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AN EXAMINATION OF DETERMINANTS OF INDIA'S INTRA-INDUSTRY TRADE

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AN EXAMINATION OF DETERMINANTS OF INDIA'S INTRA-INDUSTRY TRADE

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Abstract

After economic liberalization, the share of intra-industry trade in total trade has increased significantly. Various factors such as rise in per capita income (PCI), gross domestic product (GDP), reduction in trade barriers, product differentiation and easy entry for foreign firms are the major determinants of IIT. The determinants of IIT vary from country to country. Furthermore, it also depends on whether country's IIT is dominated by vertical IIT (VIIT) or horizontal IIT (HIIT). Considering these facts, the paper attempts to identify the determinants of India's IIT during 1990–91 to 2013–14. The trends of IIT exhibit that although India's IIT is dominated by VIIT, the intensity of HIIT is also increasing from 1990–91 to 2013–14. This study employsthe Toda and Yamamoto method and applies the modified Granger causality test to identify the causal relation between IIT and its determinants. A unidirectional causality has been observed from GDP, PCI and FDI to IIT. Furthermore, a unidirectional causality has also been observed from HIIT to GDP, PCI and trade openness. Thus, it can be confirmed that trade liberalization has assisted the growth of India's IIT.

Key words: IIT, Granger Causality, VIIT, HIIT
JEL Codes**:** F140

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1. INTRODUCTION:

The Indian economy has witnessed rapid economic growth post economic liberalization. The opening up of the economy has reduced the trade barriers. Consequently, the share of merchandise trade to gross domestic product (GDP) has surged from 14.73 percent in 1992 to 41.52 percent in the 2013 (World Bank, 2015). This remarkable growth in trade has been mainly due to the increase in simultaneous exports and imports of products between industries (inter-industry trade) and within the same industry (intra-industry trade (IIT)). Under the new economic policy, preferential treatment was given to export-promotion policies as opposed to import-substitution policies adopted in the past. Furthermore, the economic liberalization has also given an impetus to economic growth, easy market access for products, foreign investments, product differentiation, economies of scale, demand for various variety of products, etc. Consequently, domestic firms began facing competition from the foreign firms. Domestic firms exploit the economies of scale to specialize in production as well as to compete with the imports. In this process, firms benefit from the reallocation of resources within the same industry. Thus, specialization of firms is reciprocated withthe growth of IIT.Therefore, various studies have analyzed the important factors for bilateral or multilateral growth of IIT.

The existing literature relating to determinants of IIT can be categorized into two parts. In the first case,the focus has been on country-specific factors. In this analysis, macroeconomic variables such as GDP, per capita income (PCI), market size, trade barriers, geographical distance, and exchange rate have been considered. While in the second case, industry-specific factors such as product differentiation, economies of scale, involvement of multinational enterprises, share of research and development, etc have been considered. However, empirical studies relating to India's IIT with world are very meager. Considering this fact, the present paper tries to examine India's IIT with the rest of the world during1991–92 to 2013–14. Moreover, this study identifies the major factors determining India's IIT. Furthermore, it examines whether an increase in economic growth, foreign direct investment (FDI), PCI and exportslead to growth of IIT. Thus, it attempts to find a causal relation between India's IIT and its determinants.

Following this brief introduction, the remainder of this study is structured as follows. Section *Two* overviews the literature on the determinants of IIT. Section *Three* covers data sources and methodology that has been applied for the analysis. Section *Four* presents the results of econometric technique and its analysis, Section *Five* presents the concluding observations.

2. REVIEW OF LITERATURE:

The literaturerelating to the determinants of IIT can be distinguished as those focusing on country-specific factors and those focusing on industry-specific factors. However, previous studies did not focus on the segregation of IIT into two parts: horizontal IIT (HIIT)and vertical IIT (VIIT). However, after the pioneering study of Abd-el-rehman (1991), IIT has been classified into HIIT and VIIT. If the products are close substitutes to each other and differentiable only in their outer attributes,then IIT of such products is considered to be HIIT. These products are,thus, similar in the terms of quality, cost and technology applied for their production. VIIT,in contrast, is associated with large differences in the quality of differentiatedproducts.Thereafter, on the basis of unit value the IIT has been segregated into VIIT and HIIT by Greenaway, Hine and Milner (GHM) (1994) and Fontagane and Freudenberg (FF) (1997). Both these methodologies have used the ratio of unit value of export to import and have chosena dispersion percentile (α) to segregate IIT into HIIT and VIIT. These methods have been widely used for empirical analysis. Azhar and Elliott (AE) (2006) indicated that FF and GHM methods did not consider the proportionality effect, *i.e*., when the unit value of exports and imports have equal but opposite sign.To solve this problem, they proposed a complementary approach'product quality space' to distinguish IIT. Further, Azhar*et al.* (2008) developed an index to measurechanges in product quality in IIT based on 'product quality space'. Existing literature reveals that segregation of IIT plays a crucial role in analyzing the determinants of IIT. Some determinants positively affect VIIT, whereassome determinants boost HIIT. Therefore, the division of IIT is necessary for a detailed analysis.

Few empirical studies have specifically focused on the determinants of VIIT and HIIT. Various studies have developed the theoretical link between various

determinants and HIIT and VIIT. Earliest studies in this regard are that of Dixit and Stiglitz (1977) and Lancaster (1980). Dixit and Stiglitz (1977) proposed the love of variety approach, whereas Lancaster propounded the favorite variety approach. Although both these approaches are based on different concepts, they highlight the fact that preferences can differ based on the outer attributes of products. Thus, there exists demand for horizontally differentiated products.On the basis of these two approaches, Krugman (1981) demonstrated a positive relation between economic growth of a country and HIIT. With the economic progress,a country can be integrated with other trading countries,thereby increasing the exchange of similar products. Therefore, the proportion of HIIT increases with economic growthanda positive relationexists between the two.

