SOME FURTHER EVIDENCE ON THE FACTOR CONTENT OF INDIA'S FOREIGN TRADE

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Abstract

The changing production structure of the Indian economy and the march from a backward, primary sector dependent economy to a more vibrant industrial economy have a significant impact on the structure and commodity composition of its foreign trade.

The paper attempts to measure the factor content of India's foreign trade during the reform period with the objective to find out whether the factor intensity of trade has been in tune with comparative advantage of the country as determined from its endowment of factors or there are some other factors which have also affected its foreign trade. As a labour abundant country, India enjoys natural comparative advantage in labour intensive commodities and the study confirms it by revealing India's exports to the rest of the world to be more labour intensive than its import replacements. However, India's exports to the OECD, the largest trading partner, are found to be more capital intensive than imports during later years of the reform period, producing an instance of Leontief Paradox. The Paradox has also been witnessed in cases of India's trade with the EU, North America and Japan.

Introduction

From the 1950's onwards India's trade structure has exhibited marked changes. India's export basket before initiation of planning primarily consisted of jute, tea, cotton, hides and skins, manganese ores, mica etc while the manufactured products constituted the bulk of imports. The implementation of the industrialization programme starting from the Second Plan and consequent diversification and modernization in the production structure led to a significant change in the composition of the export and import baskets over the years. Table 1 reveals that Agriculture and allied products which constituted 44.2% of total export in 1960-61, accounted for only 10.2% of total export in 2005-06. Jute, tea and cotton textiles were the principal items in the export basket at the time of independence and accounted for half of the total export earnings but the combined share of these commodities gradually declined over the decades. On the other hand the share of manufactured products in total export earnings increased from 45.3% to 72% between 1960-61 and 2005-06. The commodities registering a substantial increase in export earnings and gradually becoming the principal export items over the years were handicrafts, gems and jewellery, engineering goods, readymade garments and chemicals and allied products. The contribution of handicrafts export in total export earnings rose from 1.7% to 18.8% between 1960-61 and 2005-06 while the contribution of readymade garments went up from a meagre share of 0.1% to a modest share of 14.5% during the same period. Consequent upon the programmes of industrialization initiated during the plan period a spectacular rise in the share of the non traditional item like engineering goods has also been observed. The share of this group in total export rose from 3.4% in 1960-61 to 20.7% in 2005-06. During recent years this group has occupied either second or third place in India's export earnings. The results of industrialisation are also expressed through increases in the exports of chemical and allied products. For this item the share shot up from 1.1% to 11.6% between 1960-61 and 2005-06.

Table 1: Composition of India's export (percentage share)

	1960-61	1970-71	1980-81	1990-91	2000-01	2005-06
I. Agriculture and allied products	**44.2**	**31.7**	**24.4**	**19.5**	**13.5**	**10.2**
II. Ores and minerals	**8.1**	**10.7**	**5.0**	**5.2**	**2.6**	**5.2**
III Manufactured goods	**45.3**	**50.3**	**55.8**	**72.2**	**78.0**	**72.0**
a) leather products	4.4	5.2	9.4	7.8	3.8	2.6
b) jems and jewellery	0.1	2.9	9.2	16.0	16.6	15.1
c) chemicals and allied	1.1	1.9	3.4	7.8	5.7	11.6
e) engineering goods	3.4	12.9	12.8	12.0	14.1	20.7
j) cotton yarn, fabrics, made up etc	n.a	n.a	n.a	6.3	7.9	n.a
k) ready made garments	0.1	1.9	7.9	12.4	12.5	14.5
l) handicrafts	1.7	4.7	12.9	16.9	17.8	18.7
IV Crude and petroleum	**n.a**	**n.a**	**n.a**	**2.9**	**4.2**	**11.5**
V others	**n.a**	**n.a**	**n.a**	**0.3**	**1.7**	**n.a**

Source: Government of India, Economic Survey

The change in the domestic production structure has also led to a change in the commodity composition on the import side. The shares of food grains and allied products which constituted a significant proportion in total imports at the beginning years of economic planning declined remarkably over the years (Table 2). Besides, the declining share of the capital goods which primarily consist of non electrical machinery, electrical machinery, transport equipments etc. has also been observed. The combined import expenditure share on these items was 30% in 1960-61 mainly on account of the industrialisation programme but it reduced to around 15% in 2005-06 indicating lesser dependence on imported capital goods needed for industrialisation. The commodities which registered a substantial growth in import over the years were pearls, precious and semi-precious stones, gold and silver and POL. Due to increasing demand of the gems and jewellery on the export front, the imports of pearls, precious and semi-precious stones have increased significantly. This item accounted for only 0.1% of total import expenditure in 1960-61 but its share shot up to 10.9% in 2005-06, occupying the second place in total import expenditure share. A substantial rise in the import expenditure has also been observed in case of

POL import. The share of petroleum and lubricants in total import expenditure increased from 8.9% in 1960-61 to 29.5% in 2005-06%.

Table 2: Composition of India's import (percentage share)

	1960-61	1970-71	1980-81	1990-91	2000-01	2005-06
I. Food and allied products	**37.8**	**16.7**	**6.2**	**2.2**	**3.7**	**n.a**
II Fuel						
a) coal	n.a	n.a	n.a	1.8	2.2	2.6
b) POL	8.9	8.8	34.4	25.1	31.0	29.5
III Fertilisers	**1.1**	**6.9**	**6.2**	**3.9**	**1.5**	**2.0**
IV paper board, manufactures and newsprint	**n.a**	**n.a.**	**3.6**	**2.1**	**0.9**	**1.1**
V Capital goods	**30.0**	**25.1**	**15.4**	**24.1**	**11.0**	**15.0**
VI Others						
a) chemicals	11.0	9.0	3.6	7.5	6.7	6.1
b) pearls, precious and semi precious stones	0.1	1.5	3.9	8.6	9.6	10.2
c) iron and steel and non ferrous metals	5.1	9.9	6.8	7.7	2.5	3.1
e) optical goods etc	n.a.	n.a.	n.a.	2.5	1.7	1.3
f) gold and silver	n.a.	n.a.	n.a.	n.a.	9.3	7.6
VII unclassified items	n.a.	**28.2**	n.a.	**8.6**	**19.9**	**22.1**

Source: Government of India, Economic Survey

Thus, it clearly depicts that the changing production structure of the Indian economy and the march from a backward dependent economy to a more vibrant industrial economy has a significant impact on the structure and commodity composition of its foreign trade.

