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India's Export Sophistication in a Comparative Perspective

C. Veeramani and Gordhan K. Saini

INTRODUCTION

Since the onset of the trade liberalization process in 1991, firms in India's domestic industries, which had been operating under protective umbrellas, have been forced to respond to competitive pressure from imports. In this scenario, domestic firms might respond by dropping their least sophisticated product lines and by moving up in the quality ladder. If this indeed happens, it will be reflected in the growing sophistication of India's export basket.

Using highly disaggregated trade data, this chapter attempts to analyse the relative sophistication of India's exports of manufactures during the pre- and post-liberalization periods. We also compare the Indian experience with that of other selected developing countries/regional groups. Following Schott (2008), we assume that the sophistication level of a country's exports improves as its export basket becomes more similar to that of the high-income OECD (Organisation for Economic Co-operation and Development) countries. This is consistent with the fact that richer countries generally hold comparative advantages in products that are highly sophisticated.

TRADE LIBERALIZATION AND EXPORT SOPHISTICATION: WHAT ARE THE CAUSAL LINKS?

In this section, drawing upon the existing literature, we elaborate on the causal mechanisms that may link trade liberalization to export sophistication. In the context of growing integration of national economies, a large number of empirical and theoretical studies address the question of how the domestic firms respond to trade liberalization and increased foreign competition. Empirical evidence from the developing countries confirms the positive effect of trade liberalization on aggregate productivity.[1] As noted by Tybout (2003), the productivity gains in these countries have been driven primarily by within-industry resource reallocation as opposed to across-industry reallocation emphasized by the old theories of comparative advantage.[2] Trade liberalization can lead to within-industry resource reallocation in two possible ways. First, market shares might be reallocated from the least productive to the most productive firms within a given industry (Melitz 2003). Second, firms are forced to focus on their 'core competencies' by dropping the product lines that are inconsistent with their comparative advantages (Bernard et al 2006b).

An important outcome of these adjustment processes, apart from the productivity gains, is the potential improvement in the 'sophistication' level of the country's export

[1] See Tybout (2003) for a survey.

[2] The importance of within-industry resource reallocation is also evident from studies that establish significant growth of intra-industry trade in many countries after trade liberalization. See Veeramani (2002, 2009) for evidence from India and for references to other studies.

basket. This can happen for the following two reasons. First, within an industry, the relatively more productive firms may also be producing the relatively more sophisticated varieties. Thus, reallocation of market shares towards the more productive firms may imply an overall improvement in the sophistication level of the country's export basket. Second, heightened competition may induce the firms to 'move up' by reallocating resources within and across plants towards the manufacture of more sophisticated goods.

We may expect an improvement in the level of India's export sophistication for certain other reasons as well. First, accumulation of productive factors, such as human and physical capital, that characterizes economic growth, can bring about a dynamic process of changing comparative advantage. For example, the road to export success of the Newly Industrialized Countries (NICs) of Asia started with labour-intensive and low-technology manufactures. However, as investments in the physical and human capital rose and as labour costs increased with the accumulation of skills, relatively more sophisticated manufacturing activity expanded in these countries at the expense of labour-intensive manufactures. Second, trade and foreign direct investment (FDI) play an important role as a transmission channel for knowledge spillovers across countries (e.g., Keller 2004). Thus, India's export basket may become more sophisticated over time as a result of the positive spillover effects from her expanding trade and inward FDI. Finally, trade enables the use of better (Aghion and Howitt 1992) and larger (Romer 1987) variety of intermediate products and capital equipments, which can directly improve the sophistication level of a country's exports.

TRENDS AND PATTERNS OF MANUFACTURED EXPORTS

This section provides an overview of the trends and patterns of manufactured exports for India and other selected countries/regional groups. The selection of eighteen developing countries (including India) is based on the fulfilment of all the following three criteria: (i) the country should fall in the group of lower and middle-income countries (World Bank classification); (ii) the country's gross domestic product (GDP) (constant US$) in 2006 should be at least $21 billion (which is the GDP figure of Sri Lanka in 2006); and (iii) the average share of manufactured exports in the total exports of the country should be higher than 50 per cent during 2000–6 (India's average share during this period was 74 per cent).[3] Excluding India and China, the remaining sixteen of these countries have been clubbed into five regional groups. These are Africa–3 (Morocco, South Africa, Tunisia); Central and South America–2 (Brazil, Mexico); South Asia–3 (Bangladesh, Pakistan, Sri Lanka); South-East Asia–4 (Indonesia, Malaysia, Philippines, Thailand); and Turkey and Eastern Europe–3 (Turkey, Hungary, Poland, Romania).

During 1990–2006, manufactured exports from India grew at a rate of 12 per cent per annum. During the same period, exports from China and Turkey and Eastern Europe–3 had recorded significantly higher growth rates of 19 per cent and 16 per cent respectively. However, India fares better than South Asia–3 (9 per cent growth rate) and high-income OECD (6 per cent growth rate). Exports from the remaining regional groups grew at rates roughly similar to that of India: that is, 13 per cent for both Africa–3 and Central and South America–2; and 11 per cent for South-East Asia–4 (estimated using United Nations COMTRADE Database, accessed through World Bank's WITS software).

