) and its GDP data drawn from WDI (World Bank, undated b), following Türkcan and Ates (2010).	Computed by authors
5	LPI_i*LPI_j	Multiplicative term using the Logistic Performance Index (LPI) reported for India and partner country (World Bank, undated c). As LPI data is not provided for all years, the values have been used by authors for appropriate years.	Computed by authors
6	BORDER	Dummy variable created by assigning value of 1 for countries having border with India and 0 otherwise.	Constructed by authors
7	LANGUAGE	Dummy variable created by assigning value of 1 for countries having English as a major spoken language and 0 otherwise.	Constructed by authors
8	Tariffline	Product Differentiation variable, constructed on the basis of Indian exports to ROW at the most disaggregated level, as taken from Trade Map (ITC, undated)	Constructed by authors
9	Standard Difference	Absolute difference in Environmental Performance Index (EPI) of India and trade partner, taken from YCELP (undated). As EPI data is not provided for all years, the values have been used by authors for appropriate years.	Constructed by authors
10	Manufacturing Share	Absolute difference of share of manufacturing sector in India's GDP and partner country, as obtained from WDI (World Bank, undated b).	Constructed by authors

Source: Authors' compilation

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