Factor Content of India's Foreign Trade with Developed and Developing Regions

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Abstract

A notable economic feature of India is that a huge labour force (second largest in world) is combined with a relatively small stock of physical capital. Therefore India offers an excellent case study for Heckscher-Ohlin theory which states that the pattern of trade is determined by the endowments of factors of production of a country. At the same time it is also evident that under the impact of industrialization the composition of India's foreign trade has undergone a substantial change over the years: particularly the non traditional items have grown in importance in the export basket. This paper attempts to measure the factor content of India's foreign trade with the rest of the world, the European Union, and the developing Asia to find out whether the factor intensity of trade has been in tune with comparative advantage as determined from its endowment of factors. The period covered in the study is from 1989-1990 to 2003-2004.

First, the factor contents of trade are measured in the light of two alternative theoretical frameworks provided by Leontief (1953) and Leamer (1980). Then the factor content is further studied by incorporating the factor-augmenting productivity differences into the model as argued by Trefler (1993, 1995). The study confirms the Heckscher-Ohlin presumption regarding India's trade with the World and regarding its bilateral trade with the EU. However, paradoxical findings have been witnessed in cases of India's trade with North America and developing Asia.

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Introduction

Over the last six decades, the commodity composition of India's foreign trade has undergone a substantial change in the face of structural changes in the economy. The implementation of the industrialization programme starting from the Second Plan and consequent diversification and modernization in the production structure was responsible to a large extent for this change. Agriculture and allied products which constituted 44.2% of total merchandised export in 1960-61, declined substantially to 19.4% at the beginning of the 1990's and further declined to only 9.1% of total merchandised export in 2008-09 (Table 1). The share of manufactured products in total merchandised export earnings increased from 45.3% to 66.4% between 1960-61 and 2008-09. However the manufactured goods have not registered any significant hike in share in the total merchandised export during the 1990's and 2000's. In 1990-91, the share of this group in total export earnings was 72.9% which further rose to 78.9% in 2000-2001 and finally declined to 66.4% in 2008-09. The manufactured commodities registering a substantial increase in export earnings and gradually becoming the principal export items over the years were chemicals, dyes, pharmaceuticals, gems and jewellery, Iron and steel, machinery, transport equipments, electronic goods and clothing products. Leather product and textiles showed decline in total merchandised export. The structural change was relatively minor in the first decade of the post reform period. Changes occurred in the second decade with engineering products and chemicals leading the way. The product composition has changed to some extent from 2000-2001 to 2010-2011 (Table 2). Over this period crude petroleum products entered in substantial proportion in 2000-01 and reached 16.1% of total merchandised exports in 2010-11. Petroleum products became an important segment of exports with the share of over 16% in 2010-11. India has become one of the leading petroleum refining centre in Asia. On the other hand, the declining share of textiles in total export is a point of concern as its share has fallen to less than 10% in total merchandised export. To a lesser extent similar is the case with gems and jewellery.

Table 1. Composition of India's Exports (share in %)

Product categories	1960-61	1970-71	1980-81	1990-91	2000-01	2007-08	2008-09
1. Agricultural and allied products	**44.28**	**31.71**	**30.65**	**19.41**	**14.04**	**9.93**	**9.13**
1.1 Coffee	1.1	1.62	3.19	0.78	0.58	0.29	0.27
1.2 Tea and mate	19.32	9.65	6.34	3.29	0.97	0.31	0.32
1.3 Edible oil and oil cake	2.15	3.59	1.86	1.87	1.01	1.24	1.21
1.4 Tobacco	2.52	2.12	2.1	0.81	0.43	0.29	0.41
1.5 Cashew kernels	2.97	3.74	2.09	1.37	0.93	0.34	0.35
1.6 Spices	2.67	2.51	0.17	0.73	0.79	0.66	0.74
1.7 Sugar and molasses	4.46	1.92	0.59	0.12	0.25	0.86	0.53
1.8 Raw cotton	1.86	0.94	2.46	2.6	0.11	1.35	0.34
1.9 Rice		0.34	3.33	1.42	1.45	1.79	1.31
1.10 Fish and fish preparations	0.74	1.92	3.23	2.95	3.13	1.05	0.83
1.11 Meat and meat preparations	0.15	0.2	0.82	0.43	0.72	0.57	0.63
1.12 Fruits, vegetables and pulses (excluding cashew kernels and processed food and juices)	0.97	0.79	1.19	0.66	0.79	0.62	0.66
1.13 Miscellaneous processed foods (including processed fruits and juices)	0.15	0.3	0.53	0.65	0.54	0.33	0.37
2. Ores and minerals	**8.81**	**10.68**	**6.16**	**4.6**	**2.03**	**5.55**	**4.17**
2.1 Iron ore	2.67	7.63	4.53	3.22	0.8	3.56	2.55
3. Manufactured goods	**45.32**	**50.27**	**55.83**	**72.92**	**78.95**	**64.13**	**66.44**
3.1 Textile fabrics and manufactures (excluding carpets handmade)	11.37	9.45	13.89	20.98			
3.1.1 Cotton yarn, fabrics, made up etc,	10.1	9.26	6.08	6.45	**7.87**	**2.85**	**2.22**
3.1.2 Readymade garments of all textile materials		1.92	8.2	12.32	12.52	5.94	5.9
3.2 Coir yarn and manufactures	0.96	0.84	0.26	0.15	0.11	0.1	0.08

3.3 Jute manufactures	21.03	12.41	4.91	0.92	0.46	0.2	0.16
3.4 leather and leather products	4.38	5.22	5.81	7.99	4.38	2.08	1.87
3.5 Handicrafts (including carpets handmade)	1.71	4.73	14.19	18.94	2.50*	0.88	0.57
3.5.1 Gems and jewellery		2.9	9.22	16.12	16.57	12.06	15.09
3.6 Chemicals and allied products	1.1	1.92	3.47	6.48	11.23	10.65	10.06
3.7 Machinery, transport and metal manufactures (including iron and steel)	3.42	12.85	12.31	11.89	15.56	22.82	25.45
4. Mineral fuels and lubricants (including coal)	**1.1**	**0.84**	**0.41**	**2.91**	**4.33**	**17.8**	**14.94**

Source: Handbook of Statistics on the Indian Economy of RBI

Table 2. Change in the Composition of Exports 2000-01 to 2010-11 (in %)

Product Groups	Exports 2000-01	Exports 2010-11	Rise or fall in %
Engineering Goods	12.4	23.63	10.79
Petroleum Products	1.66	16.59	14.93
Gems and Jewellery	16.75	13.75	-3
Textiles	24.26	9.34	-14.92
Agriculture and Allied Products	8.8	6.97	-1.83
Ores and Minerals	2.62	4.42	1.8
Electronic Goods	2.54	3.36	0.82
Leather and Leather Goods	4.41	1.59	-2.83
Marine products	3.16	1.17	-1.99
Chemicals and related Products	14.01	12.93	-1.08

Source: Economic Survey, Government of India. Various years.

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. The share of food grains and live animals which constituted a significant proportion in total merchandised imports at the beginning years of economic planning

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declined remarkably over the years. Table 3 shows that the share of food grains and live animals category imports declined sharply from 19% in 1960-61 to 3% in 1980-81 and became insignificant thereafter. In this category cereals and cereal preparations was the main item, its share in total merchandised imports declined from 16.1% in 1960-61 to 0.02% in 2008-09. The decline was continuous over the period. The share of raw materials and intermediates increased from 46.9% in 1960-61 to 57.5% in 2008-09. The share of this product group increased sharply in the pre-reform period and touched 77% of total merchandised imports in 1980-81 and declined thereafter. For iron and steel import the share declined continuously till 2000-2001 and thereafter there was an increase. Non ferrous basic metals enhanced its share in total merchandised imports between 1960-61 and 2008-09 and also in both pre-reform and reform period. Similar is the case for petroleum oil and lubricants. Its share galloped from 6.1% in 1960-61 to 30.07% in 2008-09. The share of capital goods in total merchandised imports declined from 31.7% in 1960-61 to 15.5% in 2008-09. In this category, both electric and non electric machinery showed decline in the share of imports in total. However transport equipment showed an increased share in total merchandised imports over the period 1960-61 to 2008-09.

In last two decades India's performance in the service sector export was quite phenomenal, particularly in comparison with other Asian emerging economies. The share of India in total world export of services increased from 0.6% in 1990 to 1.2% in 2001 and went further up to 2.8% in 2008 while during the same period its share in global export rose from 0.5% in 1990 to 0.7% in 2001 and 1.1% in 2008. Services accounted for 20% of India's exports in 1990 and in 2008 it has accelerated to 59.2%. India's service export have been driven by business services (including software) and accounted for 67.8% of total service export in 2008. Since 1999, India is second largest exporter of business services among emerging Asian economies. Since mid 1990's software and computer services have been the most dynamic component of Indian exports. India has now become the leading exporter of software services ahead of The US.