In the case of VIIT, Falvey (1981) and Shaked and Sutton (1983) demonstrated that there hasbeen a positive relation between PCI and IIT. They explained that high income countries use capital-intensive technique forproduction. Consequently, the countries will export high tech-capital intensive products,leading to VIIT.PCI is used as a proxy to measure income; therefore, increase in PCI causesVIIT.Furthermore, the integration of economy also fosterFDI. However, the link between FDI and IIT has been vague. Whether FDI would cause HIIT or VIIT depends on the purpose and nature of FDI (Markusen, 1997).

On the basis of above mentioned theoretical linkages, various studies have focused on determinants of IIT at bilateral or multilateral level. Most of the studies have taken into account country-specific determinants such as GDP growth, PCI, distance between trading partners, FDI, tariff rates, etc. (Balassa, 1986;Helpman, 1987; Bergstrand,1990; Hummels and Levinsohn, 1995; Ekanayake, 2001;Veeramani, 2002; Bhattacharyya, 2005). Furthermore, various studies have also explored industry-specific determinants of IIT (Caves, 1981; Toh, 1982; Greenaway and Milner, 1984; Hughes, 1993; Veeramani, 2007). All these studies deal with industry-specific factors such as product differentiation, advertising to sales ratio, concentration ratio, share of FDI, economies of scale and research and development expenditure for the purpose of analysis. However, these studies do not segregate IIT into VIIT and HIIT. Previous studies in this regard have been conducted by Greenaway, Hine and Milner (1994). They analysed country-specific factors affecting UK's IIT with 62 trading partner

countries for 1988. Using ordinary least squares (OLS) regression, their study exhibited that market size and membership in the custom union have positive relation with VIIT. Country-specific determinants for HIIT were not found to be significant. They concluded that the determinants of IIT differ as per its IIT.

Aturupane *et al*. (1999) examined the determinants of IIT between Central and Eastern European nations from 1990 to 1995. They employed Grubel Lloyed (GL) (1975) index to calculate IIT and GHM index to segregate IIT into VIIT and HIIT. The study utilized trade classification at six-digit level given by European Unionto calculate IIT. Furthermore, the trade data was concurred with three-digit industrial classification for firm-level analysis. Thus, firm-level datawas used to calculate industry-specific determinants. Using non-linear least squares method, they found that FDI and product differentiation had a positive and significant impact on VIIT and HIIT. However, economies of scale negatively affected HIIT, whereas it positivelyaffectedVIIT. The study concluded that HIIT was largely determined by country-specific factors. It confirmed that the intensity of the determinants of IIT vary with the nature of IIT.

Durkin and Markus (2000) explored the relation between per capita GDP differences and IIT at bilateral level. Bilateral IIT of United States with its 20 OECD partner countries was examined from 1989 to 1992. Following the GHM methodology, IIT was distinguished as HIIT and VIIT. Their results revealed that GDP per capita difference and magnitude of VIIT between the trading partners was positively related. However, no such evidence was found for HIIT. Kinnerup (2005) examined country-specific determinants of IIT of France with its 61 trading partner countries. Sheemployed the Standard Industrial Trade Classification (SITC) at the five-digit level from 1990 to 1998 and found that VIIT in France increased with each of the trading partners during the period of study. The IIT has been classified by using the methodology adopted by Abd-el-Rahman (1991). The result confirmed that PCI and trade intensity positively related to HIIT. Difference in human capital revealed a positive relation, whereas that of average market size exhibited a negative relation with HIIT. In the case of VIIT, none of the variableswere significant, except trade intensity that positivelyaffected VIIT.

Cabral *et al*. (2013) studied the IIT of European Union with 51 trading partner countries for 2002.They used the GHM method to segregate IIT. Following Chamberlain–Heckscher–Ohlin model, the study confirmed that the share of HIIT declined with the increase in factor endowments difference between the countries. However, the relation with VIIT varies with the intensity of factor endowment difference between countries. VIIT did not exhibit any specific relation. All these studies explained that factors determining HIIT and VIIT differ. However, none of the studies analysed the causal relation between IIT and various other determinants.

Bhattacharyya (2005) examined the causal relation between IIT and economic development for Korea. IIT was calculated using SITC revision 3 from 1963 to 1995. IIT was measured using the GL index. Furthermore,the GHM index was used to segregate IIT into HIIT and VIIT. The co-integration results revealed the existence of a long-run relation between economic development and VIIT. Following the vector error correction model for Granger causality, the study showcased a unidirectional causality from economic development to VIIT. However, no causality was found between economic development and HIIT.

In the case of India, Das (2005) explored the determinants of India's IIT with the world, Asian economies and developed countries. The GL index for SITC manufactured products was measured from 1975 to 1992. His analysis revealed that the share of IIT increased during the underlying period. Using the OLS method,the study demonstrated that economic development proxied by per capita gross national product positively affected IIT. Furthermore, trade openness and the share of manufacturing export in total exports also demonstrated positive relation with IIT. Furthermore, theratio of total trade to GDP exhibited a negative relation with IIT. However, the segregation of IIT was not considered to analyse the impact of each of these variables on HIIT and VIIT.

