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Exploring the Determinants of India's Intra-Industry Trade: A Panel VAR/VECM Approach

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Abstract

Intra-Industry Trade (IIT) is a simultaneous import and export of similar goods and services by a country. This type of trade pattern has become an integral part of not only India's trade but also for World. Since comparative advantage is not mandatory and adjustment costs are also lower, therefore, this type of trade is supposed to be better than the conventional trade pattern. A country has to identify its key determinants which may promote the IIT, to be a successful player in the long run. The present study is an attempt to identify the key determinants of India's IIT with different country groups. The paper employed panel VAR/VECM model to find out the cause and effect relationships between the determinants and IIT. The data ranges from the year 1991 to 2013 and the findings reveal that indicators of economic distance like per-capita GDP difference and capital-labor ratio are not found to significant for causing IIT, however, the indicator for absolute values of economic size like per-capita GDP and capital-labor ratio are found to be the factors which are causing IIT. Therefore, India needs to pay more attention on its trade policies to get maximum benefits from IIT.

Keywords: *Capital-labor ratio, GDP, Intra-Industry Trade, VAR, VECM, Granger Causality, Stationarity, Cointegration*

1. Introduction

Intra-Industry Trade (IIT) is a simultaneous import and export of similar goods and services by a country. The phenomenon, although discovered late (1950s), but soon became one of the important trade theory to explain the reasons for international trade. The research in the direction propelled specially after Balassa (1966) [1] coined the term "Intra-Industry Trade" and Grubel and Lloyd (1971) [2] proposed its measurement technique. A country should formulate policies to promote IIT because it does not require the comparative advantage and it leads to equitable income distribution which is in contrast to classical and neo-classical trade theories which focuses mainly on comparative advantage, therefore, IIT stimulates innovations and exploits economies of scale (Ruffin, 1999) [3]. With the passage of time, the proportion of IIT has increased significantly not only in the world trade but also for India's international trade. Brulhart (2008) [4] calculated the GL-index for the world and found that the degree of GL-index has increased significantly from 20% to 44% during 1962 to 2006. On the other hand, Srivastava and Medury (2010, 2011) [5,6] found that the 6-digit GL-index for India has increased from 29.8% to 34% during 1988 to 2008 and predominantly, it is vertical in nature.

In early 1980s, IIT was disentangled into two categories – horizontal intra-industry trade (HIIT) and vertical intra-industry trade (VIIT). In case of former, the products differ in attributes but do not differ significantly in quality or price and the producers of the industry are assumed to use same factors of production/techniques, while in latter case, products differ significantly in terms of quality and in-turn price also. Thereafter, it has been proposed that the countries, with similar factor endowments, will trade more on IIT, specially HIIT, while dissimilar economies will have more inter-industry trade or VIIT. Therefore, a large number of researches have been done on exploring the determinants of IIT but most of the researches are on developed countries and only few studies are for developing or least developed countries (LDCs).

Moreover, there are only a few studies on India's IIT and it is largely unexplored area which needs more attention for research. The present study tries to explore the determinants of India's IIT not only with the different country groups but also with the world. The study, to the best of author's knowledge, first time uses the panel causality test to find out the determinants of India's IIT with different country groups and with the world as such. The remainder of the paper is organized as follows: Section II deals with the brief literature review, Section III deals with the methodology of the study, Section IV deals with the data analysis and result, and in the last, Section V deals with the conclusion and scope of future research.

2. Literature Review

Till the early 1950s, it was believed that the international trade is a case of inter-industry trade and comparative advantage was supposed to be the key factor playing role in the international trade. Contemporary trade theories, specially Ricardian and Hecksher-Ohlin theories advocated

the philosophy of comparative advantage as a reason for international trade. Later on, in late 1950s, Leontief's Paradox changed the entire scenario. Leontief found that during 1950s, US which is a capital-rich country, is importing capital intensive product more and exporting labor intensive products more. Linder, in 1961, found that countries with similar per capita income have similar demand patters which resulted into the trade of almost similar products. Later on, Hanink (1988) [7] extended and empirically proved his work. Balassa (1966) [1] first time used the word "intra-industry trade" for the simultaneous export and import of goods of the same industry between the trade partners. Thereafter, several impressive work, both conceptual and empirical, have been done to understand the nature and determinants of IIT like "love-of-variety" model of Dixit and Stiglitz (1977) [8], "most preferred model of Lancaster (1980) [9], different work of Krugman (1979, 1980, 1981) [10,11,12], Falvey (1981) [13] and Shaked and Sutton (1983) [14].

In the meanwhile, Grubel (1967) [15] and Grubel and Lloyd (1971) [2] developed the measurement technique of IIT. This gave a boost in the research of IIT. Later on, several other indices were developed to measure the degree of IIT, few of them are Aquino (1978) [16], Bergstrand (1983) [17] and so on. Greenaway and Milner (1981, 1983) [18,19] worked on the effect of categorical aggregation on measuring the IIT.