Table 3. Composition of India's Imports (share in %)

Product categories	1960-61	1970-71	1980-81	1990-91	2000-01	2007-08	2008-09
1. Food and live animals (excluding raw cashew)	**19.08**	**14.85**	**3.03**				
1.1 Cereals and cereal preparations	16.15	13.04	0.8	0.42	0.04	0.28	0.02
2. Raw materials and intermediate munf.	**46.96**	**54.39**	**77.77**	**59.25**	**53.37**	**54.56**	**57.54**

Item							
2.1 Cashew nuts (unprocessed)		1.8	0.07	0.31	0.42	0.17	0.19
2.2 Crude rubber (including synthetic and reclaimed)	0.98	0.23	0.25	0.52	0.3	0.31	0.28
2.3 Fibres	9.01	7.77					
2.3.1 Synthetic regenerated fibres (manmade fibres)		0.56	0.77	0.13	0.12	0.05	0.05
2.3.2 Raw wool	0.08	0.93	0.35	0.42	0.2	0.11	0.07
2.3.3 Raw cotton	7.31	6.06			0.51	0.09	0.12
2.3.4 Raw jute	0.72		0.01	0.05	0.04	0.02	
2.4 Petroleum, oil and lubricants	6.16	8.33	41.94	25.04	30.97	31.68	30.07
2.5 Animal and vegetable oils	0.42	2.36					
2.5.1 Edible oil	0.34	1.43	5.4	0.76	2.64	1.02	1.13
2.6 Fertilizers and chemical products	7.86	13.23					
2.6.1 Fertilizers and fertilizer munf.	1.55	5.23	6.52	4.09	1.31	2.01	4.27
2.6.2 Chemecal elements and compounds	3.48	4.16	2.85	5.3	0.67	0.65	0.69
2.6.3 Dying, tanning and colouring materials	0.08	0.56	0.16	0.39	0.38	0.3	0.27
2.6.4 Medical and pharmaceutical products	0.89	1.48	0.67	1.08	0.75	0.67	0.62
2.6.5 Plastic materials, regenerated cellulose and artificial resins	0.81	0.51	0.9	2.53	1.1	1.47	1.3
2.7 Pulp and waste paper	0.64	0.74	0.14	1.06	0.56	0.31	0.26
2.8 Paper, paper board and munf.	1.06	1.53	1.49	1.06	0.87	0.57	0.58
2.9 Non-metallic munf.	0.55	2.04	4.42		0.34		
2.9.1 Pears, precious and semi-precious stones, worked & unworked	0.08	1.53	3.32	8.65	9.57	3.17	5.45
2.10 Iron and steel	10.96	8.97	6.79	4.89	1.55	3.46	3.12
2.11 Non-ferrous metals	4.21	7.31	3.81	2.55	1.07	8.5	9.07
3. Capital goods	**31.75**	**24.7**	**15.22**	**24.23**	**10.95**	**19.03**	**15.5**
3.1 Manufactures of metal	2.04	0.71	0.71	0.7	0.77	1.06	1.07
3.2 Non-electric machinery, machine tools etc,	18.1	15.77	8.68	9.82	7.33	8.77	7.82
3.3 Electric machinery, apparatus etc,	5.1	4.3	2.07	3.94	0.96	1.2	1.21
3.4 Transport equipment	6.92	4.07	3.76	3.87	1.89	8	4.35

Source: Handbook of Statistics on the Indian Economy of RBI

In a nutshell, India's composition of merchandise trade as well as service trade has undergone a significant change over the years which clearly depicts that the changing production structure of the Indian economy and the march from a backward agriculture- dependent economy to a more vibrant economy.

Direction of India's foreign trade has also undergone a significant change over the years. India's export is highly concentrated in the OECD countries and it still continues, though on a lesser scale. Share of the OCED countries was 66 % in 1960-61 and declined to 50 % of the total exports in 1970-71 and thereafter till 2000-2001 it varied in the range of 46% to 53 % (Table

4A). It further fell to 36.9 % in 2008-09. India's trade with North America has been significant in terms of total export earnings and total import expenditure. India maintained more or less a steady share in export and import with this traditional trading partner. In 1960-61, the share of North America in total export earnings was 18.7% and reached 22.4% in 2000-01. The share in the 2000's declined and came down to 12.1% in 2008-09. In total import expenditure the share of this region is however found to be declining more or less consistently (Table 4B). Nonetheless, this region continues to be an important destination for India's export and source of its import over the years. In the case of the EU (or EEC), the share of export was 36% in 1960-61 which decreased sharply to 18% in 1970-71. However the share of this region in India's total merchandised export started to increase with the commencement of the reform era. In 1990-91, the share rose to 27%. However the share is found to be declining in the 2000's. In 2008-09 the share of this region was 21%. The share of EU in India's total merchandised import expenditure has also declined sharply over the years. The share of this region in total merchandised import was 37% in 1960-61 while the share in 2008-09 was 13.9%. The share of Russia (as USSR) in total export was substantial with rupee payment arrangements, which declined sharply after the disintegration of the USSR in 1991 and came to less than one per cent at the end of 2008-09. Japan one of the main trading partners also experienced a fall in its share in total exports over the years. On the export side the major shift has been away from Russia and Japan toward developing Asia. Most striking feature is the growing importance of Asia as an export destination. This is due to India's "Look East Policy" and sustained effort to develop strong relations with China and the ASEAN. Concerted effort has been made to develop trade relation with Africa and Latin America. The share of developing countries as a whole grew from 17.1 % to 37.0 % between 1990-91 and 2008-09, with each major region—Asia, Africa, and Latin America—absorbing a larger share of India's total exports than before. The share taken by developing Asia rose from 14.4% to 27.7 % between 1990-91 and 2008-09. On the import side also, the major shift has been away from the industrial countries and Russia to the OPEC nations and other developing countries. OPEC and the other developing countries meanwhile gained share. The share of imports coming from OPEC rose from 16.3 % to 32.1 % between 1990-91 and 2008-09, and that from developing countries from 18.7 % to 31.9 % during the same period.

Table 4A. Destinations of India's merchandised export (Shares in percentage)

		EXPORT							
		1960-61	1970-71	1980-81	1990-91	2000-01	2003-04	2006-07	2008-09
1	Total OECD countries	66.1	50.0	46.6	56.5	52.7	46.4	42.0	36.9
1.1	All EU Countries	36.2	18.4	21.6	27.5	23.4	21.8	21.2	21.0
1.1.1.	Belgium	0.8	1.3	2.2	3.9	3.3	2.8	2.7	2.4
1.1.2	France	1.4	1.2	2.2	2.4	2.3	2.0	1.7	1.6
1.1.3	Germany	3.1	2.1	5.7	7.8	4.3	4.0	3.1	3.4
1.1.4	Netherlands	1.3	0.9	2.3	2.0	2.0	2.0	2.1	3.4
1.1.5	U.K.	26.9	11.1	5.9	6.5	5.2	4.7	4.4	3.6
1.2	All North America Countries	18.7	15.3	12.2	15.6	22.4	19.2	15.8	12.1
1.2.1	Canada	2.7	1.8	1.0	0.9	1.5	1.2	0.9	0.7
1.2.2	U.S.A	16.0	13.5	11.1	14.7	20.9	18.0	14.9	11.3
1.3	All Asia and Oceania Countries	9.0	14.9	10.4	10.4	5.1	3.7	3.4	2.5
1.3.1	Australia	3.5	1.6	1.4	1.0	0.9	0.9	0.7	0.8
1.3.2	Japan	5.5	13.3	8.9	9.3	4.0	2.7	2.3	1.6
1.4	All Other OECD countries	2.2	1.4	2.4	3.0	1.9	1.7	1.6	1.4
2	Total OPEC	4.1	6.4	11.1	5.6	10.9	14.9	16.6	21.0
2.1	Indonesia	x	x	x	0.6	0.9	1.8	1.6	1.4
2.2	Iran	0.8	1.7	1.8	0.4	0.5	1.4	1.1	1.4
2.3	Iraq	0.5	0.6	0.8	0.1	0.2	0.1	0.2	0.2
2.4	Kuwait	0.5	1.0	1.4	0.2	0.4	0.5	0.5	0.4
2.5	Saudi Arabia	0.9	2.5	1.7	1.3	1.8	1.8	2.0	2.7
2.6	U.A.E.	x	0.4	2.3	2.4	5.8	8.0	9.5	12.9
3	Total Eastern Europe	7.0	21.0	22.1	17.9	3.0	2.4	1.2	1.1
3.1	Romania	0.2	0.9	0.9	0.3	0.0	0.1	x	x
3.2	Russia	4.5	13.7	18.3	16.1	2.0	1.1	0.7	0.6
4	Total Developing countries	14.8	19.8	19.2	17.1	29.2	35.7	39.9	37.0
4.1	All Asian Countries	6.9	10.8	13.4	14.4	22.5	28.9	29.8	27.7

4.2	All African Countries	6.3	8.4	5.2	2.2	4.4	4.8	6.9	6.2
4.3	Latin American countries	1.6	0.7	0.5	0.5	2.3	2.0	3.3	3.1
5	Others / unspecified	8.0	2.8	1.0	2.9	4.3	0.5	0.3	4.0

Source: Handbook of Statistics on the Indian Economy of RBI

Table 4B. Sources of India's merchandised import (Shares in percentage)

