Pattern of Trade & Trade Advantage in Transport Equipment Industry in India

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This paper analyses the pattern of trade and trade advantage in transport equipment during 2000-2014. Tools such as Static Index, Marginal Intra-Industry Trade (MIIT) Index or Dynamic Index, Horizontal and Vertical Intra-industry Index, Revealed Comparative Advantage (RCA) Index, Theoretical Range of the RCA value, Revealed Symmetric Comparative Advantage (RSCA) Index or Product Mapping, Revealed Competitive Advantage Index, Relative Trade Advantage (RTA) Index etc were used. It was found that intra- industry trade was taking place at high level. Higher quality trade was taking place during 2001 and 2009-14 Low quality products were exported in some years. Transport equipment industry had comparative disadvantage throughout the reference period.

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Introduction

International trade contributes to the growth of a country's economy in several ways. Some of these include the effects of import and export, specialization, increased productivity and improved infrastructure. The exportation of goods to other countries can contribute to the growth of the exporting country by increasing the earnings of that country. Another factor establishing a link between international trade and economic growth is the increase in productivity. When there is high demand for a product, the countries that produce such a product will automatically increase production in order to meet the demand for the product. This increase translates in to more revenue and an improvement in the economy of the country. The foremost principle of foreign trade, viz. the law of comparative costs , signifies that what a country exports and imports is determined not by its character in isolation but only in relation to those of its trading partners. According to Samuelson "Foreign Trade offers a consumption possibility frontier that can give us more of all goods than can own domestic production possibility frontier". The exten-

sion of foreign trade, according to Ricardo "will very powerfully contribute to increase the mass of commodities, and therefore, the sum of enjoyments". This will be true for each trading nation. In modern terminology, "trade is a positive sum game". The role of transport in economic development is usually discussed in relation to its contribution to the development of domestic trade. Globalization has changed this perception. The ability of a country, and particularly the more isolated communities within a country, to participate in trade depends on the quality of the transport and communication infrastructure that allows them access to the world trading system. If liberalization of trade can open new markets, appropriate transport infrastructure, timely delivery and the quality of services provided are essential elements in determining the competitiveness of products for global markets.

An efficient transport system is a pre-requisite for sustained economic development. It not only is the key infrastructural input for the growth process but also plays a significant role in promoting national integration, which is particularly important in a large country like India. The transport system also plays an important role of promoting the development of the backward regions and integrating them with the mainstream economy by opening them to trade and investment. The era of globalization since the late 1940s has dramatically changed the world's trading patterns as well as the measures employed by countries to survive in a world where trade is being liberalized. With the gradual reduction in trade barriers led by the process of globalization, more emphasis is now being placed on promoting export competitiveness. Competitiveness by any means is not a new issue, as it seems nowadays. This concept has become more fashionable because of the market liberalization and the emphasis in a more global economy. Competition used to be more localized within regions and nations. With increasing international trade, it applies everywhere. Competitors are not fully identified as they used to be and now they might come from faraway places, which was not the case previously.

For more than four decades theoretical and empirical researchers in the field of international trade have been keenly interested in two-way trade of products belonging to the same industry that is intra-industry trade (IIT), while theories of comparative advantage or Heckscher-Ohlin factor endowment focused on inter-industry trade. Ricardo's comparative advantage model states that countries with different comparative advantages engaging in trade will profitably benefit from it. The Heckscher-Ohlin model describes the basis of comparative advantage in terms of factor endowments. A country will export a commodity which utilizes its abundant factor and import a commodity which utilizes its scarce factor (Ali Kocyigit & Ali [a]en , 2007).

Both types of trade models assume that goods traded are homogeneous, and that a country will therefore either only export goods within the same industry, or only import these goods, but not si-

multaneously export and import goods within the same industry. However, a large portion of the output of modern economies involves differentiated rather than homogeneous products of the same industry that is intra-industry trade as opposed to inter-industry trade in completely different products. Therefore, conventional trade theories are deficient in this respect and cannot explain this type of emerging trade pattern. After the pioneering study by Grubel and Lloyd (1975) the initial key contributions in the theory of IIT study include Krugman (1979), Lancaster (1980) and Brander (1980).