Abd-El-Rahman (1991) [20], for the first time, formally differentiated the HIIT with the VIIT. He said that if the unit values of export and import differs by more than 15 percent, the trade would be VIIT while, if the difference is less than 15 percent the trade would be called as HIIT. Greenaway, Hine and Milner (1994, 1995) [21,22] based their work on Abd-el-Rahman's (1991) work to identify whether country specific factors are important in explaining the relative importance of HIIT and VIIT in UK's trade.

Substantial amount of work has also been done on the determinants of IIT like Helpman (1987) [23] found that IIT and per-capita GDP was positively correlated. Balassa and Bauwens (1987) [24] used two classes of determinants – country specific and industry specific, Hummels and Levinsohn (1993) [25] used capital-labor ratio as a proxy of factor endowments, Markusen and Venables (2000) [26] worked on the relationship between IIT with trade costs and differences in factor endowments, Cieslik (2005) [27] worked on the relationship between share of IIT and relative capital-labor ratio.

Few works on India's IIT has also been done and proved to be a milestone for understanding its nature and patterns. Veeramani (2001, 2003) [28,29] found that India's IIT is vertically dominated and liberalization promoted it. Das (2005) [30] found that India's IIT is more with the developed countries and positively correlated with per-capita GNP, trade openness and share of manufacturing exports. Banerjee and Bhattacharyya (2004) [31] found that economic development promotes India's IIT. Veeramani (2007) [32] found that IIT positively correlated where degree of product differentiation is more and negatively correlated with FDI. Burange and Chaddha (2008) [33] found that India IIT has increased in recent time and it is maximum with Asian and European Countries. Srivastava and Medury (2010, 2011) [5,6] found that India's IIT is vertical in nature and the contribution of import is more, as well as the degree of IIT has increased with the passage of time and decrease in tariff rate promoted the IIT.

Although these studies contributed significantly in understanding the nature and patterns of India's IIT, but they do not discuss about the determinants at the cause and effect level. The present study tries to fill the gap and will explore that whether the determinants of IIT are really a cause of it or not. The study will definitely improve our understanding about the determinants of India's IIT and will help the policy makers to formulate their trade policy so that maximum gains from the trade can be derived.

3. Methodology

The study uses the panel VECM/VAR approach to find out is there any causal effect of determinants on the India's IIT. The trade data taken is based on ITC (HS) classification and ranges from 1991 to 2013. The study is based on the 6-digit level of aggregation. The study uses the adjusted Grubel-Lloyd Index (GL-Index) for calculating the degree of IIT, it is shown as:

$$IIT_j = \frac{\sum_{i=1}^{n}(X_i + M_i) - \sum_{i=1}^{n}|X_i - M_i|}{\sum_{i=1}^{n}(X_i + M_i) - \left|\sum_{i=1}^{n}X_i - \sum_{i=1}^{n}M_i\right|} \times 100 \quad .....(1)$$

where, IIT_j is the degree of IIT for a country j, X_i and M_i is the export and import value for industry i of the country, n is the number of industries. The value of the equation ranges from 0 to 100. "0" means pure inter-industry trade while "100" means pure intra-industry trade. The study disentangled the total IIT into HIIT and VIIT depending on the ratio of unit value of export to unit value of import. It is shown as:

$$IIT = HIIT + VIIT \ldots\ldots\ldots (2)$$

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$$1-\alpha \le \frac{UV_{exp}}{UV_{imp}} \le 1+\alpha \quad .....(3)$$

where UV_{exp} and UV_{imp} are unit-value of export and import respectively. The value of Dispersion Factor "α" is taken as 15%. Further, if the value of equation 3 is less than 0.85 – it will be a case of low-quality VIIT (LQVIIT); if it is more than 1.15, it will be a case of high quality VIIT (HQVIIT); and if it is between 0.85 to 1.15, it will be a case of horizontal IIT (HIIT). It is obvious that the sum of LQVIIT and HQVIIT would be equal to VIIT.

While recording the trade data, different country groups have been taken as a trading partner of India. The country groups have been classified based on the World Bank GNI per-capita criteria. As of July 1st, 2013, the country classifications and their GNI per-capita were like: Low Income Countries (LIC- $1035 or less), Lower Middle Income Countries (LMIC - $1036 to $4085), Upper Middle Income Countries (UMIC - $4086 to $12615) and High Income Countries (HIC - $12616 or more). India belongs to LMIC because its per-capita GNI was $1570.