		IMPORT							
		1960-61	1970-71	1980-81	1990-91	2000-01	2003-04	2006-07	2008-09
1	Total OECD countries	78.0	63.8	45.7	57.2	39.9	37.8	35.2	31.7
1.1	All EU Countries	37.1	19.6	21.0	29.4	20.8	18.8	16.1	13.9
1.1.1.	Belgium	1.4	0.7	2.4	6.3	5.7	5.1	2.2	1.9
1.1.2	France	1.9	1.3	2.2	3.0	1.3	1.4	2.3	1.5
1.1.3	Germany	10.9	6.6	5.5	8.0	3.5	3.7	4.1	3.9
1.1.4	Netherlands	0.9	1.2	1.7	1.8	0.9	0.7	0.6	0.6
1.1.5	U.K.	19.4	7.8	5.8	6.7	6.3	4.1	2.2	1.9
1.2	All North America Countries	31.0	34.9	15.5	13.4	6.8	7.4	7.3	6.9
1.2.1	Canada	1.8	7.2	2.6	1.3	0.8	0.9	1.0	0.8
1.2.2	U.S.A	29.2	27.7	12.9	12.1	6.0	6.4	6.3	6.1
1.3	All Asia and Oceania Countries	8.0	7.4	7.4	11.2	5.9	6.9	6.4	6.3
1.3.1	Australia	1.6	2.2	1.4	3.4	2.1	3.4	3.8	3.6
1.3.2	Japan	5.4	5.1	6.0	7.5	3.6	3.4	2.5	2.6
1.4	All Other OECD countries	1.9	1.9	1.8	3.2	6.4	4.7	5.5	4.6
2	Total OPEC	4.6	7.7	27.8	16.3	5.3	7.2	30.4	32.1
2.1	Indonesia	x	x	x	0.3	1.8	2.7	2.2	2.2
2.2	Iran	2.6	5.6	10.7	2.4	0.4	0.3	4.1	4.0
2.3	Iraq	0.2	0.2	6.0	1.1	0.0	0.0	3.0	2.5
2.4	Kuwait	0.0	0.3	2.7	0.8	0.2	0.2	3.2	3.1
2.5	Saudi Arabia	1.3	1.5	4.3	6.7	1.2	0.9	7.2	6.4
2.6	U.A.E.	x	x	2.8	4.4	1.3	2.6	4.7	7.6
3	Total Eastern Europe	3.4	13.5	10.3	7.8	1.7	2.1	2.1	2.2

3.1	Romania	0.4	1.0	0.8	0.1	0.0	0.1	x	x
3.2	Russia	1.4	6.5	8.1	5.9	1.0	1.2	1.3	1.4
4	**Total Developing countries**	**11.8**	**14.6**	**15.7**	**18.7**	**22.1**	**26.3**	**31.9**	**31.9**
4.1	**All Asian Countries**	**5.7**	**3.3**	**11.4**	**14.0**	**16.7**		**25.5**	**25.9**
4.2	**All African Countries**	**5.6**	**10.4**	**1.6**	**2.4**	**3.9**	**4.0**	**3.5**	**4.1**
4.3	**Latin American countries**	**0.4**	**1.0**	**2.5**	**2.3**	**1.4**	**1.5**	**2.8**	**1.9**
5	**Others / unspecified**	**2.2**	**0.5**	**0.5**	**0.0**	**31.0**	**26.6**	**0.4**	**2.1**

Source: Handbook of Statistics on the Indian Economy of RBI

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 industrialization the composition of India's foreign trade has undergone a substantial change over the years: particularly the nontraditional items have remarkably grown in importance in the export basket. Service export has also grown significantly.

This paper attempts to measure the factor content of India's foreign trade with an aim to find out whether the factor intensity of trade 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. The study considers three factors of production- labour, physical capital and natural resources. Along with estimating the factor content in case of India's multilateral trade with the rest of the World, the same estimation is also conducted in case of India's bilateral trade with North America and the EU (27)-the traditional trading partners and with the developing countries of Asia-the emerging partner.[1]

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.

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 and Trefler. Arrangement of the paper: In section 1 the analytical frameworks applied in this study are discussed. In section 2 the results of the study are presented. The final conclusions are given in section 3.

1. Analytical Framework

In this section we shall first give an account of the analytical techniques and the empirical procedure of the structural basis of India's foreign trade.

1.1 Analytical Framework of Leontief

Leontief (1953) 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 USA import competitive goods required 30% more capital per worker than the USA exports

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[1] Here North America includes US and Canada. Developing countries of Asia includes ASEAN, China, Taiwan and SAARC countries.

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 (Swerling 1953; Buchanan1955; Kravis 1956; Vanek 1963; Travis 1964; Kenen 1965;, Keesing 1966; Baldwin 1971) which enabled us to understand the strength and weaknesses of the Heckscher-Ohlin theory.

In this paper we extend the framework using three factors of production instead of two. Let us present the framework.

Let $(I - A)^{-1}$ be (n x n) direct plus indirect intermediate input requirement matrix or Leontief Inverse, where n is the number of commodities.

Also, let F be the matrix consisting of vectors L, K and R which denote direct requirement of labour, capital and natural resource respectively per unit of output.

Post multiplying the direct and indirect requirement matrix $(I - A)^{-1}$, to the F matrix yields matrix B below,

$$B = F (I - A)^{-1} \qquad\qquad (1)$$

where each row of the matrix B gives direct plus indirect requirement of a factor per unit of each commodity's output.

Let us also define row vectors $E = (E_1, E_2\ldots\ldots\ldots E_n)$ and $M = (M_1, M_2,\ldots\ldots\ldots M_n)$. E represents vector of exported goods where each element gives share of each commodity in one million dollar worth of exports. M represents vector of import replacements, where each element gives share of each commodity in one million dollar worth of import replacements.

The total direct and indirect factor requirement for the production of these set of goods for exports and imports are formulated as

$$B E' = F (I - A)^{-1} E' = \begin{bmatrix} l_e \\ k_e \\ r_e \end{bmatrix} \qquad\qquad (2)$$

$$B\,M' = F\,(I - A)^{-1}\,M' = \begin{bmatrix} \overline{l_m} \\ \overline{k_m} \\ r_m \end{bmatrix} \qquad (3)$$

where E′ and M′ are transpose of E and M respectively. l_e, k_e, r_e are the labour, capital and natural resource respectively embodied in million dollar worth of export whereas l_m, k_m and r_m are the labour, capital and natural resource embodied in million dollar worth of import replacements respectively.

For a capital abundant country the production of the set of exported goods should require more total capital than that of imported goods whereas total labour requirement of exported goods should be lower than that of imported goods, i.e. for a capital abundant country,

$(l_e / l_m) < (k_e / k_m)$

Or, $(k_e/ k_m)/(l_e /l_m) > 1$ \hfill (4)

Conversely, for a labour abundant country, $(k_e/ k_m)/(l_e /l_m) < 1$ \hfill (5)

In our study, after estimating the total labour, capital and natural resource requirements for per million dollar worth of exported and imported goods using equations (1) to (3), we have calculated the above ratio (equation (4 and 5) for each pair of factors for obtaining the order of factor abundance in Leontief Framework for the period 1989-90 to 2003-04.

1.2 Analytical Framework based on Leamer

Leamer (1980) introduced an alternative theoretical framework using the Heckscher - Ohlin – Vanek model where he proposed new set of criteria for determining factor abundance as revealed by trade. 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.

He showed that the Leontief-type calculations of the factor requirements of trade are misleading if more than two commodities exist. He further 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) in a many-commodity case if and only if the country was found to be net exporter of labour services and net importer of capital services. Using Leontief's figures that produced the paradoxical result he showed that the USA was the net exporters of both capital and labour services in 1947 and 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 USA was found to be more capital intensive than USA 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.

Leamer developed the new criteria for factor abundance using Vanek (1968) version of multi-factor, multi-commodity and multi-country Hechscher-Ohlin model (commonly regarded as Hechscher- Ohlin -Vanek model). The basic assumptions behind the HOV model are identical technologies across countries, identical and homothetic preferences across countries, differing factor endowments, free trade in goods and services and no factor intensity reversals.

Consider there are s number of countries in the world with h number of factors and g number of commodities. The basic equation of the HOV model is,

$$\text{FCT=BT}_n = V_n - \alpha_n V_w \tag{6}$$

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

where FCT stands for factor content of trade. For country n, $B = F(I - A)^{-1}$ i.e. the technology matrix as defined in the previous section. BT_n is the factor content of net trade. V_n is the endowment of the factor in country n.

where V_w is the world factor endowment , $V_w = \Sigma V_n$

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The left hand side of the equality sign sometimes labelled the production side of the theorem or the measured factor content of trade and the right hand side is sometimes labelled the absorption or the consumption side of the theorem or the predicted factor content of trade.

If country n's endowment of factor f relative to world endowment of that factor exceeds country n's share of world GDP i.e. $(V_{fi}/V_{fw})/\alpha_n$ then country n is abundant in factor f.

Considering three factors capital, labour and natural resources and denoting their content of trade by K_T, L_T and R_T respectively we get,

$$K_T = K_n - \alpha_n K_w \tag{7}$$

$$L_T = L_n - \alpha_n L_w \tag{8}$$

$$R_T = R_n - \alpha n R w \tag{9}$$

Considering any two factors, say, capital and labour, a country n 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.

$$(K_n / K_w) > (L_n / L_w) \tag{10}$$

A country n is a net exporter in capital services ($K_T > 0$) and net importer to labour services ($L_T < 0$), directly implies $(K_n / K_w) > (L_n / L_w)$ (from equations 6 & 7). If the country n is net exporter of both factor services ($K_T > 0$, $L_T > 0$), then in such a case, the proper comparison should be between capital per man embodied in net export (K_T / L_T) and capital per man embodied in consumption (K_C / L_C). If the former exceeds latter $[(K_T / L_T) > (K_C / L_C)]$, then the country is revealed to be relatively abundant in capital to labour. If the country is net importer of both factor services i.e. ($K_T < 0$, $L_T < 0$) then the appropriate comparison between net export and consumption will be reverse i.e. the economy would be considered relatively well endowed in capital to labour if $(K_T / L_T) < (K_C / L_C)$ i.e. a country is abundant in capital relative to labour if one of the following conditions holds,

i) $K_T > 0$ and $L_T < 0$ \hfill (11)

ii) If $K_T > 0$, $L_T > 0$, then $(K_T / L_T) > (K_C / L_C)$ ➔ $(K_T / K_C) > (L_T / L_C)$ \hfill (12)

iii) If $K_T < 0$, $L_T < 0$, then $(K_T / L_T) < (K_C / L_C)$ ➔ $(K_T / K_C) < (L_T / L_C)$ (13)

We use these conditions to determine trade revealed relative factor abundance of the Indian economy for the period 1989-90 to 2003-04.