Given the endowment of factors of production, the general perception regarding India's foreign trade is that the country has a distinct natural comparative and competitive advantage in production of labour intensive commodities. Particularly, after initiation of the Economic Reforms in 1991 and the consequent rapid integration with the world economy in the following years the Indian economy is expected to export agro processed and labour intensive commodities where its comparative advantage lies. However, it is also evident that under the impact of

industrialisation the composition of India's foreign trade has undergone a substantial change over the years: particularly the non traditional items have remarkably grown in importance in the export basket.

In this paper an attempt has been made to estimate the factor content of India's foreign trade during the reform period with an aim to find out whether the factor intensity of trade during reform period has been in tune with comparative advantage as determined from its endowment of factors or there are some factors which have also affected its foreign trade.

Among India's trading partners the OECD group of countries has been the single largest destination of India's export as well as the origin of India's import. In 2005-06, the OECD countries has accounted for 46.5% of India's total export while the share of this group in total import has been 37.6%. The European Union (EU), North America and Japan continue to be large destination of India's export and source of its import over the years. However, the East Asian nations and other developing nations in Africa and Latin America have gradually gaining in importance as trading partners of India in recent years. Thus, along with the study of the factor content of India's trade with the rest of the world, further experiments on factor content of India's bilateral trade with the OECD, the EU, North America and Japan have been conducted for an in-depth analysis on the impact of compositional as well as directional changes on factor intensities of its trade.

The estimation procedure of the factor content of trade of this study heavily draws upon two alternative theoretical frameworks developed by Leontief (1951) and Leamer (1980). While verifying the factor endowment theory of international trade for the United States Leontief developed an index by which he estimated the factor intensities of the average export and competitive import of the country applying the tools of Input-Output technique. Leamer, while verifying empirically the same presumption for America's trade introduced an alternative theoretical framework using Heckscher-Ohlin-Vanek model for measuring the factor content of trade and for leading to a conclusion about the factor abundance of a country.

Very few studies have made efforts to estimate the factor content of India's foreign trade. Bharadwaj (1962) first estimated the factor intensities of India's export and competitive import of 1953-54 while investigating the structural basis of India's foreign trade. His study which heavily drew upon the Leontief study especially in respect of methodology revealed that India's export absorbs more labour than its competitive imports. However, when Bharadwaj (1962)

conducted a similar test on India's bilateral trade with the U.S. economy, India was revealed to be a capital abundant country relative to the United States refuting the endowment theory of trade. More recently, Sengupta (1989) tested factor content of India's foreign trade for the years 1979-80 and 1984-85 and confirmed India's export being more labour intensive than its import.

Research in this field focusing the Indian case is scanty, particularly for recent years. Moreover to the best of knowledge of the researcher, no comprehensive study is attempted to measure factor content of India's foreign trade using the approach developed by Leamer.

Arrangement of the paper: In section 1 the analytical frameworks used by Leontief and Leamer to measure the factor embodied in foreign trade are discussed. Section 2 will provide the data and sources, which are used in the study. In section 3 the results of the study are presented. The conclusions are given in section 4.

1. Analytical Framework

In this section we shall first give an account of the analytical technique and the empirical procedure of the Leontief study since a part of our investigation regarding the structural basis of India's foreign trade draws heavily upon it, followed by a discussion on the analytical framework used by Leamer to study the same.

Leontief (1951) made the pioneering attempt to empirically verify Heckscher-Ohlin theorem for the trade structure of the United States. Considering two factor of production labour and capital he attempted to test the commonly held notion that the United states possesses "a comparative advantage in the production of commodities which require for their manufacture large quantities of capital and relatively small amounts of labour"- a view derived from the Hechscher-Ohlin presumption and for that matter computed the factor intensities of export and import using the tools of Input-Output technique. The results, contrary to the general expectations revealed that the US import competiting goods required 30% more capital per worker than the US exports which implied the United States was abundant in labour, not in capital. This finding famously known as Leontief Paradox stimulated an enormous amount of theoretical and empirical research which enabled us to understand the strength and weaknesses of the Heckscher-Ohlin theory. Perhaps no other studies in the field of international trade have become so well-known and have triggered off so much controversy as the study conducted by Professor Leontief.

The paradox raised lots of criticisms and explanations, some of which followed almost immediately. While Swerling (1953), Buchanan(1955), Loeb(1954) etc questioned the statistical procedure adopted or the data used in the test, some other economists like Kravis (1956), Vanek (1963), Travis (1964), Kenen (1965), Keesing (1966), Baldwin (1971) and Leontief himself put forward several explanations to resolve the paradox. Differential labour quality between nations, cases of two or more factors of production, factor intensity reversal, presence of trade barriers etc were offered as explanations to reconcile the Paradox with the theory, however very few of these have been widely accepted as a satisfying explanation resolving the Paradox.

Leamer (1980) introduced an alternative theoretical framework using the Heckscher - Ohlin – Vanek model where he proposed new set of indices for factor abundance. He argued that Leontief's test was based on a wrong proposition and the Paradox would disappear "if conceptually correct calculations" were used to compute the factor content of trade. Using Leontief's figures that produced the paradoxical result he showed that the US was the net exporters of both capital and labour services and at the same time capital per man embodied in net exports was greater than that in the US consumption, which in fact implied the U.S. economy, was capital abundant.