It can be therefore deduced that the determinants of IIT can differ as per the nature of the IIT. Various country- and industry-specific factors led to the growth of IIT. As per the empirical literature, the causal relation between IIT (HIIT and VIIT) and its various determinants differ from country to county. Therefore, the objective of the paper is to analyze the causal relation between IIT of India and its determinants for

the post-liberalization period. Therefore, India's IIT has been segregated into HIIT and VIIT. Such a type of analysis will help to understand the determinants of India's IIT. Moreover, distinguishing IIT into HIIT and VIIT will aid to investigate the causal relation at the most disaggregated level. Thus, present analysis would extend another aspect of determinants of IIT and will fill the existing gap in the literature.

3. DATA SOURCES AND METHODOLOGY:

This section discusses the data sources, construction of the variables and methodology applied for the analysis. Sub-section 3.1 focuses on various data sources and adjustments made with the data. Moreover, construction of the variables has also been discussed in this sub-section. The measurement of GL, HIIT and VIIT indices are also covered. These variables are then used for econometric analysis. The detailed methodology adopted for the study is explained in sub-section 3.2.

3.1. Data Sources, Adjustments and Construction of Variables:

In order to analyze the determinants of IIT the study relied onthe secondary data sources. The study utilized India's foreign trade data given by INDIA TRADES compiled by the Center for monitoring Indian Economy (CMIE) which is published by Directorate General of Commercial Intelligence and Statistics (DGCI&S) of Indiain the *Monthly Statistics of Foreign Trade*. The value of import is measured oncost, insurance, freight (C.I.F.) and that of exports on free on board (F.O.B.). This is the major problem with values of imports and exports, but estimating both values of exports and imports in one price system is beyond the scope of this paper. Therefore, it could be a limitation of the paper.The study makes use of Harmonized System (HS), eight-digit classification for 1990-91 to 2013-14.The data for GDP, PCI and FDI have been obtained from the Handbook of Statistics on the Indian Economy, published by Reserve Bank of India. The data is in Rupees Billion, which is converted into US Dollars Million by dividing annual average exchange rate (RBI, 2014). Since, the original data is at current prices, indices of real effective exchange rates have been used to convert it into constant prices with 2004-05 as the base year (RBI, 2014).

In order to find out the determinants of IIT, first step is to construct the GL index. The GL index measures the degree of IIT. The index lies between 0 and 100. If exports for a year exactly matchits imports, the GL index takes the maximum value of 100. In contrast,zero indicates only the inter-industry trade and no IIT.

$$GL_i = \frac{(X_i + M_i) - |X_i - M_i|}{(X_i + M_i)} \times 100 \qquad \ldots\ldots\ldots\ldots (1)$$

where,

GL_i= IIT of the i^{th}product

X_i= Exports of the i^{th}product

M_i= Imports of the i^{th}product

For aggregating the GL indexat two-digit such as a section, weighted average is used where the weights are considered as the share of each product in the total trade. Furthermore,compound annual growth rate (CAGR) using the semi-log method has been computedto analyse the growth of IIT.In the second stage, IIT has been segregated into VIIT and HIIT using 'product quality space' method developed by Azhar and Elliott (2006). The unit value is measured as the division of monetary value of the product divided by the quantity to segregate IIT.After computing unit value for the given product, the index has been given as

$$PQV_i = 1 + \frac{UV_i^x - UV_i^M}{UV_i^x + UV_i^M} \qquad \ldots\ldots\ldots\ldots (2)$$

where,

PQV_i = Product Quality Index of i^{th} Product

UV_i^x= Unit Value of Exported i^{th} Product

UV_i^M = Unit Value of Imported i^{th} Product

According to Azhar and Elliott (2006), a two-way trade in the products is considered as horizontally differentiated if import and export unit value of a product is atleast 85 percent of their cost. With the cut-off of 85 percent, the PQV index distinguishes IIT. Similarly, if the cost of the country's exported product share is 50

percent of the imported product cost, then it is considered as a vertically differentiated product of high quality. Thus, from the home country perspective, IIT is classified as HIIT, if 0.85 < PQV < 1.15 and VIIT otherwise. VIIT is further classified into low quality vertically differentiated products if PQV<0.85 and considered as high quality vertically differentiated product if PQV >1.15. To summarize the result at section level, weights for PQV index have been assigned as follows:

$$w_i = \frac{UV_i^X + UV_i^M}{\sum_{i=n}^{n}(UV^X + UV^M)} = \frac{UV_i^T}{\sum_{i=n}^{n} UV_i} \quad \ldots\ldots\ldots\ldots\ldots (3)$$

Superscript T refers to total import and export unit values. Thus, the weighted PQV of i^{th} product takes the following form:

$$PQV_{wi} = PQV_i \frac{UV_i^T}{\sum_{i=n}^{n} UV_i} \quad \ldots\ldots\ldots\ldots\ldots (4)$$

The other variables used to estimate the causal relation are constructed as follows:

3.1.1.Gross Domestic Product (GDP): It is considered as an indicator of economic growthof the country. The data for GDP at constant prices with base year 2004–05 is considered for the analysis.

3.1.2. Per Capita Income (PCI):PCI is defined byPer Capita Net Domestic Product at constant prices of 2004–05. It is used as an indicator of purchasing power of the people in a country.

3.1.3. Industrial Performance (EG): It is estimated by taking the ratio of India's export of merchandise goods to India's GDP. EG is used as a proxy for industrial performance of India (Bhattacharyya, 2005).

3.1.4. FDI: FDI inflows are an indicator ofparticipation of the multinationals in the production process.This indicator is assumed to positively influence IIT.However, the causal relation is dependent on the nature of FDI (Veeramani, 2002).