1.3 Analytical Framework following Trefler

According to Trefler (1993), the problem arises due to the traditional assumption of factor price equalization (FPE), which is widely inconsistent with wage data. He suggested that the traditional concept should be replaced by the equalization of prices of the factors measured in efficiency units so that the HOV model could perform quite well in predicting the factor content of trade. In trying to explain his own theory, he resurrected Leontief's original productivity explanation, which he argued, had been largely unexplored. Trefler (1995) introduced a number of extensions of the HOV model and examined the persistence of the mysteries for each extension. He concluded in favour of extensions with country-specific neutral technology differences.. In this paper we will use the model with modified factor price equalization (FPE) with factor-augmenting productivity parameters as suggested by Trefler to study the factor content of trade of the Indian economy.

There are two ways that technological differences in terms of factor-augmenting productivity differences can be introduced into the HOV model (Feenstra, 2004). One approach is to model the productivity of factors in different countries while the other is to model differences in the factor requirement matrix. There is a close relation between these two approaches because saying that a factor is 5% more productive in one country also implies that 5% less of that factor is required per unit of production. In his earlier paper (i.e. in 1993 paper) he considers the first approach allowing all factors in every country to differ in their productivities. Let us illustrate the framework in terms of one factor, say, labour. π_{Ln} denotes the productivity parameter associated with labour in region n.[2] This parameter converts observed units of labour i.e. endowment of labour into efficiency units via the relationship $Ln^* = \pi_{Ln}Ln$. Considering India as the numeraire and setting $\pi_{Lindia} = 1$ i.e. the productivity parameter for Indian economy equal 1 and assuming further identical homothetic tastes we can rewrite the HOV relationship for India in terms of efficiency units of labour:

$$L_T{}^* = B_L \ T_{india} = \ L_{india} - \alpha_{\ india}\Sigma \ \pi_{Ln} \ V_Ln \tag{14}$$

where L_{india} is labour endowment of India.

Trefler used the second method of introducing productivity differences in this latter paper (i.e. 1995 paper) where he allows the factor requirement matrices to differ across countries, while assuming the factor endowments do not differ in efficiency units. Trefler considers that the technology matrices differ by a uniform amount across countries:

$$B_L = B_{Ln} \ \pi_{Ln}$$

$$\text{Or, } \ B_{Ln} = B_L \ / \ \pi_{Ln.} \tag{15}$$

With $\pi_{Ln} > 1$, $B_{Ln} < B_L$ which implies the region n is more productive and requires less labour for a unit production relative to India. We have applied this approach for estimating the factor content of trade where the technology matrix is expressed in productivity equivalent units.

More precisely, we will apply B_L to measure the labour content of exports while $B_{india} \ / \ \pi_{Ln}$ will be used to measure the labour content of imports i.e. labour content of trade in Trefler framework will be measured as,

$$FCT = B_{india} \ E_{india} - (\ B_{india} \ / \ \pi_{Ln} \ )M_{india.} \tag{16}$$

where FCT stands for factor content of trade. In a similar way the capital and natural resource content of India's foreign trade will be measured.

[2]since Trefler framework and framework using producers' technology have been used for India's bilateral trade with regions EU(27), North America and developing countries of Asia, from mow on 'n' denotes a region instead of a country.

Factor neutral productivity adjustment is common in much of the HOV literature [Trefler (1995), Davis and Weinstien (2001)]. Trefler showed that the international productivity differences can be reflected in international per capital income differences. In his calculation he found a high correlation between π_n and per capital GDP Yn. However other researches Maskus and Nishioka (2006, 2008), Marshall (2011) have showed the importance of factor-specific rather than factor

neutral productivity adjustment. According to them Trefler's initial idea of using factor-specific productivity adjustments improves the predictive power of the HOV model significantly.

In this paper we have considered both factor-specific and factor-neutral productivity adjustments in measuring the factor content of trade. We have followed the method suggested by Marshall (2011) in estimating the factor-specific productivity while the international per capita differences are used as proxy for factor-neutral productivity differences.

The factor –neutral productivity parameter for a region n is measured as ,

π_n = weighted average of per capital GDP of countries belonging to region n / per capita GDP of India   (17)

where total population of countries belonging to region n is taken as weight.

To determine factor-specific productivity parameter, first, a virtual endowment for a representative country is constructed by measuring the factor needed by India (reference country) to produce a the country's output, so that

$V_n^{**} = FX_n$ (18)

where F is India's direct factor requirement matrix and X_n is the final output of representative country n.

The actual endowment of country n is

$V_n = F_nX_n$.   (19)

Factor-specific productivity differences are then measured by dividing each element of V_n^{**} by the corresponding actual endowment of country n, i.e.

$\pi_n = V_n^{**} / V_n = FX_n / F_nX_n$ (20)

where $F \approx \pi_n F_n$. We assume that the productivity difference between the representative country of a region and India will be same for other countries belonging to that region.

1.4 Analytical framework using producers' technology

Deardorff (1982) and Helpman (1984) developed versions which allow for differences in relative factor prices across countries which cannot be handled as simple factor-augmenting

differences. The key insight is that when techniques vary across countries if FPE fails, the actual factor content should be measured using producer's technology. Davis and Weinstein (2001) develop a variant of the Deardorff-Helpman model with explicit consideration of the nature of technical differences, as well as the presence of non-traded goods and show that such a model has substantial empirical support.

The factor content of trade in this framework is measured as,

$$FCT = B_{india} \, E_{india} - B_n M_{india.} \tag{21}$$

where $B_n = F_n(I-A_n)^{-1}$ is the foreign technology or factor requirements to produce imported goods. Actual technology i.e. the country-specific IO matrix (A_n) and factor coefficient matrix (F_n) are used to measure the factor content of imported goods.

In this study the actual factor content of trade as suggested by Deardorff-Helpman will be applied in case of India's bilateral trade with EU(27), North America and the developing Asia. Due to unavailability of reliable and comparable data on technology, the measure of actual factor content of trade could not be applied in case of India's trade with the rest of the world.

1.5 Data

Details of the data source are provided in the appendix.

2. Results and discussions

2.1 Results in Leontief Framework

2.1.1. Considering two factors of production- Labour and Capital

Rest of the World

The results pertaining to the factor content of India's foreign trade with the rest of the world using Leontief framework are concisely presented in this section. It is observed from Table 5 that over the study period the capital intensity of export relative to import (ke/km) is consistently lower as compared to labour intensity of export relative to import (le/lm). For a labour abundant

country like India, labour, as expected, is found to be highly embodied in export relative to import. Even after going through substantial compositional changes since Independence, India's export basket is still tilted more towards labour intensive commodities whereas its imports consist of capital intensive goods. In 2003-04, the traditional labour intensive sectors like agriculture, forestry and fishing (1-3), food products, beverages and tobacco (7-10), textiles (11), other light industries (12-16), miscellaneous manufacturing (39) and services (42-44) account for almost 64% of India's total export. On the other hand, in 2003-04 capital intensive sectors and mining account for about 65% of India's total import (appendix table 2).

However, the noticeable point is that the ratio (ke/km) over the period 1993-94 to 2003-04 has increased which implies the capital intensity of export relative to import is consistently rising over the reform period. In case of India's trade with the world that the compositions of exports and imports have changed between 1989-90 and 2003-04 though the changes are not as substantial as expected after adoption reforms measures in 1991. In total imports the aggregate percentage share of chemicals (19-22), Iron and steel & other non ferrous metals (25-26) and machinery including transport equipments (27-38), which can be characterized as capital intensive sectors relative to other sectors has been falling particularly during the reform period. In 1989-90, the aggregate share of these sectors in total import was 44.8% and decreased to 34.1% in 2003-04. On the export side, the share of these sectors in total exports to the world has increased from 16% in 1989-90 to 21% in 2003-04. Therefore, the reason for having an increasing capital intensity of export relative to import replacements are two-fold, first, the share of capital intensive goods has been increasing in the export basket and secondly, the share of this category in total imports has been falling.

The European Union

In case of India's bilateral trade with the EU, the ratio of labour embodied in export to import replacements is found to exceed that for capital indicating that India's export to the EU is more labour intensive than its import replacements. This result is consistent with Heckscher-Ohlin proposition for India.

North America

For India's bilateral trade with North America, India's export is found to be more labour intensive than capital as compared to its imports for the period 1989-90, 1993-94 and 1998-99. However for 2003-04, India's export to North America becomes more capital intensive than labour. From appendix table 4, it can be observed that exports of capital intensive sectors like Other chemicals (22), Iron and Steel (25) and other machinery (30) have increased in 2003-04 compared to previous years. But at the same time, increased total export share of some of the labour intensive sectors like textiles (11) and Miscellaneous food products (8) have also been observed. On the import side import share of Miscellaneous manufacturing (39) has increased almost four times in 2003-04 compared to 1998-99. Between 1998-99 and 2003-04 the share of this sector in total imports from North America has increased from 10% to 42.4%. Miscellaneous manufacturing could be treated as a labour intensive commodity when we are using India's technology as common technology matrix to measure the factor content of export and import both. High share of labour intensive miscellaneous manufacturing could be the reason for high labour intensity of import (which in turn implies high capital intensity of export) and therefore a paradox is observed for India's trade with North America in 2003-04.

Developing Asia

When the factor intensity of export and import replacements for India's bilateral trade with developing countries of Asia is considered it is observed that in 1989-90 and 1993-94, India's exports to developing countries of Asia absorbs less labour than capital as compared to its import replacements, In 1993-94, the relative capital intensity of export to Asia is slightly higher than relative labour intensity of exports. Increasing share of some capital intensive goods such as Iron and steel (25), Other chemicals (22) is observed in 1993-94 (appendix table 5). On the other hand import share of other machinery (30) has been increased in case of India's trade with developing Asia. All these factors could contribute in higher capital intensity of export relative to labour as compared to import replacements in 1993-94.