Intra-industry specialization involves a country specializing in a narrow range of products within a given industry.

Instead of specialization in an entire industry or activity, that is, inter-industry specialization, intra-industry specialization involves a country specializing in a narrow range of products within a given industry. Another corollary of IIT theory is related to economies of scale, principally because IIT occurs when each country with economies of scale produces only a limited range of products within an industry. Thus, IIT represents a simultaneous movement towards specialization in separate differentiated goods and achieves economies of scale in production, and thereby leads to two-way trade in products similar enough to be grouped in the same industry in standard industry classification schemes. As Krugman (1979) pointed out, IIT with these features produces extra gains from international trade because it creates a larger market. As a consequence, a country engaged in a narrower form of specialization can, via IIT, increase both productivity and the variety of goods available to domestic consumers.

The IIT phenomenon was first considered empirically when a group of European countries formed the European Common Market, which has now grown into the European Union and currently consists of twenty five countries. A large number of theoretical and empirical studies have been carried out to measure the size and importance of IIT, and also to investigate the determinants of it since that time. In addition to the desirable welfare effects mentioned before, trade analysts also noted another positive aspect of IIT from the investigation of the European experience after the formation of the EC, namely, the adjustment cost of economic integration. It was shown from the actual experience of the EC in the late 1950s and 1960s that the proposition that intra-industry trade increases as a nation's economy develops has found general support and is now widely accepted. Accordingly, the bulk of empirical studies have focused on the IIT of developed countries. However, an increasing number of studies have also been done on developing country IIT, or on the IIT between developed and developing countries. Some of the studies have focused on country-specific determinants of IIT while others have concentrated on industry-specific ones.

Horizontal vs Vertical IIT

However, there are some studies which focus on both types of determinants. IIT studies in recent times have also estimated the extent of horizontal and vertical intra-industry trade and identified their determinants. In this study we estimated the extent of stage wise intra-industry trade in textile and clothing trade taking into account the major importers and exporters the worldwide. Grubel–Lloyd index measures intra-industry trade of a particular product. It was introduced by Herb Grubel and Peter Lloyd in 1971. Several alternative measures have been developed in the literature to estimate the degree of IIT. To measure the extent of IIT, our study uses the most widely preferred index, viz. Grubel-Lloyd (G-L). This index measures intra-industry trade as a percentage of a country's total trade which is assumed to be balanced, that is exports equal imports. An effort was also made in this study to measure horizontal intra-industry trade. It is trade in similar products ("horizontal trade") with differentiated varieties, e.g. cars of a similar class and price range).Vertical intra- industry trade is trade in "vertically differentiated" products distinguished by quality and price, e.g. exports of high-quality transport equipment and imports of lower-quality transport equipment.

The nature of an economy's comparative/competitive advantage has utility as it can help to identify the implications for an economy of a shift in a policy regime and to determine the influence on economic welfare both in the long run and in the short run. An understanding of comparative advantage provide clearer directives regarding the direction that an economy's trade and investment regime should adhere to in order to benefit from explicit differences in international factor endowments and relative demand. Gains from international trade are realized due to an improvement in the allocation of scarce resources when an economy produces its comparative advantage. With the gradual reduction in trade barriers led by the process of globalization, more emphasis is now being placed on promoting export competitiveness

Methodology

This study was based on secondary data for the period spanning between 2000 and 2014. Data relating to export, import and total trade for transport equipment industry in the world and in India were drawn from WTO statistical data base. Data on GDP and FDI were taken from Economic Survey and Hand Book of Statistics on Indian Economy published by Reserve Bank of India. The variables namely exports and imports were converted in to real terms by dividing them by GDP. The following statistical tools were used to analyze the data.

Pattern of Trade

Grubel Lloyd (GL) Index or Static Index created by Grubel and Lloyd in 1975 is one of the most popular Static Index measures. This index is similar to measure the share of intra-industry in the trade. The GL index was used to measure the static level of intra-industry trade in this industry.