Different determinants of IIT considered here are trade share (TRDSHR) with the partner country group, per-capita GDP difference (PCGDPDIFF) and differences in capital-labor ratio (CLDIFF) used as a proxy for differences in factor endowments, per-capita GDP (PCGDP) and capital-labor ratio (CLRATIO) of India have also been taken as a determinants of IIT. Since the values of different variables are of different range, therefore, log of all the variables have been taken to normalize the data. Trade data have been taken from WITS website, capital-labor data from the website of UNCTAD handbook of statistics and GDP data have been taken from Trade Map website.

The data have been arranged, in the form of a panel, into 5 cross-sections of different country groups like LIC, LMIC, UMIC, HIC and WLD (World). The time period of the data is of 23 years, from 1991 to 2013. Therefore, the panel is of 5 cross-sections of 23 observations in each having 105 observations and it is a balanced panel. There are two models have been framed for the study, the structure of the model is shown below:

Table 1: Models framed for the study

Models	Dependent Variables (used individually)	Independent Variables
Model 1	IIT, VIIT, HQVIIT, LQVIIT HIIT	PCGDPDIFF, CLDIFF, TRDSHR
Model 2	IIT, VIIT, HQVIIT, LQVIIT HIIT	PCGDP, CLRATIO, TRDSHR

As shown in the Table 1, in the Model-1, the independent variables are the differences in per-capita GDP and capital-labor ratio and trade share between India and the country group. In the Model-2, the independent variables are absolute value of per-capita GDP, absolute value of capital-labor ratio of India and trade share of India with the country group.

All the tests have been performed here like unit-root test, co-integration test and VAR/VECM test, are for the panel data for both the models. Levin, Lin and Chu (2002) [34] test has been used for panel unit-root and Pedroni Residual Cointegration Tests is used for co-integration. Separate VAR/VECM tests have been conducted for finding out the determinants of different models where dependent variables are IIT, VIIT, HQVIIT, LQVIIT and HIIT. Wald coefficient diagnostic tests have been conducted for each model separately, to test the causality from independent variables to dependent variable. Since the objective of the paper is to find out the determinants of different types of IIT, therefore, the result of only one-way causality tests have been shown here. For all the tests, lag selection is done according to Schwarz Information Criterion by automatic lag selection.

4. Data Analysis and Results

4.1 Test of Stationarity

It is mandatory to check the stationarity of the each variables used in the cointegration as well as causality tests. To check the stationarity of the series, panel unit root developed by Levin, Lin and Chu (2002) [34] has been conducted. The null hypothesis of the test is that the series is having unit root, i.e., non-stationary while the alternate hypothesis is the series is stationary. For cointegration test, it is important that the series should be non-stationary at level while it should be stationary at first difference. The significance level considered here is 5%. Table 2 shows the result of panel unit root test for different series used in the present study. It is clear from the table that all the series used in the study are non-stationary at level while they are stationary at the first difference. Therefore, all the series can be used for further tests like cointegration and causality tests.

Table 2: Panel Unit Root Tests of different series used in the study

Series	Level	t-statistics	Probability
IIT	Level	0.5859	0.7211
	1st Diff	-12.0700	0.0000**
VIIT	Level	-1.0800	0.1385
	1st Diff	-11.8100	0.0000**
HIIT	Level	0.9200	0.8230

	1st Diff	-11.8700	0.0000**
PCGDPDIFF	Level	3.3100	0.9995
	1st Diff	-4.0200	0.0000**
CLDIFF	Level	3.3900	0.9997
	1st Diff	-7.1300	0.0000**
TRDSHR	Level	-0.5600	0.2869
	1st Diff	-7.7500	0.0000**
PCGDP	Level	4.0900	1.0000
	1st Diff	-3.0500	0.0011**
CLRATIO	Level	8.5300	1.0000
	1st Diff	-5.2800	0.0000**
LQVIIT	Level	-3.4300	0.1303
	1st Diff	-12.9500	0.0000**
HQVIIT	Level	0.3200	0.6265
	1st Diff	-11.7900	0.0000**

Source: Author's Calculation; **=shows significance at 5% level

4.2 Test of Cointegration

It has been found that all the variables are integrated at the same level, i.e., I(1), therefore, the variables can be used for cointegration tests. The study uses Pedroni Residual Cointegration Test (1999) [35] for the panel data where the null hypothesis is "there is no cointegration" among variables. Since the study uses 5% significance level, therefore if the probability of statistics is more than 5% then null hypothesis would be accepted, i.e., there is no cointegration among the variables. However, if the probability of the statistics is less than 5%, the null hypothesis would be rejected, i.e., the variables are cointegrated. VAR Granger Causality test would be used if variables are not cointegreted, however, VEC Granger Causality test would be used if variables are cointegrated. The test of cointegration has been used for all the dependent variables of both the models. Table 3 and Table 4 show the result of test of cointegration for the Model-1 and Model-2 respectively.