Table 5 : Trade revealed factor abundance of India in Leontief framework

Years	le/lm	ke/km	re/rm	(ke/km)/(le/lm)	(ke/km)/(re/rm)	(re/rm)/(le/lm)	factor abundance
[1]	[2]	[3]	[4]	[5] = [3]/[2]	[6] = [3]/[4]	[7] = [4]/[2]	[8]

Trade with the World:							
1989-90	1.4248	0.7563	0.6864	0.5308	1.1018	0.4818	L>K>R
1993-94	1.4157	0.8190	0.6575	0.5785	1.2455	0.4645	L>K>R
1998-99	1.4104	0.8409	0.6663	0.5962	1.2620	0.4724	L>K>R
2003-04	1.2161	0.8553	0.6214	0.7033	1.3763	0.5110	L>K>R
Trade with EU(27):							
1989-90	1.5298	0.7053	0.9903	0.4610	0.7122	0.6473	L>R>K
1993-94	1.3492	0.7423	1.0242	0.5502	0.7248	0.7591	L>R>K
1998-99	1.2278	0.7508	1.1583	0.6115	0.6482	0.9434	L>R>K
2003-04	1.0236	0.8959	1.0202	0.8752	0.8781	0.9967	L>R>K
Trade with North America:							
1989-90	1.4183	0.7999	0.7287	0.5640	1.0978	0.5138	L>K>R
1993-94	1.3921	0.8274	0.6619	0.5943	1.2501	0.4754	L>K>R
1998-99	1.4350	0.8568	0.6657	0.5971	1.2871	0.4639	L>K>R
2003-04	0.9813	0.9865	0.8426	1.0052	1.1707	0.8586	K>L>R
Trade with the developing countries of Asia:							
1989-90	0.8957	0.9738	0.5288	1.0872	1.8414	0.5904	K>L>R
1993-94	0.9991	1.0081	0.6710	1.0090	1.5024	0.6716	K>L>R
1998-99	1.2042	0.9756	0.6923	0.8102	1.4092	0.5749	L>K>R
2003-04	0.9838	0.9165	0.9818	0.9315	0.9334	0.9980	L>R>K

Source: result from the study

2.1.2. **Considering a third factor of production-Natural resource**

When the third factor natural resource are considered, it is observed that throughout the study period India's exports absorbs relatively more labour followed by capital and then by natural resource. This implies natural resource is the least abundant factor. The similar conclusion can be drawn for India's bilateral trade with North America and developing Asia. However, in case of India's bilateral trade with EU, natural resource intensity of exports is more than capital intensity of exports from 1989-90 to 1998-99. The share of miscellaneous food products and textiles (the natural resource content of which is quite high) in total export to EU is found to be quite significant over the study period (appendix table 3) and perhaps that is why natural resource intensity of exports to EU is found to be high. The combined share of natural resource intensive sectors (1-11 and 14) in total export was 37.7% in 1989-90, 31.3% in 1998-99 and 30.5% in 2003-04. Therefore natural resource intensive sectors still have significant importance in India's

total export basket to EU (27) even during the reform period. The other sector which has high natural resource content is transport services (42).

2.2. Results in Leamer Framework

2.2.1 Considering two factors of production- Labour and Capital

Rest of the World

India is found to be net exporter of labour services and net importer of capital services using the alternative framework developed by Leamer. To determine the factor abundance as revealed by the trade structure we have to compare the factor ratios embodied in domestic expenditure with that embodied in net export. Table 6 shows that India is abundant in labour relative to capital in 1989-90, 1993-94, 1998-99 and 2003-04. The order of factor abundance between labour and capital for 1989-90, 1993-94, 1998-99 and 2003-04 obtained in the Leontief framework is similar to that obtained when we used Leamer's method. Both the frameworks have revealed that India's trade with the rest of the world during pre-reform and reform period may be in tune with its comparative advantage as addressed by the Heckscher-Ohlin theory.

The European Union and North America

In case of India's bilateral trade with the EU India is found to be net importer of capital services and net exporter of labour services. On the other hand for India's bilateral trade with North America, the country is found to be net exporter of both capital and labour services over the study period. As already explained, the ratio of net exports to domestic requirements can be used to comment on sources of comparative advantage or order of factor abundance. Applying Leamer method it is observed that India has stronger comparative advantage in labour than capital when two factors are concerned for its bilateral trade relation with EU from 1989-90 to 2003-04 and with North America from 1989-90 to 1998-99. In 2003-04, capital is revealed to be the more abundant factor relative to labour in case of India's bilateral trade with North America.

Developing Asia

For India's bilateral trade with developing countries of Asia, the results are similar to those observed in Leontief framework, that is In 1989-90 and 1993-94, India is abundant in capital

relative to labour whereas in later years labour is observed to be the more abundant factor than capital.

2.2.2. Considering the third factor of production –Natural resource

When three factors are considered the results are found to be more or less similar as those obtained in Leontief framework except for two cases - India's trade with the world in 1989-90 and for India's trade with developing countries of Asia in 2003-04. In its trade with the world India is found to be net importer of natural resources and when compared with capital India is observed to be more abundant in natural resource than capital in 1989-90. During the reform era capital is found to be relatively more abundant factor compared to natural resource. But in Leontief framework we have observed that India has become more abundant in capital than natural resource in 1989-90. For India's trade with developing Asia in 2003-04, the country is revealed to be more abundant in labour relative to natural resource in Leontief framework. In contrast this framework shows that natural resource to be the more abundant factor than labour. This result could be supported by the data as we have seen the growing importance of natural resource intensive sectors, mining in particular in India's export basket to the developing countries of Asia.

Table 6: Trade revealed factor abundance of India in Leamer framework

YEAR	L_T	K_T	R_T	L_T/L_C	K_T/K_C	R_T/R_C	FACTOR ABUNDANCE
[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Trade with the world:							
1989-90	5.9	-33731.7	-12084.0	0.0185	-0.02549	-0.01936	L>R>K
1993-94	6.6	-64990.7	-30269.2	0.0180	-0.03534	-0.04061	L>K>R
1998-99	3.9	-192086.8	-63588.5	0.0098	-0.06852	-0.07250	L>K>R
2003-04	7.9	-142426.6	-89457.8	0.0184	-0.03636	-0.08631	L>K>R
Trade with EU(27):							
1989-90	0.6	-22438.5	-2281.7	0.0019	-0.01710	-0.00371	L>R>K
1993-94	0.6	-34177.5	-2318.9	0.0016	-0.01890	-0.00323	L>R>K
1998-99	0.3	-57423.7	-487.4	0.00072	-0.02152	-0.00060	L>R>K
2003-04	1.5	-868.3	2732.9	0.00348	-0.00023	0.00289	L>R>K
Trade with North America:							
1989-90	1.4	885.6	-173.3	0.00424	0.00069	-0.00028	L>K>R
1993-94	2.5	5388.3	-643.0	0.00664	0.00305	-0.00090	L>K>R

1998-99	5.4	35860.2	3003.3	**0.01392**	**0.01381**	0.00371	L>K>R
2003-04	6.6	72561.8	9865.7	0.01524	0.01960	0.01053	K>L>R
Trade with the developing countries of Asia:							
1989-90	0.0	1401.6	-2200.0	0.00009	0.00109	-0.00358	K>L>R
1993-94	2.1	18284.8	335.9	0.00557	0.01041	0.00047	K>L>R
1998-99	0.2	-16941.1	-10741.6	0.00049	-0.00645	-0.01303	L>K>R
2003-04	4.4	44990.5	14186.6	**0.01315**	0.01206	0.01521	R>L>K

2.3. Results in Trefler Framework

In this framework the idea is that instead of using common technology matrix to measure the factor content of export and import both, productivity adjusted technology could be used to measure separately the factor content of export and factor content of import. The factor content of export is estimated by using India's technology matrix while the factor content of import is calculated using productivity adjusted technology matrix of the origin country. Here we have applied this method to estimate the factor content of trade for India's bilateral trade with the EU, North America and Developing Asia.

We have applied factor-neutral and factor specific productivity adjustments in the technology matrix. For factor-neutral productivity adjustment the ratio of per capita GDP of a country to the per capita GDP of India is taken as the proxy variable (Trefler, 1995). For factor-specific productivity, as mentioned in section 1, we have used the concept of virtual endowment (Marshall, 2011) (which requires different countries' IO tables) to calculate the productivity parameter for each country where India is considered as numeraire. Due to unavailability of reliable required data to estimate productivity parameter for each country belonging to a region (this problem is more acute for the developing countries of Asia), we have considered a representative country and estimate the productivity parameter using the country's IO matrix assuming that the productivity difference between the other countries in the region and India would be same as that between the representative country and India.

2.3.1 Results for factor-neutral productivity adjustments

2.3.1.1. Considering two factors of production- Labour and Capital

Each of the regions considered in this study consists of a number of countries whose data on per capita GDP are obtained from World Penn table version 6.2. A weighted average of the per capita GDP in each year of all member countries of the region are taken as the per capita GDP of entire region, where total population is considered as weight.

The results of the investigation on factor content of trade between India and EU(27) , North America and developing countries of Asia are given in table 7.