1.1 Analytical Framework of Leontief

In his pioneering attempt to test the Heckscher-Ohlin proposition Leontief applied the tools of Input-Output technique to test the factor intensities of the average export and competitive-import of the United States. Using Input-Output table for 1947 and considering two factors labour and capital, Leontief calculated the direct and indirect requirement of labour and capital to produce a representative bundle of one million dollar worth of the U.S. exports and representative bundle of one million dollar worth of domestic goods, directly competitive with the U.S. imports. Although the Heckscher-Ohlin theory is applicable to the actual imports, the computation of the input coefficients for actual imports requires thorough knowledge of the production functions of each product in the United States and all its trading partners which seems to be a stupendous task. Therefore due to difficulties in availability of such foreign data on factor requirements of actual imports of the United States, Leontief calculated the factor requirements of the import–competing industries using the domestic technology coefficient matrix, omitting non-competitive imports from the import basket. In his view, if the possible alternative pattern of trade is to have

any meaning in respect of competitive imports then one must consider the stepped-up domestic production as an alternative to actual imports. By using the same technology matrix, Leontief assumed that production function for each commodity was identical allover the world and therefore there was no factor intensity reversal. In this context the distinction between competitive imports and non-competitive imports should be explained. The imported commodities which can also be produced domestically, either fully or partially are regarded as competitive imports while those imports which are impossible or extremely difficult to produce at home are referred to as non-competitive imports.

Let us present Leontief's analytical framework in detail.

Let A = (n x n) technology matrix, an element of which gives the direct requirement of intermediate input per unit of output.

$x = (x_1, x_2, \ldots\ldots\ldots x_n)$, (1 x n) is the gross output vector

$C = (C_1, C_2\ldots\ldots\ldots C_n)$, (1 x n) domestic expenditure vector

$E = (E_1, E_2\ldots\ldots\ldots\ldots E_n)$, (1 x n) export vector, each element shows the share of each commodity in one million dollar worth of exports.

$M = (M_1, M_2, \ldots\ldots\ldots M_n)$, (1 x n) import vector where each element represents the share of each commodity in one million dollar worth of imports. As mentioned earlier due to due to difficulties in obtaining the foreign data, the import bundle includes those commodities which are produced in the domestic economy also in competition with import and excludes non-competiting imports.

$L = (L_1, L_2\ldots\ldots\ldots\ldots L_n)$, (1 x n) labour coefficient vector, an element of it shows the direct requirement of labour per unit of output, measured in physical unit.

$K = (K_1, K_2, \ldots\ldots\ldots\ldots K_n)$, (1 x n) capital coefficient matrix, each element shows the direct capital requirement per unit of output expressed in money unit.

The balancing equation in the input-output model which shows that the output of each sector is just sufficient to meet the input requirements of all sectors including itself as well as the final demand, is

$x = Ax + C' + E' - M'$ (prime indicates transpose)

or, $x = (I - A)^{-1} (C' + E' - M')$ (1)

Multiplying L with Inverse matrix $(I - A)^{-1}$ we get

$G = L (I - A)^{-1}$, G is a (1 x n) vector an element of which gives the direct and indirect requirement of labour per unit of output.

Again, multiplying G with E′ and M′ we obtain the total labour embodied in one million dollar worth of export (l_E) and labour embodied import replacements (l_M) of equivalent value respectively

$$l_E = L\,(I - A)^{-1}\,E' = G\,E' \qquad (2)$$

and

$$l_M = L\,(I - A)^{-1}\,M' = G\,M' \qquad .(3)$$

Similarly, first multiplying K by the inverse matrix and then again by E′ and M′ respectively, the capital embodied in one million dollar worth of export and competiting-import are obtained, i.e.

$$H = K\,(I - A)^{-1}$$

$$k_E = K\,(I - A)^{-1}\,E' = H\,E' \qquad (4)$$

and

$$k_M = K\,(I - A)^{-1}\,M' = H\,M' \qquad (5)\ k_E$$

and k_M denote the capital embodied in export and competiting-import respectively.

To verify the Heckscher-Ohlin predictions regarding the pattern of trade a comparison has to be made between the capital-labour ratio for exports (k_E / l_E) and the capital-labour ratio for import replacements (k_M / l_M) . One million dollar worth of export will be more or less capital intensive than one million dollar worth of import replacements according as

$$(k_E / l_E) / (k_M / l_M) > 1 \rightarrow L_1 > 1 \qquad (6)$$

$$\text{or } (k_E / l_E) / (k_M / l_M) < 1 \rightarrow L_1 < 1 \qquad (7)$$

1.2 Analytical Framework of Leamer

Using an alternative theoretical framework Leamer showed that Leontief's index for measuring factor content of trade was inappropriate for U.S. data for 1947 and therefore he proposed a new set of indices for factor abundance. According to him, " Leontief figures, which produced the so called paradoxical results that the U.S. exports are less capital intensive than the U.S. competing imports, can also be used to show that U.S. net exports are more capital intensive than U.S. consumption which, in fact, implies that capital is abundant relative to labour." He argued that lower capital per worker embodied in exports relative to imports implied a country was abundant in labour and scarce in capital (the proposition used by Leontief) if and only if the country was found to be net exporter of labour services and net importer of capital services. Finding the U.S. economy a net exporter of both capital and labour services in 1947, Leamer contended that

Leontief's result was based on a false proposition. He also showed that under these circumstances, a country to be abundant of capital requires net exports to be more capital intensive than consumption. Since for 1947 data net export of the U.S. was found to be more capital intensive than U.S. consumption, Leamer confirmed the notion that the United States was well endowed with capital relative to labour in 1947 and the Paradox ceased to exist.

Arguing Leontief's index (comparison of (k_E / l_E) and (k_M / l_M)) to be conceptually incorrect and theoretically inappropriate when a country is net exporter or importer of both capital and labour services, Leamer developed a new index for factor abundance using H-O-V model which is discussed below.

Consider there are c number of countries in the world with n number of factors and m number of commodities. The basic equation of the H-O-V model is,

$$AT_i = F_{fi} = V_{fi} - \alpha_i V_{fw} \qquad (8)$$

$(i = 1\ldots\ldots\ldots c,\ f = 1,\ldots\ldots\ldots,n \text{ and } g = 1,\ldots\ldots\ldots,m)$

where for country i, A = (n x n) the technology matrix.

T_i = (m x 1) vector of net export

V_{fi} = (n x 1) endowment vector

V_{fw} = (n x 1) endowment vector of world, $V_{fw} = \sum_{i=1}^{c} V_{fi}$

and α_i = i-th country's share in total world expenditure.