It can be seen from the Table 3, which shows the result of Model-1 in which independent variables are PCGDPDIFF, CLDIFF and TRDSHR, the variables are found to be correlated only when the dependent variable is IIT, while there is no correlation found when the dependent variables are VIIT, HQVIIT, LQVIIT and HIIT. On the other hand, the result of Table 4, for Model-2 (where independent variables are absolute value like PCGDP, CLRATIO and TRDSHR), except the case when dependent variable is HIIT, in all other cases variables are found to be correlated. Therefore, depending upon the case of cointegration or no cointegration, causality model would be used. If variables are found to be correlated, VEC Granger Causality Model would be used, while if the variables are not correlated then VAR Granger Causality Model would be used.

Since, the existence of cointegration reflects that there is a long-term relation between the independent variable and dependent variables, therefore, it can be said that, in Model-1, long-term relationship exists between PCGDPDIFF, CLDIFF and TRDSHR with IIT, while in case of Model-2, long-term relationship exists between PCGDP, CLRATIO and TRDSHR with each of the dependent variable separately like, IIT, VIIT, HQVIIT and LQVIIT. Last row of both the tables 3 and 4, shows the recommended tests for checking the causality, i.e., in case of cointegration, VECM is to be used, and in case of non-cointegration, VAR is to be used.

4.2 Test of Causality

After the test of cointegration, causality has to be tested and confirmed. Different methods of causality have been used here, depending upon the cointegration or non-cointegration, as discussed above. The current section will discuss VECM first and then VAR test of causality. The lag selection is based on Schwarz Information Criteria on automatic lag selection method basis. The equation used for VEC Granger Causality Model is shown below:

D(DV) = C(1)*(Cointegrating Equation) + C(2)*D(DV(-1)) + C(3)*D(DV(-2)) + C(4)*D(IV-1(-1)) + (5)*D(IV-1(-2)) + C(6)*D(IV-2(-1)) + C(7)*D(IV-2(-2)) + C(8)*D(IV-3(-1)) + C(9)*D(IV-3(-2)) + C(10) …….. (4)

where, DV = dependent variable, IV-1, IV-2 and IV-3 are independent variables 1, 2 and 3 respectively. (-1) and (-2) shows the lag 1 and lag 2 respectively. C is the coefficients of the concerned parameter 1, 2 …. 10, C(10) is for constant. The independent variables 1, 2 and 3 for Model-1 are PCGDPDIFF, CLDIFF and TRDSHR respectively while for Model-2, respectively they are PCGDP, CLRATIO and TRDSHR. The result of VEC Granger Causality is shown in Table 5:

The first coefficient, C(1), is the coefficient of the cointegrating equation (as shown in Equation -4). Its value should be negative and significant which reflects that the speed of error correction, higher the value faster would be the convergence. As shown in the table, in all cases, both in Model-1 and Model-2, the coefficient of cointegrating equation is negative and significant, therefore, all the models are overall significant.

Table 3: Result of Cointegration Test for Model-1

			Dependent Variables				
			IIT	**VIIT**	**HQVIIT**	**LQVIIT**	**HIIT**
Common AR Coefficients (Within Dimension)	**Panel v-Statistic**	**Stat**	2.2441	1.9004	-0.0082	-1.9004	0.9366
		Prob	0.0124**	-0.9713	0.5033	0.9713	0.1745
		Wt. Stat	2.0824	1.8785	-1.1082	-1.8785	0.1173
		Prob	0.0187**	-0.9698	0.8661	0.9698	0.4533
	Panel rho-Statistic	**Stat**	-2.0523	0.9586	-0.9977	0.9586	-0.7782
		Prob	0.0201**	0.8311	0.1592	0.8311	0.2182
		Wt. Stat	-2.0055	0.9836	-0.2847	0.9836	-0.5289
		Prob	0.0225**	0.8373	0.3879	0.8373	0.2984
	Panel PP-Statistic	**Stat**	-3.7248	0.7734	-1.9058	0.7734	-1.7485
		Prob	0.0001**	0.7804	0.0283**	0.7804	0.0402**
		Wt. Stat	-4.1798	0.8024	-0.8053	0.8024	-1.4198
		Prob	0.0000**	0.7888	0.2103	0.7888	0.0778
	Panel ADF-Statistic	**Stat**	-3.6487	0.8782	-2.6337	0.8782	-1.7325
		Prob	0.0001**	0.8101	0.0042**	0.8101	0.0416**
		Wt. Stat	-4.1776	0.9078	-0.8793	0.9078	-1.3853
		Prob	0.0000**	0.8180	0.1896	0.8180	0.0830
Individual AR Coefficients (Between Dimension)	**Group rho-Statistics**	**Stat**	-1.3540	0.4618	-0.1544	0.4618	-0.0428
		Prob	0.0879	0.6779	0.4387	0.6779	0.4829
	Group PP-Statistic	**Stat**	-5.3348	-0.9071	-1.9738	-0.9071	-2.0532
		Prob	0.0000**	0.1822	0.0242**	0.1822	0.0200**
	Group ADF-Statistic	**Stat**	-5.2443	-0.7233	-3.2070	-0.7233	-2.0168
		Prob	0.0000**	0.2347	0.0007**	0.2347	0.0219**
Final Result - Whether Cointegrated or Not			**YES**	**NO**	**NO**	**NO**	**NO**
Recommended Causality Test			**VECM**	**VAR**	**VAR**	**VAR**	**VAR**