The European Union

When factor-neutral productivity parameters are introduced in measuring factor content of India's bilateral foreign trade with the EU, India is found to be net exporter of labour services in all years. The result in case of labour is similar to that obtained when no productivity adjustment is taken into account as in Leamer framework. However with the introduction of productivity parameters the net export of labour services as a proportion of labor content of total domestic consumption is found to have increased to a large extent. For instance, L_T/L_C without any productivity adjustment as obtained in Leamer framework have been found 0.001, 0.001, 0.0007 and 0.003 in 1989-90, 1993-94, 1998-99 and 2003-04 respectively. With factor neutral productivity adjustments it becomes 1.2, 1.7, 1.9 and 2.0 in 1989-90, 1993-94, 1998-99 and 2003-04 respectively. Thus productivity parameters take into account the so called problem of "missing trade". With factor-neutral productivity adjustment India has become net exporter of capital services in all years. This result is in sharp contrast to that obtained in Leamer framework. The magnitude of net export of capital as a proportion of factor content of domestic consumption are found to be increased in this case too. Between labour and capital, labour is revealed to be more abundant factor.

North America

With factor-neutral productivity-adjustments for India's bilateral foreign trade with North America, India is found to be net exporter of labour services in all years, as obtained in case of

the EU. In 2003-04, capital has become the most abundant factor of production followed by labour. Therefore even after substantial productivity adjustment which is factor-neutral in character, paradox still exits.

Developing Asia

For India's bilateral trade with developing Asia too, India is found to be net export of all three factor services. A paradox still exists in case of India's trade with the developing countries of Asia in 1993-94 and 1989-90.

The labour and capital contents as a proportion of factor contents of domestic consumption have increased in magnitude also in cases of India's trade with North America and developing countries of Asia. Therefore by introducing productivity adjustments while measuring the factor content of trade, the problem of missing trade can be taken into account.

2.3.1.2 Considering the third factor of production –natural resource

With productivity adjustment India has become net exporter of natural resources in all years for its bilateral trade with the three regions concerned in our study. For its trade with the EU(27), the order of abundance of three factors with per capita GDP based productivity adjustment is same as that obtained in the case without any productivity adjustment. India is found to have comparative advantage in labour followed by natural resource then by capital except in 2003-04. India has more comparative advantage in capital relative to natural resource in 2003-04.

In case of India's trade with North America and developing countries of Asia, natural resource is the least abundant factor as compared to labour and natural resource, except in 2003-04, with developing countries of Asia.

Table 7. Factor Content with factor-neutral productivity adjustments

	1989-90	1993-94	1998-99	2003-04
India's Trade with European Union (27)				
LT/LC	1.25	1.71	1.91	2.07
KT/KC	1.02	1.25	1.54	2.01
RT/RC	1.17	1.58	1.77	1.75
	L>R>K	L>R>K	L>R>K	L>K>R

India's Trade with North America				
LT/LC	1.71	1.89	2.25	2.15
KT/KC	1.25	1.79	1.69	2.25
RT/RC	0.98	1.10	1.15	1.54
	L>K>R	L>K>R	L>K>R	K>L>R
India's Trade with Developing Asia				
LT/LC	0.75	0.84	0.85	1.54
KT/KC	0.85	1.20	0.75	0.68
RT/RC	0.32	0.52	0.35	0.74
	K>L>R	K>L>R	L>K>R	L>R>K

2.3.2 Results for factor-specific productivity adjustments

2.3.2.1 Considering two factors of production –labour and capital

In this framework after factor-specific productivity adjustments, the results are consistent with those expected for a developing economy as India is found to be net exporter of labour services and net importer of capital services over the study period for its bilateral trade with the EU and North America. The paradox which has been observed in previous two frameworks for India's bilateral trade with North America in 2003-04 vanishes. In case of India's trade with developing Asia, mixed results are obtained. In 1993-94, as revealed by its trade with Asia, India is still found to be abundant in capital relative to labour. With both types of productivity adjustments the magnitude of net factor trade as a proportion of factor content of domestic final consumption has increased significantly.

Table 8. Factor Content with factor-specific productivity adjustments

	1989-90	1993-94	1998-99	2003-04
India's Trade with European Union (27)				
LT/LC	0.9	0.6	0.8	1.3
KT/KC	-5.3	-8.3	-14.8	-8.3
RT/RC	0.5	0.4	0.8	1.0
	L>R>K	L>R>K	L>R>K	L>R>K
India's Trade with North America				
LT/LC	0.6	0.9	1.5	1.5
KT/KC	-4.8	-2.7	-3.1	-1.5
RT/RC	0.2	0.3	0.9	1.4

	L>R>K	L>R>K	L>R>K	L>R>K
India's Trade with Developing Asia				
LT/LC	-0.2	0.2	-0.5	0.1
KT/KC	-0.1	0.3	-3.1	-1.6
RT/RC	-0.5	-0.2	-2.1	0.9
	K>L>R	K>L>R	L>K>R	L>R>K

2.3.2.2 Considering third factor-natural resource

When three factors are concerned natural resource abundance relative to capital for India's trade with North America can be observed in this framework with factor-specific productivity adjustments. This result differs from those obtained in previous framework. Also, for India's trade with developing countries of Asia, natural resource is more abundant factor relative to capital in 2003*-04.

2.4 Results of the Framework using Producers' technology

A standard way for measuring the factor content in the case of absence of factor price equalisation (FPE) is developed in Deardorff (1982) and Helpman (1984). Deardorff (1982) and Helpman (1984) developed versions which allow for differences in relative factor prices across countries which cannot be handled as simple factor-augmenting differences. The key insight is that when techniques vary across countries, as is the case when FPE fails, factor content should be measured using producers technology. Davis and Weinstein (2001) develop a variant of the Deardorff-Helpman model with explicit consideration of the nature of technical differences, as well as the presence of non-traded goods and show that such a model has substantial empirical support.

The factor content of export and import is measured with producer's technology, i.e. factor content of export is measured with Indian technology matrix and factor content of import is measured with technology matrix of the country which represents a region studied in this paper. For EU(27), North America and developing countries of Asia the representative countries are United Kingdom, United States and China respectively. The representative country occupies a significant share in the region's, in which it belongs, total trade with India.

2.4.1. Considering two factors of production –labour and capital

After estimating factor content of trade using producers' technology, India is found to be net exporter of labour services in its bilateral trade with the EU(27) and North America. In case of India's trade with Asia, India is net importer in labour services in 1989-90 and 1998-99. On the other hand the country is found to be net importer of capital services over the years for its bilateral trade with regions concerned. (table 9)

Between labour and capital, labour has emerged as the more abundant factor in all three cases. No paradox has been observed, even in 1993-94 which has been evident with factor-specific productivity adjustments.

Table 9. Factor Content in a framework with producers' technology

	1989-90	1993-94	1998-99	2003-04
India's Trade with European Union (27)				
LT/LC	1.1	0.8	0.9	2.5
KT/KC	-6.4	-9.6	-5.6	-9.7
RT/RC	0.8	0.5	0.5	2.0
	L>R>K	**L>R>K**	**L>R>K**	**L>R>K**
India's Trade with North America				
LT/LC	1.2	1.5	1.87	1.75
KT/KC	-5.9	-3.8	-5.4	-2.5
RT/RC	0.8	0.7	1.1	1.2
	L>R>K	**L>R>K**	**L>R>K**	**L>R>K**
India's Trade with Developing Asia				
LT/LC	-0.54	1.2	-0.87	.98
KT/KC	-0.87	-0.54	-4.8	-2.5
RT/RC	-0.77	-0.25	-0.45	0.85
	L>R>K	**L>K>R**	**L>K>R**	**L>R>K**

2.4.2. Considering third factor-natural resource

As observed in the framework with factor-specific productivity adjustment, India has found to have more comparative advantage in natural resource intensive goods as compared to capital in this framework too, in cases of India's trade with the EU(27) and North America and also for developing countries of Asia for 2003-04.

3. Conclusion

A few studies had been conducted during pre-liberalisation period to empirically investigate whether India's foreign trade follows Hechscher-Ohlin theory. All of these studies had confirmed that the India's trade supports the theory showing India a labour abundant country. In this paper an attempt has been made to verify the same presumption regarding India's foreign trade focusing the reform period from 1989-90 to 2003-04. We measure the factor content of India's trade with World and India's bilateral trade with EU (27), North America and Developing Asia using frameworks developed by Leontief and Leamer. Then the factor contents of bilateral trade between India and each of three above-mentioned regions have been further studied incorporating factor-augmenting productivity parameters suggested by Trefler. In this study we have considered two types of factor-augmenting productivity-first factor neutral i.e. total factor productivity (TFP) and secondly factor-specific productivity. The factor content of trade is further measured with producers' technology. The study is conducted by considering three important factors of production, labour, natural resources and capital.

The results of the study demonstrate that in case of India's trade with rest of the World, both Leontief and Leamer frameworks produce the ranking of abundance as labour, followed by capital and natural resource during reform period. Thus, India's factor content tends to reveal India as a labour abundant country relative to natural resource and capital and supports or at least does not contradict the Heckscher-Ohlin presumption for the Indian economy.

Similar finding has been observed in case of India's bilateral trade with the EU (27). However, with EU, India has most comparative advantage in labour followed by natural resource and capital in 1989-90, 1993-94, 1998-99 and 2003-04 as obtained in the frameworks with factor-specific productivity adjustments and with producers' technology. For India's trade with the EU(27), the importance of natural resource intensive sectors can be observed. Agriculture, Mining, Miscellaneous food products, Textiles and Leather products which have high natural resource content, account for 47% and 31% of total export to the EU(27) in 1989-90 and 2003-04 respectively.