3.1.5. Hufbauer Index (HI): HI is constructedusing the ratio of standard deviation of the export unit values to its un-weighted mean. It indicates the variation in the export unit valuesand thus is used as a proxy for product differentiation. Itis expected to positively influence IIT.

3.1.6. Trade Openness (TO): It is defined astheratio of total tradeto GDP of India. It represents the trade openness of the country. The more the ratio, the higher is the countries' integration with the world trade,increasing IIT. Therefore, we expect positive relation with IIT (Das, 2005).

3.2. Estimation of Causality:

The main objective of the study is to find the determinants of IIT in India. After defining all the variables, the Granger causality test is employed to identify the causal relation between these variables and IIT. X_t is said to granger cause Y_t if lagged values of X_t provide statistically significant information to forecast Y_t. The null hypothesis of X_t not granger causing Y_t is tested using standard F-test. Therefore, the causality between the IIT and conserved variables can be given as follows:

$$LIIT = f (LGDP, LPCI, LEG, LFDI, LHI, LTO) \quad \ldots\ldots\ldots\ldots (5)$$

where,

LIIT = Log of GL index
LGDP = Log of GDP
LPCI = Log of PCI
LEG= Log of merchandise export as a percentage of GDP
LFDI= Log of FDI
LHI = Log of HI
LTO = Log of total trade as a percentage of GDP

Therefore, in the first step, the stationarity of the time series is verifiedusingthe Augmented Dickey–Fuller (ADF) test developed by Dickey and Fuller (1979). The null-hypothesis of non-stationary is tested against the alternative hypothesis of stationarity. The t-statistic is compared with appropriate critical values designed by

Dickey and Fuller to check the stationarity of the variables. If the value of t-statistic is greater than the critical value, thentime-series is confirmed as a stationary (Enders, 2004). If the variables are found to be stationary at the levels, then the standard vector autoregressive (VAR) model can be used to estimate the causal relation. Moreover, if all variables are integrated of order one, then vector error correction model(VECM) can be applied to find the causal relation. However, if variables are found to be a mixture of level stationary and first difference stationary, then VAR and VECM cannot be used to analyse the causality. In such a situation, the methodology proposed by Toda and Yamamoto (1995) can be used to establish the causality.

Toda and Yamamoto (1995) developed atechnique to estimate the causal relation for the variables with different order of integration.The Toda and Yamamoto approach is based on Granger non-causality equation with an extra lag determined by the order of integration. The method proposed by Toda and Yamamotois also known as the modified Wald test. Thisprocedure requires the estimation of an augmented VAR in three steps. In the first step, the lag length (k) is determined using the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC).The second step is the selection of the maximum order of integration (d_{max}) for the variables in the system. In the final step, augmented VAR is formulated with selected lag splus the maximum order of integration ($k+d_{\max}$) (Toda and Yamamoto, 1995).

4. EMPIRICAL RESULTS:

The empirical results based on the methodology explained in the earlier sections are presented in the following two sub-sections. The first sub-section describes the performance of India's IIT during post-liberalization period. Section 4.2 explains the determining factors for the growth of India's IIT and exhibitsthe results from the causality test.

4.1. Performance of India's IIT:

Performance of India's IIT is analyzed using the GL index for the period 1990–91 to 2013–14. The slop of the trend line in Figure 1 confirms that India's IIT has been growing over the period of time. As shown in Table 1, the GL index stood at 7.09 in

the year 1990–91.The IIT index reached a double digit mark in 1996–97 and remained persistent thereafter. In the year 2008–09, the IIT index reached its peak at 24.09. This steady increase in IIT led to 5.61 percent CAGR for nearly two decades of

Table 1: Index of India's IIT at the eight-digit level

Year	GL-Index
1990-91	7.09
1991-92	6.93
1992-93	7.21
1993-94	7.89
1994-95	8.95
1995-96	9.52
1996-97	10.01
1997-98	11.39
1998-99	10.52
1999-00	11.09
2000-01	12.02
2001-02	13.04
2002-03	13.35
2003-04	15.48
2004-05	16.51
2005-06	16.54
2006-07	18.46
2007-08	19.63
2008-09	24.09
2009-10	20.79
2010-11	23.43
2011-12	19.48
2012-13	20.24
2013-14	19.53
CAGR (%)	**5.61**

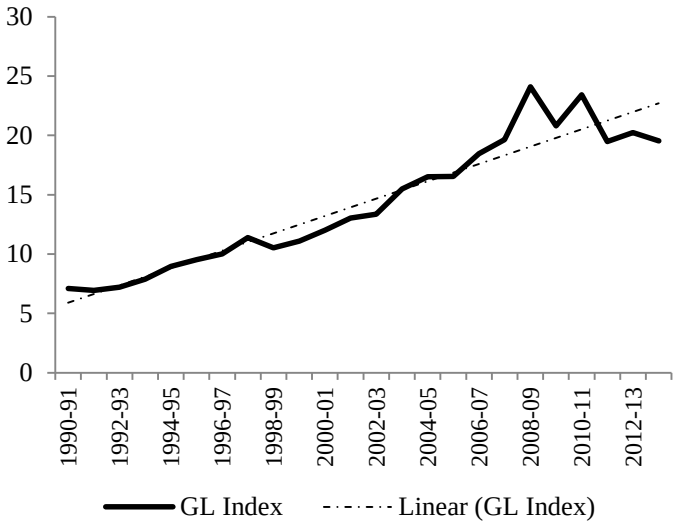

Figure 1: Index of Indi's IIT at the eight-digit level

the study. Rising IIT over the last 24 years has been influenced by many factors. In the wake of 21stcentury, the IIT of India has significantly increased. The contribution of IIT to total trade has also increased. The GL index recorded the highest level in 2008–09, which is largely driven by VIIT. Greater degree of IIT reveals that trade liberalization entails to reallocate resources within the industry rather than between industries.Thus, it can be inferred that trade liberalization boosts IIT.