Source: Author's Calculation; **=shows significance at 5% level

Table 4: Result of Cointegration Test for Model-2

			Dependent Variables				
			IIT	**VIIT**	**HQVIIT**	**LQVIIT**	**HIIT**
Common AR Coefficients (Within Dimension)	**Panel v-Statistic**	**Stat**	2.4622	-1.6797	2.2107	1.3032	0.2236
		Prob	0.0069**	0.9535	0.0135**	0.0963	0.4116
		Wt. Stat	1.5612	-1.6374	2.1855	0.8697	-0.2281
		Prob	0.0592	0.9492	0.0144**	0.1922	0.5902
	Panel rho-Statistic	**Stat**	-2.0874	-1.2683	-2.0864	-1.7612	-0.4438
		Prob	0.0184**	0.1023	0.0185**	0.0391**	0.3286
		Wt. Stat	-2.0644	-1.2478	-2.1099	-1.5324	-0.3405
		Prob	0.0195**	0.1061	0.0174**	0.0627	0.3667

	Panel PP-Statistic	**Stat**	-3.4536	-2.2984	-4.3251	-3.4408	-1.3757
		Prob	0.0003**	0.0108**	0.0000**	0.0003**	0.0845
		Wt. Stat	-3.5336	-2.3078	-4.3652	-3.1418	-1.2508
		Prob	0.0002**	0.0105**	0.0000**	0.0008**	0.1055
	Panel ADF-Statistic	**Stat**	-3.3107	-2.3124	-4.3743	-3.4986	-1.3634
		Prob	0.0005**	0.0104**	0.0000**	0.0002**	0.0864
		Wt. Stat	-3.4860	-2.3266	-4.4097	-3.2183	-1.2281
		Prob	0.0002**	0.0100**	0.0000**	0.0006**	0.1097
Individual AR Coefficients (Between Dimension)	**Group rho-Statistics**	**Stat**	-1.3974	-0.5561	-1.5353	-1.2979	0.2860
		Prob	0.0811	0.2891	0.0624	0.0972	0.6126
	Group PP-Statistic	**Stat**	-4.1456	-2.8395	-5.7794	-4.8713	-1.6205
		Prob	0.0000**	0.0023**	0.0000**	0.0000**	0.0526
	Group ADF-Statistic	**Stat**	-4.0208	-2.9259	-5.5591	-4.7304	-1.5947
		Prob	0.0000**	0.0017**	0.0000**	0.0000**	0.0554
Final Result - Whether Cointegrated or Not			**YES**	**YES**	**YES**	**YES**	**NO**
Recommended Causality Test			**VECM**	**VECM**	**VECM**	**VECM**	**VAR**