Considering two factors, capital and labour and denoting their content of trade by K_T and L_T respectively we get,

$$K_T = K_i - \alpha_i K_w \qquad (9)$$

and

$$L_T = L_i - \alpha_i L_w \qquad (10)$$

A country i is abundant in capital if and only if the share of capital endowment of the country in the world endowment of capital is greater than the share of its labour endowment in world's endowment of labour i.e. $(K_i / K_w) > (L_i / L_w)$

or, $(K_i / L_i) > (K_w / L_w)$ (11)

From equations (9), (10) and (11) we get,

$(K_i / L_i) > [(K_i - K_T) / \alpha_i] / [(L_i - L_T) / \alpha_i]$

or, $- K_i L_T > - L_i K_T$ (12)

Since there are two factors, if trade is balanced K_T and L_T should be opposite in sign i.e if $K_T > 0$ then $L_T < 0$ if trade is balanced. If l_E and k_E are the labour and capital content of a million dollar worth of exports respectively and e is the total value of export. Similarly, l_M and k_M are the labour and capital embodied in one million dollar worth of imports m respectively. Then

$L_T = L_E - L_M = l_E\, e - l_M\, m$

If $L_T < 0 \Rightarrow l_E\, e - l_M\, m < 0 \Rightarrow (l_E / l_M) < (m / e) = 1$ (since trade is balanced)

Similarly, $K_T > 0 \Rightarrow (k_E / k_M) > (m / e) = 1$

Therefore, $(k_E / k_M) > (l_E / l_M)$ (13)

Thus, given balanced trade $K_T > 0$ and $L_T < 0$ implies $(k_E / k_M) > (l_E / l_M)$ which is precisely the index Leontief applied. Leamer found that for 1947 U.S. data, $K_T > 0$ and $L_T > 0$, therefore $(k_E / k_M) < (l_E / l_M)$ was the false proposition to conclude that the U.S. was poorly endowed with capital.

$K_T > 0$ and $L_T > 0$ indicates the presence of either an additional factor or trade surplus or both. However, Deardorff (1984) pointed out that under the assumption of balanced trade, the presence of a third factor might not resolve the Paradox. Leamer took the second route to reconcile the Paradox with the theory. In his explanation he defined K_C and L_C as the capital and labour embodied in the domestic expenditure of the commodities respectively used in country i, where $K_i = K_C + K_T$ and $L_i = L_C + L_T$. Using these relations in equation (12), we get the condition

$(K_T / L_T) > (K_C / L_C)$, (if $K_T, L_T > 0$) (14)

which implies a country is rich in capital relative to labour if the production endowed more capital than domestic expenditure.

Moreover, given $K_T > 0$ and $L_T > 0$, equation (12) also implies

$(K_T / L_T) > (K_i / L_i)$ (15)

Leamer deduced the following conditions either one of which a country richly endowed with capital relative to labour as revealed by trade should satisfy.

$K_T > 0 , L_T < 0$ (16)

$K_T > 0 , L_T > 0 , (K_T / L_T) > (K_C / L_C) \rightarrow L_2 > 1$ (17)

$K_T < 0 , L_T < 0 , (K_T / L_T) < (K_C / L_C) \rightarrow L_2 < 1$ (18)

Combining the calculations done by Leontief and Travis in their respective studies, Leamer checked these conditions for the U.S. economy and found that the U.S. was abundant in capital relative to labour.

2. Data sources of the study

The present study of the factor content of India's foreign trade focusing the reform period has used a wide range of data to estimate the labour and capital coefficients embodied in export, import replacements and domestic expenditure. In this section an idea has been presented on the kind of data used, the sources they have been collected from and their manipulation in the required form.

When Leontief's index is applied the following data have been used.

A) The Input-Output Transaction table for 1993-94 and 1998-99 prepared by CSO. The original (115x115) sector table is aggregated and reduced into (44x44) one. It is important to note that while lumping the sectors wherever convenient it has been assumed that the sector aggregated use inputs in identical proportion or are related to one another through strict complementary or vertical integration as to keep input-output coefficient undisturbed. The aggregated table of 1998-99 is expressed at 1993-94 prices to make the input-output tables comparable. The aggregation scheme is given in the Appendix table A.

B) Data series on mandays employed per unit of output for each sector which is considered as the labour-output ratio or labour coefficient for each sector.

Before going into the discussion on the data and their sources required for estimating the labour coefficients of the sectors let us first illustrate the concept regarding labour that we have used in our study. Here, employment is measured in man-days which represent the total number of days worked during the accounting year. Man-days are obtained by summing the number of persons attending in each shift over all the shifts on all days. It is obvious from the concept underlined above that by considering mandays a better insight into the structure of our foreign trade could be obtained. Because when the labour coefficients are estimated in terms of mandays instead of number of men employed, the problem of overestimation due to the existence of disguised unemployment could be tackled in a better way. (Bharadwaj, 1962).

The labour coefficient is defined as

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$l_w = L_w x^{-1}$ where l_w is the row vector of mandays-output ratio, L_w is the row vector of mandays employed in each sector and x is the diagonal matrix representing the gross output of the sectors.

The data on employment for sectors 7-40 in 1993-94 and 1998-99 are obtained from Annual Survey of Industries of 1993-94 and 1998-99 prepared by CSO. The data on gross output of these sectors are also taken from the ASI.

For sectors 1-6 and 4-44 the employment data are complied from NSS 50th round survey on Employment and Unemployment for 1993-94 while NSS 55th round survey on Employment and Unemployment data for 1999-00 has been used to obtain the employment data for 1998-99. The outputs of these sectors are complied from National Account Statistics.

C) Data series on capital stock per unit of output i.e. the capital coefficient for each sector.

The total value of fixed capital and physical working capital including depreciation are considered while estimating the capital stock of each sector. The capital coefficient is

computed as $k_w = K_w x^{-1}$, where k_w is the row vector of capital-output ratio, K_w is the row vector of total capital stock invested in each sector.

The data on capital stock for sectors 7-40 in 1993-94 and 1998-99 are obtained from Annual Survey of Industries of 1993-94 and 1998-99 prepared by CSO. The data on capital stock of these sectors excluding 4-6 are taken from National Account Statistics. In case of 4-6 due to unavailability of the disaggregated data the capital stock are estimated indirectly, where the sectoral maydays employed by sectoral wage rates are subtracted from the corresponding sectoral gross value added to obtain the capital stock invested in these sectors. The data on gross value added of these sectors are obtained from IOTT tables while the wage data are complied from NAS.