For an individual product group or industry *i* the share of IIT is formulated as:

$$GLi = 1- |Xi - Mi| / (Xi + Mi)$$

Where Xi and Mi stand, respectively, for the exports and imports of industry *i*. If all trade was balanced GLi would equal 1. On the other hand, if all trade was one-way, GLi would equal zero. Thus, the closer GLi is to 1 (that is, Xi = Mi), the more trade in industry *i* is intra-industry trade. The closer GLi is to zero (that is, either Xi = 0 or Mi = 0), the more trade in industry *i* is inter-industry trade. Therefore, the index of intra-industry trade takes values from 0 to1, that is, $0 \leq GLi \leq 1$. If GLi = 1, there is only intra-industry trade, no inter-industry trade. Conversely, if GLi = 0, there is no intra-industry trade, only inter-industry trade. When GL index is less than 0.25 intra-industry trade level is low; when GL index greater than 0.25 or less than or equal to 0.5, intra-industry trade is in a lower level; when GL index greater than 0.5 and less than or equal to 0.75, intra-industry trade at a higher level; when the GL index is greater than 0.75 and less than or equal to 1, shows that intra-industry trade at a very high level.

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Marginal Intra-Industry Trade (MIIT) Index or Dynamic Index: The GL index being of a static kind, it cannot reflect the changes in intra- industry trade level in different periods. If the imports and exports increase in same proportion in a nation, the GL index would lapse. Therefore, simply using GL index to measure the level of intra-industry trade is not comprehensive. Hence the dynamic index known as Marginal Intra-Industry Trade (MIIT) Index was first proposed by Brulhart (1994). The formula is:

$$MIITi= (\Delta Xi-|\Delta Mi|)/(|\Delta Xi|+|\Delta Mi|)$$

Brulhart points out that it is intra-industry trade, if an industry's absolute value of MIIT is less than 0.5. The closer the absolute value of MIIT to 0, the higher is the level of intra-industry trade.

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Horizontal and vertical intra-industry trade was measured by using the Greenaway, Hine and Milner (1994; 1995) methodology. Nielsen and Lüthje (2002) also showed that the methodology introduced by Greenaway, Hine and Milner is more appropriate for the measurement of horizontal and vertical intra-industry trade.The method introduced by Greenaway, Hine and Milner also supposes the separation of total IIT or, disentangling of Bi on the belonging shares of horizontal IIT (HBi) and vertical IIT (VBi):

$$Bi = HBi + VBi$$

Following this methodology, the unit value index (UV) was calculated for ex-

ports and imports of pharmaceutical industry. Horizontal IIT is defined as a ratio between the unit value of exports UVxi and the unit value of imports UVmi for a particular industry i or, to put it differently, UVxi /UVmi . More specifically, horizontal IIT is defined (HBi) when the unit value index (UV) was within the range of ± 15%:

$$0.85 \leq UVx\ i\ /\ UVm\ i \leq 1.15$$

When the unit value index (UV) was outside the ±15% range, vertical IIT (VBi) is defined for the particular industry. The share of vertical IIT (VBi) is separated on the dependent share of V1 and V2 using the following condition:

V1: UVx I / UVm i > 1.15 and V2: UVx I / UVm i < 0.85,

Where V1 represents the share of vertical IIT when the ratio between the unit value of exports UVxi and the unit value of imports (UVmi) is greater than 1.15, and V2 represents the share of vertical IIT when the ratio between the unit value of exports UVxi and the unit value of imports Vmi is smaller than 0.85. It is assumed that the relative quality of each product is best defined by the achieved relative price for the same product and that the relative share of V1 represents trade in vertically differentiated products of higher quality, which are sold at a higher average price, and that V2 represents trade in vertically differentiated products of lower quality, which are sold at a lower average price. In short, since the Greenaway, Hine and Milner methodology for measurement of horizontal and vertical intra-industry trade is grounded on unit value index (UV), it is able to capture adjustment costs.