Source: Author's Calculation; **=shows significance at 5% level

Table 5: The Result of Vector Error Correction Granger Causality Test

	Model 1		**Model 2**							
	IIT		**IIT**		**VIIT**		**HQVIIT**		**LQVIIT**	
Coefficients	**Value**	**Prob.**	**Value**	**Prob.**	**Value**	**Prob.**	**Value**	**Prob.**	**Value**	**Prob.**
C(1)	-0.3319	0.0000**	-0.1275	0.0057**	-0.0766	0.0240**	-0.0420	0.0000**	-0.0858	0.0000**
C(2)	0.0038	0.9669	-0.0835	0.3568	-0.2229	0.0203**	-0.7082	0.0000**	-0.5102	0.0000**
C(3)	-0.0144	0.8630	-0.1404	0.0807	-0.2914	0.0044**	-0.4606	0.0000**	-0.4305	0.0000**
C(4)	0.2255	0.2240	-0.3694	0.5075	-0.2639	0.0058**	4.1237	0.0000**	-4.2913	0.0000**
C(5)	-0.1203	0.4771	0.1800	0.6905	0.1502	0.0680	2.2860	0.0000**	-1.2599	0.0460**
C(6)	-0.0051	0.8752	0.6157	0.0207	0.0495	0.3523	-2.6887	0.0000**	1.9773	0.0000**
C(7)	-0.0176	0.6090	0.4197	0.0820	-0.0154	0.7101	-1.9758	0.0000**	1.2622	0.0003**
C(8)	0.0254	0.8777	-0.0728	0.6713	0.0161	0.5743	0.0226	0.8600	0.0759	0.6614
C(9)	0.0396	0.8108	-0.0831	0.6238	-0.0392	0.1745	-0.0546	0.6688	-0.0581	0.7377
C(10)	0.0040	0.6459	-0.0263	0.1191	0.0007	0.8373	-0.0118	0.1825	0.0424	0.0081**
Statistics of One-Way Granger Causality (Wald Test), for the two lags of Independent Variables										
	Chi-sq	**Prob**	**Chi-sq**	**Prob**	**Chi-sq**	**Prob**	**Chi-sq**	**Prob**	**Chi-sq**	**Prob**
IV - 1	1.6448	0.4394	0.5546	0.7578	9.8613	0.0072**	85.7678	0.0000**	38.5194	0.0000**
IV - 2	0.2673	0.8749	6.4555	0.0396**	1.3713	0.5038	101.6286	0.0000**	44.2896	0.0000**
IV - 3	0.0691	0.9660	0.3577	0.8362	2.4434	0.2947	0.2474	0.8836	0.3606	0.8350
All	1.7255	0.9431	11.4684	0.0749	13.5942	0.0345**	109.2252	0.0000	45.5155	0.0000**

Source: Author's Calculation; **=shows significance at 5% level

Table 5: The Result of Vector Auto Regression Granger Causality Test

Coefficients of Independent Variables (with two lags)	Dependent Variables of Model-1					Dependent Variable of Model-2
	Test Statistics	VIIT	LQVIIT	HQVIIT	HIIT	HIIT
Constant	coeff.	0.5549	0.7809	0.5154	0.3354	-0.4406
	prob	0.0006**	0.0000**	0.0005**	0.0001**	0.1524
Dependent Variable (-1)	coeff.	0.6475	0.2930	0.4798	0.6573	0.6296
	prob	0.0000**	0.0032**	0.0000**	0.0000**	0.0000**
Dependent Variable (-2)	coeff.	0.0645	0.2401	0.1945	0.0592	-0.0324
	prob	0.5345	0.0159**	0.0523	0.5594	0.7662
Indep Var-1 (-1)	coeff.	0.0190	-0.0523	0.1382	-0.0950	2.2244
	prob	0.5589	0.7903	0.4378	0.6199	0.0016**
Indep Var-1 (-2)	coeff.	-0.0208	0.0213	-0.1301	0.1072	-1.0575
	prob	0.5191	0.9143	0.4705	0.5730	0.0473**
Indep Var-2 (-1)	coeff.	0.0087	0.1129	-0.0794	-0.0505	-0.9503
	prob	0.1751	0.0071**	0.0370**	0.1857	0.0013**
Indep Var-2 (-2)	coeff.	-0.0061	-0.0907	0.0766	0.0322	0.0402
	prob	0.3523	0.0321**	0.0428**	0.4046	0.8868
Indep Var-3 (-1)	coeff.	0.0246	0.0659	0.0195	-0.1818	0.0000
	prob	0.4201	0.7309	0.9105	0.3170	0.3665
Indep Var-3 (-2)	coeff.	-0.0256	-0.0263	-0.0513	0.1891	0.1571
	prob	0.4036	0.8917	0.7686	0.3006	0.3582
Statistics of One-Way Granger Causality (Wald Test), for the two lags of Independent Variables						
Indep Var-1 (-1, -2)	Chi-sq	0.4866	0.7076	0.6499	0.4146	11.0247
	prob	0.7840	0.7020	0.7226	0.8128	0.0040**
Indep Var-2 (-1, -2)	Chi-sq	1.8459	7.4658	4.9998	1.7644	11.5770
	prob	0.3974	0.0239**	0.0821	0.4139	0.0031
Indep Var-3 (-1, -2)	Chi-sq	0.7177	1.7188	1.2572	1.1000	0.8760
	prob	0.6985	0.4234	0.5333	0.5769	0.6453

Source: Author's Calculation; **=shows significance at 5% level

However, in Model-1, jointly the two lags of any of the independent variable, do not Granger cause dependent variable. On the other hand, in Model-2, the joint effect of two lags of CLRATIO on IIT, PCGDP on VIIT, PCGDP and CLRATIO on HQVIIT, and PCGDP and CLRATIO on LQVIIT are found to have causal effect. Moreover, Model-2 also shows that there is joint effect of all the three independent variables on VIIT, HQVIIT and LQVIIT.