In case of India's trade with North America, Leontief framework shows Indian export has become more intensive in capital relative to labour and natural resources as compared to imports

in 2003-04 and therefore produces a paradoxical finding. The findings from Leamer Framework are also in the same tune. With factor-specific productivity adjustments the result still exists. When factor-specific productivity parameters in a modified version of FPE have been introduced the result reveals labour as the country's abundant factor and capital and natural resources as the scarce factors, finally disappearing the paradox for India's trade with North America. The same result has also been obtained using producers' technology. Exports of capital intensive goods to North America has been increasing over the years but the rise in the share of these sectors is not enough to make the export basket more intensive in capital than labour. Therefore with factor-specific productivity adjustments and producers' technology, trade in factor services could be better predicted.

The paradoxical result which has been observed in case of India's trade with the developing countries of Asia in Leontief, Leamer frameworks and with factor-neutral productivity adjustments disappears with use of producers' technology.

Thus it is observed from the paper that the models with factor-specific productivity adjustments and producers' technology would perhaps explain India's factor abundance as revealed by its trade better.

The current paper has made a modest attempt to make a quantitative assessment of a factor content of India's trade with the rest of the world, European Union and the developing Asia using different analytical approaches. The findings of the paper we do hope will be useful for the research and policy community of India and its trading partner.

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Appendix

Data sources of the study

The present study of the factor content of India's foreign trade focusing the period 1989-90 to 2003-04 has used a wide range of data to estimate the labour, capital and natural resource 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 and Leamer frameworks are applied the following data have been used.

A) The Input-Output Transaction table for 1989-90, 1993-94, 1998-99 and 2003-04 prepared by CSO. The original (115x115) and (130x130) sector tables are aggregated and reduced into (44 x 44) 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 tables of 1989-90, 1998-99 and 2003-04 are expressed at 1999-2000 prices to make the input-output tables comparable. The aggregation scheme is given in the Appendix table A.

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

The labour coefficient is defined as

$\hat{}$

$l = L\, x^{-1}$ where l is the row vector of labour-output ratio, L is the row vector of labour 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 1989-90, 1993-94, 1998-99 and 2003-04 are obtained from Annual Survey of Industries of 1989-90, 1993-94, 1998-99 and 2003-04 respectively 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 compiled from NSS 43rd round (1987-88), NSS 50th round (1993-94), NSS 55th round (1999-2000) and 60th round (2003-04) surveys on Employment and Unemployment for the years 1989-90, 1993-94, 1998-99 and 2003-04 respectively. The outputs of these sectors are compiled from respective National Account Statistics. Data series on capital stock per unit of output i.e. the capital coefficient for each sector.

Perpetual inventory method has been used to derive the sectoral capital data. The capital coefficient is computed as $k = K x^{-1}$, where k is the row vector of capital-output ratio, K is the row vector of total capital stock invested in each sector.

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

Due to unavailability of the reliable data on natural resources for each aggregated sector of our study we have measured the natural resource usage of each sector indirectly. Vanek (1963) used the amount of products made from natural resources as approximate variables because natural resources can not be measured directly. He calculated the amount of intermediate products demanded for domestic agriculture, forestry, fishery and mining when one unit of the final demand in each industry is increased and treated as natural resource coefficient. This corresponds to the sums of each column for agriculture, forestry, fishery and mining in the inverse matrix of the input-output table. In our study we have followed the same method and used the input-output tables for 1989-90, 1993-94, 1998-99 and 2003-04 to estimate the natural resource coefficient.

D)   Data series on average million dollar worth of Indian exports and average million dollar worth of India's competitive import replacements to the rest of the world for 1989-90, 1993-94, 1998-99 and 2003-04.

The data for the two composite commodity vectors "a million dollar worth of exports" and "a million dollar worth of import replacements" for 1993-94, 1998-99 and 2003-04 have been obtained from the IOTTs for 1993-94, 1998-99 and 2003-04 respectively. 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 million

dollar. Analogously, the same procedure may be adopted to obtain the contribution of each sector to a million dollar worth of import replacements; leaving aside the non-competitive imports from the calculations. However, the input-output tables of 1989-90, 1993-94, 1998-99 and 2003-04 reveal 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.

F) Data series on average million dollar worth of Indian exports and average million dollar worth of India's competitive import replacements to EU, North America and developing Asia for 1989-90, 1993-94, 1998-99 and 2003-04 have been collected from the UN Comtrade data which is published in dollars at http://comtrade.un.org/.

When Trefler's framework is applied the following data have been used

- A) The Input-Output tables of the U.S. Economy for the years 1987, 1992, 1997, 2002 sourced from the U.S. Bureau of Economic Analysis.

- B) The Input-output tables of the U.K for the years 1989, 1994,1999, 2004 sourced from Office of national Statistics, UK

- C) The input-output tables of china for the years 1987, 1992, 1997, 2002 available at www.iochina.org.cn, official website of Chinese Input-Output Association.

- D) For US and UK, sectoral labour employment data are taken from OECD STAN database.

E) For US and UK, sectoral capital stock data are estimated by perpetual inventory method using data from OECD STAN database.

F) For China, sectoral labour and capital data are calculated from Input-output tables.

To determine the factor coefficient for the factors labour and capital, the sectoral output data are taken from the Input-Output tables.

The natural resource coefficient of the U.S. economy is determined by the same method using the Input-Output tables of the U.S. as applied in the case of the Indian economy.

Appendix table 1 : Aggregation scheme

SECTOR NO	NAME OF THE AGGREGATED SECTOR	SECTORS IN ORIGINAL I-O TABLE
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)
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 2. Percentage share of each sector in total export and import with World

Sector	1989-90		1993-94		1998-99		2003-04	
	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT
1	4.2	3.5	4.6	2.1	6.1	1.8	3.3	1.4
2	0.2	1.1	0.4	0.6	0.6	0.8	0.2	0.7
3	0.0	0.1	2.4	0.0	1.9	0.0	1.0	0.0
4	0.0	1.6	0.0	0.1	0.0	0.2	0.0	1.2
5	0.0	11.0	0.3	12.5	0.0	10.1	0.0	14.6
6	0.7	5.6	1.2	8.6	0.7	7.0	7.0	11.2
7	2.6	0.0	1.2	0.0	1.2	0.0	0.4	0.0
8	6.0	1.7	4.7	1.6	2.5	4.1	4.1	3.1
9	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
10	0.4	0.0	0.3	0.0	0.3	0.0	0.1	0.0
11	11.9	1.4	11.4	1.6	13.2	1.6	11.8	2.0
12	0.3	0.1	0.3	0.0	0.1	0.1	0.1	0.4
13	0.8	3.5	0.5	2.5	1.5	3.7	0.3	1.4
14	4.2	0.2	3.8	0.4	2.7	0.3	1.8	0.3
15	0.5	0.2	0.7	0.2	0.7	0.2	0.8	0.2
16	0.3	0.3	0.8	0.3	0.7	0.7	0.5	0.3
17	1.5	6.1	1.1	7.5	0.2	6.1	2.7	3.5
18	0.0	1.6	0.0	1.6	0.0	1.5	0.0	0.4
19	2.2	6.3	1.8	5.5	3.5	5.3	3.2	4.8
20	0.0	3.2	0.1	2.3	0.0	1.3	0.0	0.5
21	0.4	3.4	0.1	1.9	0.2	1.8	0.9	1.3
22	5.1	3.1	4.5	2.2	4.9	2.5	3.4	2.1
23	0.0	0.1	0.2	0.0	0.1	0.0	0.5	0.1
24	7.6	0.3	6.2	1.6	6.1	1.6	0.3	0.3
25	1.0	7.7	1.8	3.5	1.2	2.3	3.2	2.2
26	0.4	3.2	0.4	2.7	0.4	8.0	0.9	8.2
27	0.8	0.7	1.0	0.3	1.4	0.5	1.5	0.6
28	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.0
29	1.3	5.2	0.5	3.0	0.5	2.0	0.4	1.2
30	1.2	5.8	1.2	6.4	1.4	7.3	2.5	3.8
31	0.2	0.7	0.2	1.5	0.4	1.4	0.4	0.7
32	0.3	0.2	0.1	0.1	0.2	0.2	0.1	0.3

33	0.5	0.2	0.7	0.2	0.7	0.4	0.1	0.1
34	0.7	1.7	0.3	0.9	1.3	2.5	0.7	2.2
35	0.1	0.9	0.1	0.7	0.2	1.1	0.6	1.0
36	0.7	1.1	0.4	0.6	0.1	1.5	0.6	2.8
37	0.0	0.1	0.0	0.3	0.1	0.4	0.1	1.6
38	1.2	1.2	1.8	7.7	1.3	0.7	1.9	0.8
39	7.1	5.1	7.9	8.5	9.1	7.8	9.7	21.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	12.3	8.0	10.9	1.1	9.0	4.9	6.7	0.7
43	0.0	0.6	0.0	0.0	0.1	0.0	0.0	0.0
44	23.2	3.2	25.8	9.3	25.4	8.4	28.0	2.8
	100	100	100	100	100	100	100	100

Appendix table 3. Percentage share of each sector in total export and import with EU(27)