The capital-output and labour-output ratio of 1998-99 is adjusted to 1993-94 prices to facilitate comparison of the factor coefficients of the two years. Both labour and capital coefficients are the gross ratios. The capital coefficients show the relationship between the investment including depreciation and gross output including the value of material input while the labour coefficient are measured as the mandays to gross output. Gross ratios are used since the entries of the input-

output table are gross in character and the model shows the average relationship between the inputs and the outputs. (Bharadwaj, 1962).

D) Data series on average crores worth of Indian exports and average crore rupees worth of India's competitive import replacements for 1993-94 and 1998-99.

The data for the two composite commodity vectors "a crore rupees worth of exports" and "a crore rupees worth of import replacements" for 1993-94 and 1998-99 have been obtained from the IOTT for 1993-94 and 1998-99. The composite commodity vector for export is derived by a simple arithmetic procedure where the sector-wise export entries are divided by the total value of export and then multiplying them by a rupees crore. Analogously, the same procedure may be adopted to obtain the contribution of each sector to a crore rupees worth of import replacements; leaving aside the non-competitive imports from the calculations. However, the input-output tables of 1993-94 and 1998-99 reveals that there are no non competitive imports for these years. This seems somewhat surprising considering the vast differences in labour, capital and natural resources between India and her trading partners. Contrary to the popular belief the incompatibility between imports and its domestic replacements is not accounted for by the differences in natural resources as such. This is because the vast expanse of the Indian subcontinent is endowed with a variety of geographical and climatic conditions. Moreover, recently domestic substitutes of ordinary and specialized imports are also available. Again all the data required for a realistic assessment of the factor requirements for all the import items could be collected. For all these reasons no exclusions are necessary from the set of import replacements. But the qualitative differences between two shall persist.

Finally in this paper a decomposition study has been conducted for which the data on India's trade with the OECD, the EU, North America and Japan for 1993-94 and 1998-99 have been collected from the Foreign Trade Statistics provided by the United Nations.

3. Results and discussions

The results pertaining to the factor content of India's foreign trade using the Leontief index and Leamer index are concisely presented in this section. Using Leontief index for measuring comparative capital-labour intensity it is observed that in 1993-94 and 1998-99, the capital required per mandays for exports to the rest of the world is less than that required for domestic replacements of competitive imports (Appendix Table B). This implies India's overall exports

absorb relatively more labour and less capital than import replacements in 1993-94 as well as in 1998-99. Therefore India's structure of trade with the rest of the world during reform period as revealed by the Leontief index is one of a labour-abundant country (Table 3).

It is also observed that the capital intensity of import replacements relative to exports to the rest of the world has increased over time. In 1993-94, the import replacements use 7% more capital per mandays relative to export while import replacements in 1998-99 absorb 28% more capital per mandays than exports. When the capital intensities of export and domestic replacements of import are compared between 1993-94 and 1998-99 it is found that capital intensities of both exports and import replacements have gone up between these two years. While the capital intensity of exports has increased by 5% over the study period, the ratio for import replacements has increased by 28% (Appendix Table B).

Table 3: Relative Factor Abundance

Trading partners	Leontief Index		Leamer index	
	1993-94	1998-99	1993-94	1998-99
Rest of the world	L_1 <1 LABOUR	L_1 <1 LABOUR	KT<0, LT<0 L_2>1 LABOUR	KT<0, LT<0 L_2>1 LABOUR
OECD	L_1<1 LABOUR	L_1<1 LABOUR	KT<0, LT>0 LABOUR	KT<0, LT<0 L_2<1 CAPITAL
EU	L_1<1 LABOUR	L_1>1 CAPITAL	KT<0, LT<0 L_2>1 LABOUR	KT<0, LT<0 L_2<1 CAPITAL
North America	L_1>1 CAPITAL	L_1 >1 CAPITAL	KT<0, LT<0 L_2<1 CAPITAL	KT<0, LT<0 L_2<1 CAPITAL
Japan	L_1>1 CAPITAL	L_1 >1 CAPITAL	KT<0, LT<0 L_2<1 CAPITAL	KT<0, LT<0 L_2<1 CAPITAL

Applying Leamer's methodology, India is found to be net importer of both capital and labour services in 1993-94 and 1998-99. To determine the factor abundance as revealed by the trade structure we have to compare the capital per labour embodied in domestic expenditure with that embodied in net export. From Table 2 it is observed India's net trade absorbs more capital per

mandays than its domestic expenditure (i.e.L_2 >1) in 1993-94 and 1998-99, which corroborates the result regarding the factor abundance obtained in the Leontief framework. So, India's trade with the rest of the world during reform period may be in tune with its comparative advantage as addressed by the Heckscher-Ohlin theory.

3.1 Further experiment on the Factor content of India's trade

The decade of the 1990's has also witnessed a significant change in the direction of India's foreign trade. During the first half of the decade of the 1990's our export effort suffered a major shock with collapse of the Soviet Union. Exports to Russia accounted for as much as 16% of India's to total export but the share came down to only 2.4% in 1993-94. On the other hand, in 1993-94 exports to some selected East Asian countries boomed, increasing on the average by 61% in dollar terms. During this decade an impressive growth in India's trade with the OPEC and particularly developing countries in Asia, Africa and Latin America has been witnessed whereas the country maintained more or less a steady share in export and import with its traditional trading partners like the OECD (including the EU, North America and Japan). In recent years developing nations of Africa, Asia and Latin America accounted for more than one-fourth of India's export earnings and most important in this group have been the countries of Asia. In fact, export to Asian countries accounted for 21% of India's total export earnings 2000-01. In 2005-06, China and UAE have emerged as the second and third largest trading partners of India. The percentage growth of these countries was about three times the overall export growth. Region-wise the ASEAN nations have also emerged as a significant trading partner in terms of both export and import during later years of reform period. The Asia and ASEAN countries including West Asia and North Africa and China, Hong Kong accounts for half of India's total export in 2005-06. regarding India's import, Asia and the ASEAN continued to be a major and rapidly growing source during the reform period.