Comparative & Competitive Advantage

Balassa's Revealed Comparative Advantage (BRCA) Index: Our study utilized the Balassa (1965) measure of computing the RCA Index. As per the measure comparative advantage is 'revealed' by the relative export/import performance of individual product categories. Thus, the study was based on export and import data covering 15-years period from 2000 to 2014.

The index for country i in commodity j is calculated as follows:

$$BRCAij = (Xij/Xwj)/(Xi/Xw)$$

Where

BRCAij= Revealed comparative advantage of Indian transport equipment industry.

Xij = Merchandise exports of Indian transport equipment industry.

Xwj = World merchandise exports of transport equipment industry.

Xi = Total merchandise exports of India

Xw = Total merchandise world exports.

If the BRCA index for a particular industry is greater than 1, it implies that the country has a revealed comparative advantage in the exports/imports of that industry and vice-versa. A positive value of BRCA might be interpreted as an indication of comparative advantage. The BRCA is measured using post-trade data. The advantage of using the comparative advantage index is that it considers the intrinsic advantage of a particular export/ import commodity and is consistent with changes in an economy's relative factor endowment and productivity.

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Theoretical Range of the Balassa RCA Values: In order to provide a more even distribution of the BRCA scores, Hinloopen and Van Marrewijk (2001**)** have divided the theoretical range of the Balassa Indices.

The BRCA values into four classes are as follows.

BRCA Classifications

Class 'a'	0 <BRCA < 1	Comparative disadvantage
Class 'b'	1<BRCA < 2	Weak comparative disadvantage
Class 'c'	2 <BRCA < 4	Medium comparative advantage
Class 'd'	4 <BRCA	Strong comparative advantage

Revealed Symmetric Comparative Advantage (RSCA) or Product Mapping suffers from the problem of asymmetry as 'pure' RCA is basically not comparable on both sides of unity, as the index ranges from zero to one, if a country is said not to be specialized in a given sector, while the value of the index ranges from one to infinity, if a country is said to be specialized. The index is made symmetric, following the methodology suggested by Dalum et al. (1998) and the new index is called 'revealed symmetric comparative advantage' (RSCA). Mathematically, it can be expressed by equation RSCA = (RCA-1) / (RCA+1). This measure ranges between -1 and +1 and is free from the problem of skewness. A commodity is said to have comparative advantage in its exports if the corresponding RSCA value is positive and vice versa. In the present study, the RSCA was used to look into the comparative advantage of the selected commodities.

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In the next step, the comparative advantages, i.e. competitiveness on international markets, are directly compared with the degree of export specialisation for these products. A few changes are made to RCA 1, and TBI is introduced to develop a product map. First, RCA 1 is modified so as to obtain a symmetric index with values from -1 to +1. This RSCA index is neutral at zero and takes the form

$$RSCA_i = (RCA1_i - 1)/ (RCA1_i + 1)$$

This is an extension of Balassa's method. It takes into account the import demand of a specific commodity for a country. Its advantage is that it uses both export and import data and competitive advantage is determined by both supply and demand. The revealed competitive advantage is calculated as the difference between revealed comparative export share for commodity *j* and revealed comparative import share for commodity *j*. Therefore the White's index provides the results of net comparative advantage (unlike Balassa's approach which only takes into the account of exports). The index is calculated as:

$$WRCA_{ij} = RCSij - RCDij$$

$$WRCA_{ij} = \frac{RXij/Xwj}{Xi/Xw} - \frac{Mij/Mwj}{Mi/Mw}$$

Where W*RCAij* is revealed competitive advantage of country *i* for commodity *j*, *RCSij* is the ratio of country *i*'s share of commodity *j* to its share in total world exports, *RCDij* is the ratio of country *i*'s share of commodity *j* to its share in total world imports, *Mij* is import of commodity *j* by country *i*, *Mwj* is total world imports of commodity *j* , *Mi* is total world imports of country *i* , *Mw* is total world imports. If *WCAij* >0 and *BRCAij* >1, then the results of both the models are identical and will show that the country has an advantage in exports of commodity *j* and vice versa.