Hence, it can be said that the absolute value of both per-capita GDP and capital-labor ratio has a causal effect on HQVIIT and LQVIIT, while absolute value of per-capita GDP and capital labor ratio has causal effect on VIIT and IIT respectively. However, none of the independent variables of Model-1, like PCGDPDIFF, CLDIFF and TRDSHR, have any causal effect on IIT.

For all those set of variables, from both the models, which are not cointegrated, VAR Granger Causality Test is used to find out the causality effect, if any. The equation used for VAR test is shown below:

$$DV = C(1)*DV(-1) + C(2)*DV(-2) + C(3)*IV\text{-}1(-1) + C(4)*IV\text{-}1(-2) + C(5)*IV\text{-}2(-1) + C(6)*IV\text{-}2(-2) + C(7)*IV\text{-}3(-1) + C(8)*IV\text{-}3(-2) + C(9) \quad \ldots\ldots\ldots\ldots\ldots (5)$$

where, DV = dependent variable, IV-1, IV-2 and IV-3 are independent variables which are, for Model-1 – PCGDPDIFF, CLDIFF and TRDSHR respectively, and for Model-2, PCGDP, CLRATIO and TRDSHR respectively. (-1) and (-2) represents the lag 1 and lag 2 of the respective parameters. C(1), C(2) … C(8) are the coefficients of different independent variables, while C(9) is the constant.

Here, it can be seen that the cointegrating equation (as mentioned in equation 4), is missing because, in this case there was no cointegration among the variables. The result of VAR Granger Causality Test is shown below in Table 6: The result of the VAR Granger Causality Test, for both the models, is shown above in Table 6. It can be seen that, in Model 1, only CLDIFF has a causal effect on LQVIIT, however, in Model 2, only PCGDP has causal effect on HIIT. Therefore, significant cause and effect relationship has not been found here.

Hence, the overall result of causality tests show that the causal effect of absolute value of India's per-capita GDP and capital-labor ratio is found to be more than that of differential value like per-capita GDP difference and capital-labor ratio difference. Trade share do not found to be significant in causing any type of IIT.

5. Conclusion and Scope of Future Research

Intra-Industry Trade (IIT) has become an integral part of any country's international trade and India is also not an exception. The result shows that absolute values of independent variables are found to be more significant than that of differential values of independent variables. This was really surprising, because the theory of IIT says that if the economic distance between the two trading partners is less then we can expect more IIT between them. The present study shows that the indicators of economic distance like per-capita GDP difference and capital-labor ratio are not found to significant for causing IIT. However, the indicator for absolute values of economic size like per-capita GDP and capital-labor ratio are found to be the factors which are causing IIT. The phenomenon, although surprising, can be explained with two reasons – first, the international trade policy may not be supportive enough which can promote IIT, and second – it may be immature to say so, because the study clubs all the products for calculating different types of IIT, as well as it clubs all the countries of a country-group. It may be possible that we could get better result, if more precise study would be performed. However, the present study is the first study, to the best of author's knowledge, which uses the panel causality test to analyze India's intra-industry trade and certainly enlighten us in a significant way. The present study can be used as a reference for more refined future studies.

References

[1] B. Balassa, Tariff Reductions and Trade in Manufactures among Industrial Countries, *American Economic Review*, *Vol. 56 (June)*, 1966, 466-473.

[2] H. G. Grubel and P.J. Lloyd, The Empirical Measurement of Intra-Industry Trade, *The Economic Record, 47 (December)*, 1971, 494-517.

[3] R.J. Ruffin, Nature and Significance of Intra-Industry Trade, *Economic and Financial Review Fourth Quarter, article prepared for Federal Reserve Bank of Dallas*, (https://www.dallasfed.org/assets/documents/research/efr/1999/efr9904a.pdf, accessed on Jan 10, 2015).

[4] M. Brülhart,An Account of Global Intra-Industry Trade, 1962-2006, *Research Paper Series – Globalisation, Productivity and Technology, Research Paper No. 2008/08*, 2008, The University of Nottingham.

[5] A. Srivastava and Y. Medury, Analyzing India's Intra-Industry Trade in Post-Liberalization Era, *Indian Journal of Economics and Business, 9(4)*, 2010, 783.802.

[6] A. Srivastava and Y. Medury, An Overview of India's Intra-Industry Trade, *Asia-Pacific Business Review, VII(1)*, 2011, 153-160.

[7] D.M. Hanink, An Extended Linder Model of International Trade, *Economic Geography*, *64(4)*, 1988, 322-334.

[8] A.K. Dixit and J.E. Stiglitz, Monopolistic Competition and Optimum Product Diversity, *American Economic Review*, *67(3)*, 1977, 297-308.

[9] K. Lancaster, Intra-Industry Trade under Perfect Monopolistic Competition, *Journal of International Economics*, *10*, 1980, 151-175.