On the basis of unit value measurement, the GL index is decomposed into HIIT and VIIT. The unit value is the average price of the product in the given bundle. Therefore, the products for which quantity data are unavailable have not been classified into HIIT and VIIT. The number of products for which either quantity or value data is missing is declining over the period of time. India's exports and imports of products

within the same industry with marginal difference in the price are classifiedas HIIT. However, the export and import unit price significantly varies,which means that products differ in terms of quality and thus areclassified as VIIT. As mentioned in the methodology, VIIT is further classified into two categories: low-quality VIIT and high quality VIIT. When the import unit value is higher than the export unit value, it implies that the country tends to export cheaper variety of products for which it imports the costlier variety. Such products are classified as low-quality VIIT. Second, when India exports relatively high-priced products in comparison with its imports, these products are classified as high-quality VIIT.The change in the share of vertically and horizontally differentiated products exhibited the qualitative shift in the nature of IIT. Therefore, the decomposition of IIT index into HIIT and VIIT in Table 2 suggests that India's IIT is primarily dominated by low-quality VIIT.

Table 2: Segregation of IIT index into HIIT and VIIT

Year	IIT						
	IIT Total (IIT + IIT not classified)	**IIT**	**IIT not classified***	**HIIT**	**VIIT** (LVIIT+HVIIT)	**LVIIT**	**HVIIT**
1990-91	7.09	6.47	0.62	1.53	4.94	4.12	0.81
1991-92	6.93	5.85	1.08	1.07	4.78	4.03	0.75
1992-93	7.21	6.46	0.75	1.33	5.13	4.38	0.75
1993-94	7.89	7.28	0.61	1.87	5.41	4.57	0.84
1994-95	8.95	8.36	0.59	1.94	6.42	4.72	1.70
1995-96	9.52	8.92	0.60	2.34	6.58	4.79	1.79
1996-97	10.01	9.67	0.34	2.61	7.06	5.10	1.96
1997-98	11.39	10.95	0.44	2.36	8.59	5.64	2.95
1998-99	10.52	10.09	0.43	2.05	8.04	5.39	2.65
1999-00	11.09	10.76	0.33	2.48	8.28	5.09	3.19
2000-01	12.02	11.50	0.52	2.58	8.92	5.51	3.41
2001-02	13.04	12.54	0.50	3.19	9.35	5.95	3.40
2002-03	13.36	12.68	0.68	3.45	9.23	5.88	3.35
2003-04	15.48	15.26	0.23	3.76	11.50	6.97	4.53
2004-05	16.51	16.15	0.36	4.04	12.11	6.69	5.42
2005-06	16.54	16.13	0.41	4.75	11.38	6.72	4.66
2006-07	18.46	18.07	0.39	7.47	10.60	6.75	3.85
2007-08	19.63	19.04	0.59	8.95	10.09	6.13	3.96
2008-09	24.09	23.55	0.54	8.12	15.43	7.88	7.55
2009-10	20.79	20.16	0.63	9.33	10.83	7.00	3.83
2010-11	23.43	22.92	0.51	12.49	10.43	6.91	3.52
2011-12	19.48	19.36	0.12	6.00	13.36	7.08	6.28
2012-13	20.24	20.12	0.12	7.96	12.16	7.48	4.68
2013-14	19.53	19.39	0.14	8.75	10.64	7.38	3.26
CAGR (%)	**5.61**	**6.07**	**-4.86**	**9.86**	**4.28**	**2.74**	**8.29**

*Either value or quantity data is not available

India's IIT is dominated by the low-quality VIIT because of export and import of similar products within the machinery and mechanical appliances (S-16), products of chemical and allied industries (S-6), plastic and rubber articles (S-7). These sections recorded low-quality VIIT throughout the period of the study as it is clear from Appendix Table A1. Prepared foodstuffs beverage and tobacco (S-4) also contributed to low-quality VIIT products where the unit price of Indian exports was lower than that of the imports of products. In the case of live animals (S-1) before the year 1999–2000,India was exporting the products at high unit prices and importing at low unit prices. However, India exported the products at low unit prices and imported it at high unit prices from 2000. The product quality of hide skin and leather products (S-8) has also improved from 1995-96 onward.

Furthermore, it can be also noted that IIT in horizontally differentiated products have increased over the period of time. The composition of horizontally differentiated products has witnessed a significant change during 1990–91 to 2013–14. The IIT index of HIIT spiked to 12.49 in 2010–11. The Index of HIIT was 1.53 in 1990–91which has increased to 8.75 in the year 2013–14.The increase in HIIT reveals the narrowing gap between export and import unit prices. The VIIT index stood at 4.94 in 1990–91 which registered double-digit growth of 11.50 in year 2003–04 and was persistent thereafter. It increased at a CAGR of 4.28 percent during the period of the study.

The economic theory has suggested the positive correlation between economic growth of the country and product quality. With economic development of the country, the product quality chain improves from low-quality VIIT to HIIT. The unit price difference between export and import has declined. Furthermore, the unit price of export increased over the import and overall IIT shifted toward high-quality VIIT. This states that the country is improving on its quality ladder. The increased HIIT and high-quality VIIT confirms that India is on the path of quality ladder.