The noticeable change in direction of India's foreign trade might have an effect on the factor content of its overall trade. How far such directional change affected the factor content of trade might have reflected in the study of the factor content of India's bilateral tarde with the OECD which continues to be a major trading partner over the years. With the same purpose the paper has also separately studied the factor content of India's trade with the EU, North America and Japan. The OECD group of countries has been the single largest destination of India's export as

well as the origin of India's import. In 2004-05, the OECD countries has accounted for 46.5% of India's total export while the share of this group in total import has been 37.6%. Among the OECD countries the European Union (EU) accounted for 21.8% of total exports and 18.8% of total imports in 2004-05. India's trade with North America has also been significant in terms of total export earnings and total import expenditure: particularly the USA continues to be the single largest destination for India's export and source of its import over the years. Japan accounted for 10.3% of total export in 1987-88 whereas its share in total import expenditure was 9.5% in 1987-88 but the shares have exhibited a downward trend in terms of both export earnings and import expenditure during the reform period. Table 3 shows that for India's trade to the OECD Leontief Index is less than one in both the years which implies Indian export is more labour intensive as compared to import replacements over the study period, though the capital intensity of export relative to import replacements has increased from 88% in 1993-94 to 97% in 1998-99 (Appendix Table D). It is also observed that India's export to the EU in 1993-94 has been more labour intensive than her import replacements but the ranking of factor intensity of export and import replacements has reversed in 1998-99. Therefore the trade pattern of India's trade with the EU at the beginning of the reform period has confirmed the Heckscher-Ohlin proposition as India is commonly regarded as relatively more labour abundant than the advanced countries but the factor content of its trade structure with the EU in later years of reform indicates another instance of Leontief Paradox.

When factor intensities of India's export and import replacements with North America and Japan in 1993-94 and 1998-99 have been estimated it has been observed that in both of the cases India's export to these partners is absorbing more capital than its import replacements over the period of our concern. Therefore the factor content of trade with these countries reveals India as a capital abundant country, contradicting the Heckscher-Ohlin presumption regarding India's foreign trade.

When Leamer index has been applied the results regarding the factor abundance of India for its trade with the EU, North America and Japan are almost same as those obtained in case of Leontief index. The result obtained using Leamer index differs from that obtained by Leontief measure only in case India's trade with the OECD countries in 1998-99. Unlike the Leontief measure, Leamer index produces a paradoxical result showing India becoming a capital abundant country relative to OECD countries during later years of the economic reform.

The structure of India's foreign trade is typical of a developing economy. But owing to industrialisation programme exports of non-traditional items such as engineering goods, readymade garments, chemical products have been gaining in importance and established themselves in the market of even the most advanced countries. The results of our study may substantiate this fact as the export to advanced OECD countries has been becoming more capital intensive than its import from these countries. The study finds that between 1993-94 and 1998-99 some non-traditional capital intensive goods like batteries (51%), electrical appliances (47%), electronic equipment (101%), communication equipment (42%), ships and boats (78%) have contributed significantly in the total export growth to the OECD countries.

In case of India's trade with the EU, exports of some capital intensive sectors like rubber products (98%), inorganic and organic chemicals (94%), other chemicals (73%), non ferrous basic metals (111%), ships and boats (184%), other electrical machinery (604%), batteries and electrical appliances (238%) have shot up significantly between 1993-94 and 1998-99 along with a modest rise in shares of exports in the traditional items. On the other hand, except in cases of non-ferrous basic metals, other electrical machines and communication equipment, the import of capital-intensive goods from the EU have shown a negative growth in share over the same period.

For India's import basket originating from North America the share of the capital intensive sectors except Iron and Steel, non ferrous basic metals, industrial and agricultural machines have reduced whereas the share of beverages, textiles and leather products have shot up during the reform period. On the export side not much variation in composition of commodities has been witnessed during this period, only the shares of some traditional items as well as some capital intensive sectors have risen marginally.

In case of India's trade with Japan, some of the capital intensive sectors like chemicals, iron and steel, non ferrous basic metals, engineering goods, transport equipments, plastic products have grown significantly in importance along with the labour intensive sectors like textiles, handicrafts, fishing. On import side the basket comprises of mainly machine goods, chemical products etc.

Thus, the capital intensity of India's export relative to its import has grown fast in case of its trade with the traditional and major trading partners. At the same time in case of India's overall trade with the rest of the world, export found to be less capital intensive relative to its import.

The growing importance of the new trading partners during reform period with which India's trade is characterised by the traditional export of agro- processed and labour intensive manufacturing sectors, could explain the case of less capital intensity of India's overall export as compared to its import.

4.Conclusion

A few studies had been conducted during pre liberalisation period to empirically test the Hechscher-Ohlin theory for India's foreign trade and all of these studies had confirmed the theory showing India's export being more labour intensive than its import replacements. In this paper an attempt has been made to verify the same presumption regarding India's foreign trade focusing the period of reform. In sharp contrast to its earlier policies of import substitution Indian Government has initiated a number of measures to open up the foreign trade sector and announced massive import liberalisation measues over the last decade. With opening up of the economy, India's export during this period is expected to be dominated by the labour intensive commodities in which it enjoys a natural comparative advantage. In this study, the factor content of trade has been estimated for India's trade with the rest of the economy using Leontief index and Leamer index and then the same indices have been estimated for India's trade with the OECD countries, which is the single largest trading partner of India's foreign trade. Further experiment has been conducted for India's trade with the EU, North America and Japan.

The study conducted by considering two important factors of production, labour and capital, even though a number of other factors such as natural resources, skilled labour influence the course of foreign trade considerably. But deficiency of reliable data particularly for the primary sectors has compelled us to circumscribe the scope of the present study.

Let us now present the summary of the study. India's trade with rest of the world is found to be in tune with its comparative advantage during reform period whereas its export with the OECD group has become capital intensive relative to import in later years of reform in Leamer's framework. India's export to the EU has also become capital intensive during later years of reform. Finally, in cases of India's trade with North America and that with Japan factor content of the trade contradicted the Heckscher-Ohlin prediction during the period of study.

The study reveals paradoxical finding regarding India's trade to the OECD, EU, North America and Japan in later years of reform, which are the main destinations of export as well as origin of

imports, although no such paradox has been witnessed in case of India's trade with the rest of the world.