The Relative Trade Advantage Index (RTA), which was first used by Scott and Vollrath (1992), shows the net trade advantage/ disadvantage. This index is computed as the difference between the Relative Export Advantage (RXA) and the Relative Import Penetration Index (RMP). Considering both exports and imports, the RTA is a more comprehensive measure of competitiveness, and expressed as:

$$RTAij = RXAij - RMPij$$

The competitive advantage revealed by this indicator is implicitly weighted by the importance of the relative export and the relative import advantages. It can be greater or less than zero. A positive value expresses a situation of net competitive advantage, and a negative one shows a competitive disadvantage. It is further elaborated as follows:

$$RXAij = (Xij / Xit) / (Xnj / Xnt)$$

$$RMAij = (Mij / Mit) / (Mnj / Mnt)$$

$$RTAij = RXAij - RMAij$$

$$RCij = \ln (RXAij) - \ln (RMAij)$$

Results & Discussion

Table 1 presents the indices calculated to measure the static level of intra–industry trade in transport equipment industry of India based on Grubel Llyod (GL Indices) and Marginal Intra Industry Trade Indices (dynamic) proposed by Brulhast (1994).

The GL indices showed that it was greater than 0.5 for all the years explaining the fact that the intra-industry trade was taking place at high level. That the

Table 1 Static & Dynamic Indices

Year	GL Indices (Static)	MIIT Indices (Dynamic)
2000	0.922	0.0123
2001	0.985	0.0138
2002	0.858	0.0234
2003	0.806	0.0095
2004	0.865	0.0170
2005	0.871	0.0064
2006	0.644	0.0035
2007	0.816	0.0085
2008	0.659	0.0005
2009	0.930	0.0035
2010	0.918	0.0022
2011	0.770	0.0006
2012	0.913	0.0027
2013	0.889	0.0004
2014	0.691	0.0005

Note: Calculations are based on WTO statistical data base

That the absolute value of MIIT was closer to 0 shows the higher level of intra–industry trade over the reference period from 2000 to 2014.

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As per the methodology of Greenaway, Hine and Milner (1994; 1995), the total IIT is separated or Bi is disentangled as shares of horizontal IIT (HBi) and vertical IIT (VBi) and the results are shown in Table 2.

Table 2 Horizontal & Vertical Intra-Industry Trade

Year	Horizontal IIT	Vertical V1	Vertical V2
2000	1.0383	-	-
2001	1.1947	1.1947	-
2002	0.8634	-	0.8634
2003	0.8304	-	0.8304
2004	0.9923	-	-
2005	1.1035	-	-
2006	0.6950	-	0.6950
2007	1.0545	-	1.0545
2008	0.8101	-	0.8101
2009	1.3538	1.3538	-
2010	1.8189	1.8189	-
2011	2.4496	2.4496	-
2012	1.9615	1.9615	-
2013	1.8466	1.8466	-
2014	2.7184	2.7184	-

Note: Calculations are based on WTO statistical data base.

Horizontal intra industry (HII) and its split into vertical V1 (>1.15) and vertical V2 (<0.85) based on the unit value index of the transport equipment trade of India for the reference period from 2000 to 2014 revealed the following:

i) Out of total IIT (Intra Industry Trade) in 2001 and between 2009 and 2014 there was presence of HII during 2000, 2003, 2005, 2007 and 2008 ($0.85 \leq HII \geq 1.15$).

ii) Splitting the HII into V1 (>1.15) and V2 (<0.85), it was found that products of higher quality trade were taking place during 2001, and from 2009 to 2014. On the other hand the index of V2 showed that low quality transport equipment products were exported during 2003, 2006 and 2008 from India.

Balassa Revealed comparative advantage (BRCA) indices along with the theoretical range suggested by Hinloopen and Van Marrewik and Revealed Symmetric comparative advantage (RSCA) methodology given by Dalum, Lauvrsen K and Villumsen are shown in Table 3.