4.2.CausalityTest Results:

To analyse the causal relation between IIT and underlying variables,athree-step procedure has been adopted. In the first step, stationarity of the variables are tested

using the ADF test.The time trend is found to be significant.Therefore, the model with constant and time trend has been chosen for the analysis. The results of ADF test are presented in Table 3. The null hypothesis of the existence

Table 3: ADF Test Results

	LEVEL			FIRST DIFFERENCE			Order of Integration
Variable	**t-statistic**	**Critical Value***	**P-value**	**t-statistic**	**Critical Value***	**P-value**	
GL	-1.37	-3.64	0.84	-7.09	-3.63	0.00	I (1)
HIIT	-3.03	-3.62	0.15	-6.14	-3.63	0.00	I (1)
VIIT	-0.76	-3.64	0.95	-5.30	-3.66	0.00	I (1)
GDP	-3.91	-3.62	0.03	--	--	--	I (0)
PCI	-3.89	-3.62	0.03	--	--	--	I (0)
EG	-5.13	-3.66	0.00	--	--	--	I (0)
FDI	-3.65	-3.63	0.05	--	--	--	I (0)
HI	-6.65	-3.62	0.00	--	--	--	I (0)
TO	-2.73	-3.62	0.23	-5.19	-3.63	0.00	I (1)

*indicates critical values at 5 percent level of significance.

of unit root has been tested for all the variables. It can be inferred from Table 3 that variables such as GDP, PCI, EG, FDI and HI are found to be stationary at levels. In contrast, variables such as GL, HIIT, VIIT and TO are non-stationary at levels. These variables become stationary after first differencing. The time trend is found to be significant for the variables. Therefore, the model with constanttrend is chosen to formulate a VAR. The Toda and Yamamoto (1995) method has been used to construct a VAR of the variables with different order of integration. The proposed methodology has an advantage that VAR can be constructed irrespective of the order of integration and co-integration properties. Before proceeding with the causality test, one lag has been chosen based on AIC and SBC (Table, 4).

Table 4: Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	107.122	NA	3.91E-13	-8.706	-8.360	-8.619
1	263.096	203.443*	4.4000*	-18.008*	-15.243*	-17.313*

* indicates lag order selected by the criterion

Furthermore, the results of the modified Wald test are presented in Table 5. It can be seen from the table that a unidirectional causality exists from GDP, PCI, FDI

and HI to IIT. However, causality from IIT to these variables is not found. It can betherefore inferred that economic growth, rise in PCI and product differentiation increase the IIT of India. This result is in line with the theoretical explanation which that the proportion of IIT increases with the economic growth of the country. It can

Table 5: Toda-Yamamoto Causality Test Results for IIT

Null Hypothesis	Chi-square	Probability	Granger Causality
GDP Does not Granger Cause IIT	9.111009***	0.0025	GDP to IIT
IIT Does not Granger Cause GDP	2.410873	0.1205	
PCI Does not Granger Cause IIT	9.187177***	0.0024	PCI to IIT
IIT Does not Granger Cause PCI	2.486139	0.1149	
EG Does not Granger Cause IIT	0.054789	0.8149	No Causality
IIT Does not Granger Cause EG	1.146576	0.2843	
FDI Does not Granger Cause IIT	3.818573**	0.0507	FDI to IIT
IIT Does not Granger CauseFDI	0.538653	0.463	
HI Does not Granger Cause IIT	3.762445**	0.0524	HI to IIT
IIT Does not Granger Cause HI	0.153541	0.6952	
TO Does not Granger Cause IIT	0.246591	0.6195	No Causality
IIT Does not Granger Cause TO	0.52918	0.467	

***and** denote1 and 5 percent l.o.s .respectively.

also be argued that with the liberalization of the Indian economy, policy effort has been made to reduce the trade and investment barriers. Consequently, import-substitution policy has been substituted by export promotion policy. All these factors have increased GDP, PCI and FDI in India. Rise in PCI of the people has led to the demand for differentiated products. The increase in demand for various products has boosted product differentiation, leading to the exchange of similar products between the countries. Consequently, the unidirectional causal relation from HI to IIT is found to be significant. No causality is found between EG and IIT for the entire period of the study. Similarly, trade concentration ratio does not cause IIT. After looking at the determinants of IIT, the analysis can be extended to HIIT and VIIT.

Table 6 exhibits a unidirectional causality from HIIT to GDP, PCI and TO. Although, India's IIT is dominated by VIIT, the share of HIIT is also increasing rapidly. Rise in HIIT implies that the gap between export unit value and import unit value of

the products is narrowing. This has positive impact on economic growth, PCI and trade openness. Thus, past values of HIIT assist the growth

Table 6: Toda-Yamamoto Causality Test Results for HIIT

Null Hypothesis	Chi-square	Probability	Granger Causality
GDP Does not Granger Cause HIIT	0.538621	0.463	HIIT to GDP
HIIT Does not Granger Cause GDP	25.25233***	0.000	
PCI Does not Granger Cause HIIT	0.335092	0.5627	HIIT to PCI
HIIT Does not Granger Cause PCI	25.26672***	0.000	
EG Does not Granger Cause HIIT	11.81914***	0.0006	EG to HIIT
HIIT Does not Granger Cause EG	0.165721	0.6839	
FDI Does not Granger Cause HIIT	0.475926	0.4903	No Causality
HIIT Does not Granger CauseFDI	0.033141	0.8555	
HI Does not Granger Cause HIIT	1.337197	0.2475	No Causality
HIIT Does not Granger Cause HI	0.015122	0.9021	
TO Does not Granger Cause HIIT	14.60798***	0.0001	HIIT to TO
HIIT Does not Granger Cause TO	0.649055	0.4205	

*** denotes 1 percent l.o.s.

process of GDP, PCI and TO. However, no causality is observed from GDP, PCI and TO to HIIT. Similarly, causality from EG to HIIT has also been observed. It suggests that increase in export as a percentage of GDP boosts the demand for similar products. It can also be inferred from Table 6 that no causal relation exists between FDI and HIIT.