Over the years the trade shares with the entire group of the OECD countries have been declining. Export to the OECD countries has declined from 59% in 1987-88 to 57% in 1998-99 and further to 49.3% in 2001-02. Similarly, there has been a sharper decline in imports from the OECD countries from 60% in 1987-88 to 54% in 1998-99 and further to 40.1% in 2000-01. On the other hand, India's trade with developing countries of Asia, Africa and Latin America has shown an upward trend. It has seen that during reform period Hong Kong, Singapore and Thailand have become major export destinations whereas a large share of import has been from Singapore, South Korea and Malaysia. The exports to developing nations shot up from 14.2% in 1987-88 to 29% in 1998-99 and further to 35.5% in 2003-04. So far as imports from these countries are concerned the share has risen from 17.3% in 1987-88 to 33% in 1998-99. The trade with the OPEC has also improved significantly; export share increasing from 6.1% to 15%. However import from the OPEC have shown downward trend from 13.3% in 1987-88 to 7.3% in 2003-04. India's trade with the non-OECD nations is characterised by the traditional export of agro processed and labour intensive manufacturing sectors and import of raw materials needed for industrialisation. Thus the growing importance of the developing nations in India's trade during reform period couple with declining importance of the OECD group in total trade could explain why structure of India's trade with the rest of the world is one of a labour abundant country.

Among the OECD group of countries, the export share to the EU has increased 25% in 1987-88 to 27% in 1998-99 but the share has declined in 2001-02 to 21.7% while the import from the EU accounted for 33% in 1987-88 and fell sharply to 25% in 1998-99 and further to 19.1% in 2001-02. Export to Japan has also fallen from 10.3% in 1987-88 to 4.9% in 1998-99 to further 2.7% in 2003-04 while Import has declined from 8.5% in 1987-88 to 5.8% in 1998-99 to further 3.4% in 2003-04. However exports to North America has posted healthy growth rate during this period as the share of this region in total export has increased to 19.7% in 1987-88 to 23.5% in 1998-99 although the share of this region in total import has declined from 10.3% to 9% during the same period. Thus it is evident that imports from advanced countries, which comprised mostly the capital-intensive goods fell remarkably during later years of economics reform. Coupled with this the study has also revealed that owing to industrialisation over the years the commodity composition in the export basket has shifted towards capital intensive machine goods,

engineering goods, non ferrous basic metals etc in later phase of reform period, which might have produced the paradox in cases of India's trade with the OECD, the EU, North America and Japan.

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Appendix table A : Aggregation scheme

SECTOR	NAME OF THE AGGREGATED	SECTORS IN ORIGINAL I-O TABLE

NO	SECTOR	
1.	Agriculture & allied activities	Paddy (1), Wheat (2), Jowar (3), Bajra (4), Maize (5), Gram (6), Pulses (7), Sugarcane (8), Groundnut (9), Jute (10), Cotton (11), Tea (12), Coffee (13), Rubber (14), Coconut (15), Tobacco (16), Other crops (17), Milk and Milk products (18), Animal services (agricultural) (19), Other livestock products (20).
2.	Forestry and logging	Forestry and logging (21)
3.	Fishing	Fishing (22)
4.	Coal and lignite	Coal and lignite (23)
5.	Crude petroleum and natural gas	Crude petroleum and natural gas (24)
6.	Other Metallic minerals & Non metallic minerals	Iron ore (25), Manganese ore (26), Bauxite (27), Copper ore (28), Other metallic minerals (29), Lime stone (30), Mica (31), Other non metallic minerals (32)
7.	Miscellaneous food products	Sugar (33), Khandsari boora (34), Hydrogenated oil (vanaspati) (35), Edible oils other than vanaspati(36), Miscellaneous food products(38)
8.	Tea and coffee processing	Tea and coffee processing (37)
9.	Beverages	Beverages (39)
10	Tobacco products	Tobacco products (40)
11.	Textiles	Khadi, cotton textiles (handlooms) (41), Cotton textiles (42), Woolen textiles (43), Silk textiles (44), Art silk, synthetic fibre textiles (45), Jute, hemp and mesta textiles (46), Carpet weaving (47), Readymade garments (48), Miscellaneous textile products (49)
12.	Wood and miscellaneous wood products	Furniture and fixtures- wooden (50), Wood and wood products (51)
13.	Paper, printing and publishing	Paper, paper products & newsprint (52), printing and publishing (53)
14.	Leather and leather products	Leather footwear (54), Leather and leather products (55)
15.	Rubber products	Rubber products (56)
16	Plastic products	Plastic products (57)
17.	Petroleum products	Petroleum products (58)
18.	Coal tar products	Coal tar products (59)
19.	Inorganic & organic heavy chemicals	Inorganic chemicals (60), Organic chemicals (61)
20.	Fertilizers	Fertilizers (62)
SECTOR NO	NAME OF THE AGGREGATED SECTOR	SECTORS IN ORIGINAL I-O TABLE
21.	Synthetic fibre, resin	Synthetic fibre, resin (67)

22.	Other chemicals	Pesticides (63), Paints, varnishes and lacquers (64), Drugs & medicines (65), Soaps, cosmetics & glycerin (66), other chemicals (68)
23.	Cement and clay products	Structural clay products (69), Cement (70)
24.	Other non metallic mineral products	Other non metallic mineral products (71)
25.	Iron & steel	Iron, steel and ferro alloys (72), Iron and steel casting and forging (73), Iron and steel foundries (74)
26.	Non ferrous basic metals	Non ferrous basic metals (75)
27.	Hand tools and miscellaneous metal products	Hand tools, hardware (76), Miscellaneous metal products (77)
28.	Tractors and agricultural implements	Tractors and agricultural implements (78)
29.	Industrial machinery	Industrial machinery (F & T) (79), Industrial machinery (others) (80)
30.	Other machinery	Machine tools (81), Office computing machines (82), Other non- electrical machinery (83)
31.	Electrical industrial machinery	Electrical industrial machinery (84)
32.	Batteries and electrical wires, cables	Electrical wires & cables (85), Batteries (86)
33.	Electrical appliances	Electrical appliances (87)
34.	Communication equipments	Communication equipments (88)
35.	Other electrical machinery	Other electrical machinery (89)
36.	Electronic equipments (incl. TV)	Electrical equipments (incl. TV) (90)
37.	Ships and boats	Ships and boats (91)
38.	Other transport equipments	Rail equipments (92), Motor vehicles (93), Motor cycles & scooters (94), Bicycles, rickshaw (95), Other transport equipments (96)
39.	Miscellaneous manufacturing	Watches and clocks (97), Miscellaneous manufacturing (98)
40.	Construction	Construction (99)
41.	Electricity, gas & water supply	Electricity (100), Gas (101), Water supply (102)
42.	Transport services	Railway transport services (103), Other transport services (104)
43.	Communication	Communication (106)
44.	Miscellaneous services	Storage & warehousing (105), Trade (107), Hotels and restaurants (108), Banking (109), Insurance (110), Owner of dwelling (111), Education & research (112), Medical & health (113), Other services (114), Public administration (115).