[10] P.R. Krugman, Increasing Returns, Monopolistic Competition and International Trade, *Journal of International Economics*, *9*, 1979, 469-479.

[11] P.R. Krugman, Scale Economies, Product Differentiation and Pattern of Trade, *The American Economic Review*, 70(5), 1980, 950-959.

[12] P.R. Krugman, Intraindustry Specialization and Gains from Trade, *Journal of Political Economy*, 89(5), 1981, 959-973.

[13] R.E. Falvey, Commercial Policy and Intra-Industry Trade, *Journal of International Economics*, *11*, 1981, 495-511.

[14] A. Shaked and J. Sutton, Natural Oligopolies, *Econometrica*, *51(5)*, 1983, 1469-1483.

[15] H.G. Grubel, Intra-Industry Specialization and the Pattern of Trade, *The Canadian Journal of Economics and Political Science, 33(3)*, 1967, 374-388.

[16] A. Aquino, Intra-Industry Trade and Inter-Industry Specialization as Concurrent Sources of International Trade in Manufactures, *Weltwirtschaftliches Archiv*, *114(2)*, 1978, 275-296.

[17] J.H. Bergstrand, Measurement and Determinants of Intra-Industry International Trade, *in Tharakan, P.K.M. (ed.), Intra-Industry Trade: Empirical and Methodological Aspects, Amsterdam: North-Holland*, 1983, 201-241.

[18] D. Greenaway and C. Milner, Trade Imbalance Effects in the Measurement of Intra-Industry Trade, *Weltwirtschaftliches Archiv*, *117*, 1981, 756-762.

[19] D. Greenaway and C. Milner, On the Measurement of Intra-Industry Trade, *The Economic Journal*, 93(372), 1983, 900-908.

[20] K. Abd-el-Rahman, Firms' Competitive and National Comparative Advantages as Joint Determinants of Trade Composition, *Review of World Economics*, *127*, 1991, 83-97.

[21] D. Greenaway, R. Hine and C. Milner, Country Specific Factors and the Pattern of Horizontal and Vertical Intra-Industry Trade in the UK, *Weltwirtschaftliches Archiv*, *130*, 1994, 77-100.

[22] D. Greenaway, R. Hine and C. Milner, Vertical and Horizontal Intra-Industry Trade: A Cross Industry Analysis for the United Kingdom, *The Economic Journal*, *105(November)*, 1995, 1505-1518.

[23] E. Helpman, Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries, *Journal of Japanese and International Economics*, *1*, 1987, 62-81.

[24] B. Balassa and L. Bauwens, Intra-Industry Specialisation in a Multi-Country and Multi-Industry Framework", *The Economic Journal*, *97(December)*, 1987, 923-939.

[25] D. Hummels and J. Levinsohn, Monopolistic Competition and International Trade: Reconsidering the Evidence, *NBER Working Paper No. – 4389*, 1993.

[26] J.R. Markusen and A.J. Venables, The Theory of Endowment, Intra-Industry and Multi-National Trade", *Journal of International Economics*, *52*, 2000, 209-234.

[27] A. Cieslik, Intraindustry Trade and Relative Factor Endowments", *Review of International Economics*, *13(5)*, 2005, 904-926.

[28] C. Veeramani, India's Intra-Industry Trade under Economic Liberalisation: Trends and Country Specific Factors*"*, *Working Paper No. 313, Centre for Development Studies, India*, 2001.

[29] C. Veeramani, Liberalisation, Industry-Specific Factors and Intra-Industry Trade in India, *Working Paper No. 97*, *ICRIER, India*, 2003.

[30] G.G. Das, Growth and Pattern of Intra-Industry Trade in Manufactures in India's Overall Trade: A Quantitative Analysis, *Indian Journal of Economics and Business, 4(1)*, 2005, 161-184.

[31] S. Banerjee and R. Bhattcharyya, Does economic development cause intra-industry trade? The case of India: 1971 to 2000, *RePEc Research Paper*, 2004, (available at http://mpra.ub.uni-muenchen.de/30961/).

[32] C. Veeramani, Industry-Specific Determinants of Intra-Industry Trade in India, *Indian Economic Review*, *XXXXII(2)*, 2007, 211-229.

[33] L.G. Burange and S. Chaddha, Growth in India's Intra-Industry Trade, *Working Paper UDE24/2/2008*, *Department of Economics, University of Mumbai, India*, 2008.

[34] A. Levin, C.F. Lin and C.S.J. Chu, Unit root tests in panel data: asymptotic and finite-sample properties, *Journal of Econometrics*, *108(1)*, 2002, 1-24.

[35] P. Pedroni, Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors, *Oxford Bulletin of Economics and Statistics, Special Issue*, 1999 (0305-9049), 653-670.

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