Similarly, causal relation between VIIT and other variables is tested using Toda-Yamamoto Granger causality test. Significance of all the coefficients in the vector using chi-square distribution of modified Wald test is presented in Table 7. A unidirectional causality exists from GDP to VIIT. Furthermore, one-way causality from PCI to VIIT has also been observed. These results match with the theoretical expectations. This might be due to the fact

Table 7: Toda-Yamamoto Causality Test Results for VIIT

Null Hypothesis	Chi-square	Probability	Granger Causality
GDP Does not Granger Cause VIIT	3.50805*	0.0611	GDP to VIIT
VIIT Does not Granger Cause GDP	0.15542	0.6934	
PCI Does not Granger Cause VIIT	3.85995**	0.0495	PCI to VIIT
VIIT Does not Granger Cause PCI	0.18497	0.6671	
EG Does not Granger Cause VIIT	1.64587	0.1995	VIIT to EG
VIIT Does not Granger Cause EG	4.10196**	0.0428	
FDI Does not Granger Cause VIIT	0.38667	0.5341	No Causality
VIIT Does not Granger CauseFDI	0.00367	0.9517	
HI Does not Granger Cause VIIT	0.06472	0.7992	No Causality
VIIT Does not Granger Cause HI	1.12034	0.2898	
TO Does not Granger Cause VIIT	1.57246	0.2098	VIIT to TO
VIIT Does not Granger Cause TO	3.03733*	0.0814	

** and* denote5 and 10 percent l. o. s. respectively

that India has abundant supply of labour and relative scarcity of capital. Thus, India exports labour-intensive products and imports capital-intensive products. Although India's import basket is determined by high-technological products, it also exports similar low-technology intensive products (Das, 2005). Therefore, increase in GDP and PCI leads to the import of high-technology products from advanced countries;simultaneously, economic growth of the country promotes exports of intermediate products of same variety. These exports and imports of technologically differentiated products boost VIIT which reflects in unidirectional causality from GDP and PCI to VIIT. Furthermore, such type of exports is based on manufactured products which accountsa large share in the export basket. Thus, it might also been reason for unidirectional causality from VIIT to EG and trade openness.

In addition, it can also be inferred from Table 7 that no causality is found between FDI and VIIT as well as between HI and VIIT. It is also observed that one-way causality exists from trade openness to VIIT. This is due to the fact that trade liberalization favoured the reallocation of resources to intra-industry rather than inter-industry (Veeramani, 2002). Such type of reallocation has been dominated by vertically

differentiated products. As a result trade openness causes VIIT. Thus, it can be stated that increasing GDP and PCI is boosting the IIT. These results support the theoretical underpinning developed by Falvey (1981) and Shaked and Sutton (1983).

5. CONCLUSIONS:

This study examined the determinants of India's IIT for the post-liberalization period. The IIT of India significantly increased from 1990–91 to 2013–14. It registered a CAGR of 5.61 percent per annum during the period of study. Furthermore, it can also be inferred that this growth in IIT has been largely influenced by VIIT. In contrast, the dominance of HIIT has been found to be increasing over the period of time. The narrowing gap between export unit prices and import unit prices hasincreasedthe HIIT of India. With economic growth of the country, GDP and PCI also increased. As per the economic theory, a positive relationexists between economic growth and IIT. This relation is analysed using the modified Granger causality test developed by Toda and Yamamoto (1995). For estimations,variables such as GL, GDP, PCI, export to GDP ratio, FDI, HI and trade openness are used. Moreover, the causal relation between these variables and HIIT and VIIT has also been assessed.

For determiningthe causalrelation, the Toda-Yamamoto technique has been applied where the variables are co-integrated of different order. The results asserta unidirectional causality from GDP, PCI and FDI to IIT. The economic growth of India has boosted IIT. This confirms that the proportion of IIT has increased with the economic growth. Furthermore, Indian government also adopted the policies attracting the FDI into various sectors. As a result, the increase in FDI is leading to the growth of simultaneous exports and imports of products within the same industry. Therefore, policies in favour of FDI inflows assist the growth of IIT.

In addition,the segregation of IIT into HIIT and VIIT exhibits that the factordetermining each type of IIT is different. Aunidirectional causality from HIIT to GDP and PCI has been observed. However, the direction of causality has been reversed for VIIT. A one-way causality is running from GDP and PCI to VIIT. The result for IIT and VIIT showssimilar direction mainly because of dominance of VIIT in total IIT. Moreover, HIIT and VIIT lead to trade openness. The growing proportions of HIIT and

VIIT indicate that India's foreign trade is integrating with the world's trade. Consequently, increasing trade to GDP ratio helped IIT to grow. In a nutshell, opening up of the economy has not only increasedGDP, PCI, FDI, export to GDP ratio and product differentiation but also IIT.