Appendix Table B: Leontief Index in case of trade with rest of the world

	1993-94		1998-99	
	EXPORTS	IMPORT REPLACEMENTS	EXPORTS	IMPORT REPLACEMENTS
CAPITAL (in rupees, at 1993-94 prices)	39553469.64	40040066.63	35658824.79	38498675.17
LABOUR (in mandays)	6724.21	6349.19	5753.41	4753.53
K/L	**5882.25**	**6306.33**	**6197.86**	**8098.96**
Leontief Index: $(K/L)_X$ / $(K/L)_M$	**.93**		**.77**	

Appendix Table C: Leamer index in case of trade with rest of the world

	1993-94	1998-99
Net Export of capital services (KT) (in Rs crores)	-39037.89	-198741.15
Net Export of Labour services (LT) (in crore mandays)	-2.21	-5.19
Capital-Labour intensity of trade K_T / L_T (in Rs per mandays)	17686.61	38244.46
Capital embodied in Expenditure (KC) (in Rs)	301749518.06	386481725.08
Labour embodied in Expenditure (LC) (in crore mandays)	33611.97	37284.80
Capital-Labour intensity of expenditure K_C / L_C (in Rs per mandays)	8977.44	10365.67
Leamer Index: **$(K_T / L_T) / (K_C / L_C)$**	**1.97**	**3.69**

Appendix Table D: Leontief Index in case of trade with the OECD, the EU, North America and Japan

OECD				
	1993-94		1998-99	
	EXPORT	IMPORT REPLACEMENTS	EXPORT	IMPORT REPLACEMENTS
CAPITAL (in rupees, at 1993-94 prices)	35167537	39923362	38663181	45755510
LABOUR (in mandays)	4838	4831	5985.23	6838.02
K/L	**7269.02**	**8263.99**	**6459.77**	**6691.34**
Leontief Index: **$(K/L)_X$ / $(K/L)_M$**	**0.88**		**0.97**	
EU				
	1993-94		1998-99	
	EXPORT	IMPORT REPLACEMENTS	EXPORT	IMPORT REPLACEMENTS
CAPITAL (in rupees, at 1993-94 prices)	39864878	45715855	35990801	40342451
LABOUR (in mandays)	7043	7284	3505	4995
K/L	**5660.21**	**6276.20**	**10268.42**	**8076.57**
Leontief Index: **$(K/L)_X$ / $(K/L)_M$**	**0.90**		**1.27**	
NORTH AMERICA				
	1993-94		1998-99	
	EXPORT	IMPORT REPLACEMENTS	EXPORT	IMPORT REPLACEMENTS
CAPITAL (in rupees, at 1993-94 prices)	36303549	39852475	36481336	39038008
LABOUR (in mandays)	4634	5171	4356	5281
K/L	**7834.17**	**7706.92**	**8374.96**	**7392.16**
Leontief Index: **$(K/L)_X$ / $(K/L)_M$**	**1.017**		**1.13**	
JAPAN				
	1993-94		1998-99	
	EXPORT	IMPORT REPLACEMENTS	EXPORT	IMPORT REPLACEMENTS
CAPITAL (in rupees, at 1993-94 prices)	30552742	40180631	29337318	39954820
LABOUR (in mandays)	2814	5524	2513	5485
K/L	**10857.41**	**7273.83**	**11674.22**	**7284.38**
Leontief Index: **$(K/L)_X$ / $(K/L)_M$**	**1.49**		**1.60**	

Appendix Table E: Leamer Index in case of trade with OECD, EU, North America and Japan

OECD		
	1993-94	1998-99
Net Export of capital services (KT) (in Rs crores)	-4755825	-7092329
Net Export of Labour services (LT) (in crore mandays)	7	-852.79
Capital-Labour intensity of trade K_T / L_T (in Rs per mandays)	------	8316.62
Capital-Labour intensity of expenditure K_C / L_C (in Rs per mandays)	8977.44	10365.67
Leamer Index: **$(K_T / L_T) / (K_C / L_C)$**	**0**	**0.80**
EU		
	1993-94	1998-99
Net Export of capital services (KT) (in Rs crores)	-5850977	-4351650
Net Export of Labour services (LT) (in crore mandays)	-241	-1490
Capital-Labour intensity of trade K_T / L_T (in Rs per mandays)	24277.91	2920.57
Capital-Labour intensity of expenditure K_C / L_C (in Rs per mandays)	8977.44	10365.66
Leamer Index: **$(K_T / L_T) / (K_C / L_C)$**	**2.70**	**0.28**
NORTH AMERICA		
	1993-94	1998-99
Net Export of capital services (KT) (in Rs crores)	-3548926	-2556672
Net Export of Labour services (LT) (in crore mandays)	-537	-925
Capital-Labour intensity of trade K_T / L_T (in Rs per mandays)	6608.80	2763.97
Capital-Labour intensity of expenditure K_C / L_C (in Rs per mandays)	8977.44	10365.66
Leamer Index: **$(K_T / L_T) / (K_C / L_C)$**	**0.74**	**0.27**
JAPAN		
	1993-94	1998-99
Net Export of capital services (KT) (in Rs crores)	-9627889	-10617502
Net Export of Labour services (LT) (in crore mandays)	-2710	-2972
Capital-Labour intensity of trade K_T / L_T (in Rs per mandays)	3552.73	3572.51
Capital-Labour intensity of expenditure K_C / L_C (in Rs per mandays)	8977.44	10365.66

Leamer Index: $(K_T / L_T) / (K_C / L_C)$	**0.39**	**0.34**