Table 3 Trends in Revealed Comparative Advantage

Year	BRCA	RSCA
2000	0.21	-0.65
2001	0.20	-0.67
2002	0.20	-0.66
2003	0.24	-0.61
2004	0.29	-0.55
2005	0.35	-0.48
2006	0.35	-0.49
2007	0.35	-0.48
2008	0.49	-0.34
2009	0.63	-0.23
2010	0.63	-0.23
2011	0.64	-0.22
2012	0.62	-0.23
2013	0.63	-0.23
2014	0.77	-0.13

Note: Calculations are based on WTO statistical data base.

It was evident that transport equipment industry had comparative disadvantage on account of both the indices since the indices under class 'a' (0 <BRCA < 1) were indicative of the fact that there were comparative disadvantages throughout the reference period based on the theoretical range suggested by Hinloopen and Van Marrewik and also based on symmetric methodology given by Dalum, B.K Lauvrsen K and Villumsen.

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Revealed Competitive Advantage

Revealed Competitive Advantage indices were calculated based on Whites Revealed Competitive Advantage (WRCA) and Vollrath's measures to know the competitive strength of the transport equipment industry for each year. The necessary details are shown below.

Whites Revealed Competitive Advantage (WRCA) indices calculated

Table 4 Whites Revealed Competitive Advantage (WRCA)

Year	WRCA Indices
2000	0.001
2001	0.027
2002	-0.037
2003	-0.055
2004	-0.008
2005	0.028
2006	-0.156
2007	0.016
2008	-0.120
2009	0.162
2010	0.285
2011	0.379
2012	0.307
2013	0.294
2014	0.493

Note: Calculations are based on WTO statistical data base.

based on whites methodology for the reference period under study is discussed based on Table 4.

Across the period it was surprising to observe that the index of Whites revealed comparative advantage (WRCA) was negative in 5 out of the 15 years. In other words out of the one and a half decades more than half the period accounted for positive WRCA which showed that India had an advantage in exporting transport equipment since WRCA > 0 implying competitive strength with marginal record of WRCA index increasing more than 0.

Vollrath's Measures were used to examine revealed competitive advantage in the transport equipment industry for India from 2000 to 2014 based on three measurements namely relative trade advantage (RTA), relative export advantage (REA) and revealed competitiveness (RC). The summary of the results are presented in Table 5.

Table 5 Indices of RTA, REA & RC

Year	RTA	REA	RC
2000	-0.2953	-0.1278	-0.1278
2001	-0.0762	-0.0331	-0.0331
2002	-0.5449	-0.2334	-0.2337
2003	-0.7688	-0.3263	-0.3263
2004	-0.5127	-0.2204	-0.2204
2005	-0.4899	-0.2108	-0.2108
2006	-1.5898	-0.6339	-0.6339
2007	-0.7245	-0.3084	-0.3084
2008	-1.4993	-0.6034	-0.6034
2009	9.3858	1.9221	1.9221
2010	0.3663	0.1581	0.1581
2011	1.0166	0.4236	0.4236
2012	0.3864	0.1667	0.1667
2013	0.4820	0.2113	0.2113
2014	1.4248	0.5741	0.5741

Foot Note: Calculations are based on WTO statistical data base.

Based on the calculations, it was noticed that the changes were nearly equal showing both competitive advantage (positive values) and competitive disadvantage (negative values). Revealed competitive advantage was mainly registered from 2009 to 2014 and in the initial year 2001.

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Conclusion

Intra-industry trade was taking place at high level based on GL indices, the marginal intra industry trade (MIIT) indices for the trade & transport equipment industry proposed by Brulhast. Products of higher quality trade from India were

taking place during 2001, and from 2009 to 2014 and low quality transport equipment products were exported during 2003, 2006 and 2008. The results underpin the importance of improving the infrastructural facility of the economy and to form strategies to encourage FDI inflows in more diversified areas. It has been suggested that India has to make an effective policy to promote exports. In order to achieve sustained growth in trade, Indian policy makers should consider role of trade openness in their policy actions.

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