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Appendix

Table 1: Index of India's Product Quality Space for Sections (Weighted Average of the Eight-Digit)

Section	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
1	1.21	1.20	1.21	1.14	1.25	0.23	1.02	1.93	0.59	1.01	0.81	0.72	0.64	0.57	0.09	0.41	0.35	0.58	0.25	0.70	0.07	0.82	0.28	0.16
2	0.09	0.75	0.21	0.71	0.64	0.58	0.95	0.87	0.79	0.89	0.82	0.85	0.91	0.68	1.03	0.76	0.62	0.41	0.42	0.66	0.64	0.63	0.37	0.55
3	1.50	1.34	1.14	1.07	1.19	0.97	1.19	1.32	1.23	0.94	1.20	1.25	1.18	1.06	0.83	0.83	0.80	0.72	0.65	0.81	0.07	0.91	0.74	0.30
4	0.58	0.71	0.41	0.43	0.44	0.64	0.54	0.72	0.86	0.58	0.77	0.69	0.53	0.69	0.60	0.63	0.62	0.71	0.69	0.63	0.65	0.84	0.87	0.78
5	0.59	0.93	0.42	0.61	0.72	0.57	1.62	0.86	0.87	1.22	0.66	0.43	0.65	0.54	0.44	0.20	0.77	0.83	0.74	0.36	0.78	0.82	0.75	0.98
6	**0.80**	**0.76**	**0.80**	**0.65**	**0.51**	**0.72**	**0.42**	**0.55**	**0.46**	**0.33**	**0.72**	**0.77**	**0.51**	**0.49**	**0.28**	**0.22**	**0.31**	**0.28**	**0.40**	**0.27**	**0.17**	**0.24**	**0.14**	**0.25**
7	**0.19**	**0.25**	**0.22**	**0.25**	**0.32**	**0.35**	**0.30**	**0.42**	**0.58**	**0.49**	**0.42**	**0.54**	**0.60**	**0.72**	**0.46**	**0.39**	**0.29**	**0.43**	**0.49**	**0.36**	**0.57**	**0.33**	**0.36**	**0.39**
8	1.18	0.84	0.63	0.41	0.63	0.81	1.03	1.10	1.00	1.02	1.08	1.12	1.18	1.12	1.17	1.21	1.10	1.40	1.00	1.32	1.21	1.64	1.18	0.99
9	0.80	1.08	0.63	0.51	0.09	0.35	0.36	0.79	0.78	0.83	1.54	0.80	0.91	0.98	0.95	1.08	0.92	0.83	1.61	1.08	1.14	1.03	1.19	1.04
10	1.08	0.86	0.71	0.81	1.00	0.81	0.74	0.58	0.32	0.35	0.32	0.29	0.23	0.22	1.68	0.90	1.83	0.09	1.95	1.73	1.31	0.25	0.99	0.40
11	1.03	1.03	0.86	0.90	0.25	0.87	1.00	0.91	0.94	0.98	0.92	1.00	0.99	0.67	0.78	0.72	0.66	0.58	0.51	0.63	0.65	0.73	0.63	0.79
12	1.34	1.40	1.14	1.15	1.30	1.26	0.79	0.64	0.97	1.13	0.92	1.02	1.01	1.30	1.10	1.16	1.19	1.23	1.48	1.25	1.42	1.26	1.18	1.31
13	0.70	0.30	0.78	0.28	0.81	1.48	0.39	0.33	0.34	0.46	0.28	0.40	0.44	0.91	0.70	0.75	0.77	0.83	0.75	0.72	0.71	0.51	0.72	0.76
14	1.30	1.26	1.26	0.87	0.76	0.96	1.27	1.26	1.00	0.95	1.00	1.02	0.67	0.78	0.63	0.79	0.77	0.34	0.75	0.26	0.93	1.44	0.65	1.17
15	0.38	1.07	0.47	0.29	0.78	0.90	0.79	0.58	0.76	0.71	0.74	0.66	0.75	0.67	0.72	0.79	0.77	0.87	0.93	0.98	1.75	0.93	1.00	1.02
16	**0.13**	**0.16**	**0.18**	**0.26**	**0.33**	**0.33**	**0.51**	**0.35**	**0.40**	**0.39**	**0.53**	**0.27**	**0.49**	**0.38**	**0.36**	**0.36**	**0.56**	**0.38**	**0.21**	**0.38**	**0.42**	**0.28**	**0.32**	**0.61**
17	0.25	0.12	0.56	0.77	0.64	0.36	0.47	0.54	0.25	0.45	0.03	0.57	0.97	0.57	0.54	1.19	0.63	0.60	1.19	0.28	0.43	0.52	0.38	0.67
18	0.77	0.39	0.20	0.77	0.35	0.46	0.29	0.28	0.46	0.45	0.49	0.50	0.64	0.61	0.41	0.31	0.32	0.32	0.28	0.40	0.32	0.39	0.28	0.28
19	0.00	0.00	1.57	0.77	0.51	0.24	1.53	0.21	0.64	1.13	1.23	1.75	0.49	0.49	1.23	0.61	0.48	0.19	0.91	0.48	0.16	0.75	0.45	1.44
20	0.84	0.67	0.92	0.73	0.15	0.23	0.93	0.56	0.66	0.65	0.48	0.75	0.51	0.83	0.79	1.08	0.80	0.99	0.85	1.38	1.56	1.73	0.54	0.37
21	0.00	0.00	0.13	0.14	0.19	0.13	0.09	0.45	0.02	0.35	1.16	1.04	0.31	0.07	0.45	0.24	0.19	1.21	1.36	0.28	0.16	0.20	0.11	1.12

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