	1989-90		1993-94		1998-99		2003-04	
Sector	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT
1	3.3	0.0	2.5	0.1	2.7	0.0	1.6	0.3
2	0.4	3.0	0.7	1.3	1.0	2.4	0.5	2.0
3	0.0	0.1	1.6	0.0	0.9	0.0	1.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.6	0.0	1.0	0.0	0.8	0.0	0.0
6	0.9	4.2	0.7	3.3	0.4	1.4	2.8	3.8
7	1.9	0.0	0.7	0.0	0.9	0.0	0.2	0.0
8	4.4	0.1	6.9	0.2	3.7	0.2	6.9	1.1
9	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1
10	0.4	0.0	0.4	0.0	0.4	0.0	0.1	0.0
11	16.8	0.6	14.1	0.8	16.2	0.8	15.6	1.2
12	0.1	0.2	0.1	0.0	0.1	0.0	0.1	0.2
13	0.1	3.7	0.2	4.0	0.9	7.3	0.2	2.7
14	9.6	0.4	8.2	0.5	6.3	0.6	4.4	0.5
15	0.1	0.4	0.8	0.2	0.8	0.3	0.5	0.3
16	0.2	0.6	0.2	0.4	0.4	0.9	0.3	0.4
17	1.6	10.7	0.6	6.0	0.5	0.9	0.8	1.5
18	0.0	0.9	0.0	0.5	0.0	0.1	0.0	0.2
19	1.9	8.8	1.6	4.1	3.5	4.5	3.1	4.5
20	0.0	0.8	0.0	1.4	0.0	0.2	0.0	0.1
21	0.6	1.6	0.1	2.6	0.2	3.3	1.0	2.1
22	3.7	6.9	4.0	3.2	3.6	3.8	2.6	4.0
23	0.0	0.2	0.0	0.0	0.0	0.1	0.1	0.1
24	1.4	0.8	4.1	3.8	4.3	3.3	0.2	0.6
25	0.5	13.5	0.8	5.8	0.9	3.6	1.8	3.8
26	0.1	2.2	0.2	1.8	0.3	6.3	0.5	7.8
27	0.9	1.2	1.2	0.5	1.8	1.0	2.1	1.1
28	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0
29	0.1	6.1	0.2	6.8	0.4	5.1	0.3	3.4
30	0.6	3.5	0.8	10.9	1.2	12.9	2.4	6.2
31	0.0	1.5	0.1	3.4	0.3	3.4	0.3	1.8

Sector								
32	0.0	0.3	0.0	0.1	0.0	0.1	0.1	0.1
33	0.1	0.3	0.3	0.2	0.3	0.5	0.1	0.2
34	0.8	2.1	0.2	1.1	1.1	3.2	1.1	1.9
35	0.0	1.5	0.1	0.8	0.2	1.6	0.8	1.3
36	0.6	2.1	1.2	0.3	0.1	1.4	0.5	2.0
37	0.0	0.2	0.0	0.3	0.4	0.3	0.1	0.5
38	1.2	1.7	1.7	6.2	1.5	1.0	2.6	1.3
39	11.9	7.3	8.8	18.2	10.4	15.2	10.5	39.4
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	12.3	8.0	10.9	1.1	9.0	4.9	6.7	0.7
43	0.0	0.6	0.0	0.0	0.1	0.0	0.0	0.0
44	23.2	3.2	25.8	9.3	25.4	8.4	28.0	2.8
	100	100	100	100	100	100	100	100

Appendix table 4. Percentage share of each sector in total export and import with North America

	1989-90		1993-94		1998-99		2003-04	
Sector	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT
1	1.5	1.9	3.4	1.2	3.3	1.3	2.1	2.0
2	0.3	0.5	0.6	0.3	0.6	0.3	0.5	0.2
3	0.0	0.0	1.2	0.0	1.3	0.0	2.4	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.1	0.0	0.4	0.0	1.0	0.0	0.0
6	0.2	4.1	0.2	6.6	0.1	3.0	1.0	3.6
7	1.7	0.0	0.6	0.0	0.9	0.0	0.3	0.0
8	1.6	0.0	1.7	0.0	0.8	0.4	1.5	0.1
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0
11	13.7	0.5	13.8	0.8	16.8	0.6	19.1	1.9
12	0.1	0.1	0.2	0.1	0.1	0.1	0.2	0.6
13	0.1	2.3	0.3	4.3	0.7	5.2	0.3	2.6
14	2.5	0.1	3.8	0.3	2.1	0.2	1.5	0.1
15	0.7	0.2	0.9	0.2	0.6	0.3	0.6	0.2
16	0.5	0.2	1.0	0.2	0.9	0.7	0.4	0.2
17	0.1	14.7	0.1	17.2	0.0	18.9	0.4	7.0
18	0.0	3.7	0.0	3.3	0.0	0.4	0.0	3.0
19	1.6	7.3	1.3	4.7	2.3	5.1	2.8	3.3
20	0.0	8.8	0.0	2.2	0.0	3.4	0.0	1.8
21	0.4	4.3	0.1	0.9	0.2	1.0	0.9	1.0
22	2.9	3.1	2.4	2.2	2.2	4.3	3.3	3.6
23	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0
24	17.9	0.1	10.4	0.5	10.9	0.3	0.7	0.1
25	1.6	2.3	1.6	2.4	1.3	1.3	3.0	1.3
26	0.0	0.7	0.3	1.9	0.3	7.1	0.6	4.6
27	1.2	0.3	1.4	0.2	1.1	0.5	1.7	0.7
28	0.1	0.1	0.0	0.2	0.0	0.1	0.1	0.0
29	0.6	5.4	0.1	1.5	0.1	0.6	0.2	0.5
30	0.3	9.6	1.4	7.2	1.1	9.7	3.1	5.2

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31	0.0	0.6	0.2	1.2	0.2	1.3	0.6	0.5
32	0.1	0.5	0.0	0.2	0.0	0.4	0.0	0.2
33	0.4	0.4	1.2	0.3	0.9	0.9	0.1	0.2
34	0.1	2.0	0.4	1.3	1.2	4.2	0.5	1.1
35	0.1	1.6	0.2	0.7	0.2	1.2	0.6	1.0
36	0.1	1.7	0.1	0.9	0.3	1.8	0.7	4.3
37	0.0	0.1	0.0	0.4	0.0	0.0	0.0	1.2
38	0.5	3.1	1.5	16.9	0.7	1.1	1.6	2.0
39	13.4	7.9	12.9	9.0	13.8	10.0	14.5	42.4
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	12.3	8.0	10.9	1.1	9.0	4.9	6.7	0.7
43	0.0	0.6	0.0	0.0	0.1	0.0	0.0	0.0
44	23.2	3.2	25.8	9.3	25.4	8.4	28.0	2.8
	100	100	100	100	100	100	100	100

Appendix table 5. Percentage share of each sector in total export and import with developing Asia

	1989-90		1993-94		1998-99		2003-04	
Sector	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT
1	5.3	12.0	4.6	6.5	9.3	2.2	4.7	2.7
2	0.1	0.4	0.1	0.2	0.2	0.7	0.0	1.0
3	0.0	0.2	2.3	0.2	1.3	0.2	0.7	0.1
4	0.1	0.6	0.2	0.0	0.2	0.0	0.1	1.6
5	0.0	9.5	0.0	8.1	0.0	12.3	0.1	0.1
6	1.7	5.3	1.9	6.5	1.3	4.2	17.7	13.3
7	0.5	0.0	3.0	0.0	2.0	0.1	0.7	0.1
8	1.2	12.2	0.6	9.5	1.0	15.7	0.7	8.8
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	0.3	0.0	0.2	0.0	0.2	0.0	0.0	0.0
11	10.8	2.2	8.9	5.6	6.7	3.4	5.2	4.5
12	0.3	0.5	0.3	0.2	0.1	0.2	0.1	0.8
13	3.2	1.1	1.0	1.8	2.6	2.6	0.4	1.6
14	1.9	0.5	1.1	0.4	0.7	0.2	1.0	0.2
15	1.5	0.2	0.6	0.3	0.5	0.3	1.2	0.2
16	0.6	0.5	1.2	0.4	0.8	0.6	0.5	0.4
17	3.0	0.0	1.5	0.2	0.1	1.8	1.6	0.2
18	0.0	2.1	0.0	1.8	0.0	0.2	0.1	0.1
19	2.8	1.9	2.7	9.2	5.2	4.8	4.1	7.1
20	0.0	0.1	0.6	0.7	0.1	0.1	0.0	0.1
21	0.5	2.0	0.1	5.6	0.3	2.6	1.0	1.8
22	4.3	1.7	5.1	4.1	6.5	2.7	2.6	2.3
23	0.1	0.0	0.7	0.0	0.3	0.0	0.7	0.1
24	11.6	0.0	9.3	0.7	8.0	0.3	0.3	0.1
25	0.9	1.3	3.5	1.9	1.2	1.0	5.0	1.3
26	1.2	1.8	1.1	3.3	0.5	8.9	1.6	9.5
27	0.5	0.2	0.5	0.4	0.6	0.3	0.6	0.6
28	0.0	0.1	0.0	0.3	0.0	0.1	0.1	0.0

29	2.7	2.5	0.8	0.8	1.1	0.3	0.6	0.3
30	2.1	19.6	1.9	6.3	1.3	7.1	2.3	5.3
31	0.4	0.3	0.6	1.0	0.9	0.9	0.4	0.8
32	0.3	0.4	0.1	0.3	0.7	0.4	0.0	0.7
33	1.0	0.2	1.1	0.4	2.0	0.6	0.1	0.1
34	0.6	1.8	0.6	1.7	2.4	3.3	0.6	4.1
35	0.2	1.2	0.2	1.6	0.0	1.3	0.4	1.6
36	0.5	1.3	0.3	1.9	0.1	3.3	0.7	5.9
37	0.0	0.0	0.0	0.5	0.0	0.4	0.1	1.5
38	2.8	1.0	2.1	2.1	1.4	0.4	1.6	0.4
39	1.2	3.6	4.4	5.0	5.8	2.8	7.8	17.0
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	12.3	8.0	10.9	1.1	9.0	4.9	6.7	0.7
43	0.0	0.6	0.0	0.0	0.1	0.0	0.0	0.0
44	23.2	3.2	25.8	9.3	25.4	8.4	28.0	2.8
	100	100	100	100	100	100	100	100