Table 16.1 shows the composition of manufactured exports across the 1-digit level of Standard International Trade Classification (SITC). The composition of India's exports shows some changes away from the traditional labour-intensive sectors of 'manufactured materials' and 'miscellaneous manufactures' in favour of the relatively more capital-intensive 'chemicals' and 'machinery'. Yet, the traditional sectors account for about two-thirds India's manufactured exports in 2006, which is next to the South Asia–3 where they (mainly due to textiles) account for as much as 95 per cent of total manufactured exports. China shows a significant increase in the share of machinery, accounting for half of its total manufactured exports, a figure close to that of high-income OECD. Overall, at the highly aggregate 1-digit level of SITC, China's export basket exhibits greater degree of overlap with the high-income OECD compared to India's export overlap with the latter.

It may be instructive to look at the relative shares of differentiated and homogenous products in a country's total export. For, the variation in quality/sophistication matters more in differentiated products as compared to homogenous products. Rauch (1999) proposed a classification of 4-digit SITC categories into three classes: 'homogenous', 'differentiated', and an intermediate category called 'reference-priced'. Table 16.2 uses this classification scheme to show the changes in the shares of the three categories of products within the manufacturing sector.

As expected, differentiated products account for the major share in all countries/regional groups, except for Africa–3, which is specialized in homogenous products.[4]

[3] Twenty-one countries have satisfied all these criteria, but three of them (Slovakia, Croatia, and Ukraine) have been dropped due to non-availability of data.

[4] Within Africa-3, however, Morocco is specialized in differentiated products, while South Africa and Tunisia are specialized in homogenous products.

Table 16.1 Composition of Manufactured Exports (per cent)

Country and Region	Chemicals		Manufactured Materials		Machinery		Miscellaneous Manufacturing	
	1990	2006	1990	2006	1990	2006	1990	2006
India	*11*	*17*	*53*	*45*	*11*	*16*	*26*	*22*
China	8	5	28	19	24	50	39	26
Africa–3	28	12	17	43	10	29	44	16
Central and South America–2	12	7	37	17	42	64	9	12
South Asia–3	1	2	58	41	2	2	40	54
South-East Asia–4	4	8	27	16	39	61	30	14
Turkey and Eastern Europe–3	12	7	35	25	29	50	24	18
High-income OECD	12	17	20	18	53	53	15	13

Source: United Nations COMTRADE Database (accessed through World Bank's WITS software), available at http://wits.worldbank.org/wits/

Table 16.2 Export Profiles according to Rauch (1999) Classification (per cent)

Country and Region	Homogenous		Differentiated		Reference-priced	
	1990	2006	1990	2006	1990	2006
India	*0.1*	*0.5*	*50.5*	*67.6*	*49.5*	*31.9*
China	0.5	0.2	95.9	95.8	3.6	4.1
Africa–3	56.8	41.8	12.2	23.9	31.0	34.3
Central and South America–2	4.2	1.5	87.4	92.1	8.4	6.4
South Asia–3	0.0	1.4	94.3	96.1	5.7	2.5
South East Asia–4	1.1	0.2	93.0	95.6	6.0	4.2
Turkey and Eastern Europe–3	2.5	0.8	75.9	78.9	21.7	20.3
High-income OECD	2.3	2.5	85.8	83.4	11.9	14.1

Source: United Nations COMTRADE Database (accessed through World Bank's WITS software), available at http://wits.worldbank.org/wits/

The share of differentiated products in India's total manufactured exports increased from 50.5 per cent in 1990 to 67.6 per cent in 2006. To the extent higher product differentiation represents higher level of sophistication, the increase in the share of differentiated products is suggestive of the growing sophistication levels of India's export basket. China is highly specialized in differentiated products, accounting for 96 per cent of total manufactured exports, and so are South-East Asia–4 and South Asia–3. There is a large share of differentiated products in South Asia–3 because most of the 4-digit items under 'textiles' (the main export category of South Asia–3) are classified as differentiated products.

We now turn to a more direct measure of export sophistication proposed by Lall et al. (2006). The basic idea behind the sophistication index proposed by Lall et al. (2006) is that the products exported by the richer countries are more sophisticated than the products exported by the poor countries. Thus, sophistication scores are calculated for each product for 1990 and 2000 by taking the weighted average (the weight being each country's share of world exports in the given product) of exporter incomes. The scores are then normalized to yield an index ranging from 0 to 100. The authors have grouped the 181 manufactured products (at the 3-digit level of SITC) into six sophistication levels by dividing the total number of products into sets of 30 each (31 for the last group) along the sophistication scale, where sophistication level 1 (SL1) is the most sophisticated group while sophistication level 6 (SL6) is the least sophisticated.

Table 16.3 shows the value shares (in total manufactured exports) of the six sophistication levels. It is clear that the share of the least sophisticated SL6 has declined substantially from 44 per cent to 26 per cent in India while the shares of all other sophistication groups have increased. The combined share of the most sophisticated groups (SL1 and SL2) has increased from 13 per cent to 15 per cent. Overall, Table 16.3 indicates a slow but definite increase in the sophistication level of India's export basket. The combined shares of the middle level SL3 and SL4 have registered significant increases from 12 per cent in 1990 to 21 per cent in 2006. Despite the overall improvement in

Table 16.3 Sophistication of Exports Using Lall et al. (2006) Methodology (Percentage Shares of Sophistication Levels in Total Manufactured Exports)

Country and Region	SL1		SL2		SL3		SL4		SL5		SL6	
	1990	2006	1990	2006	1990	2006	1990	2006	1990	2006	1990	2006
India	*8*	*9*	*5*	*6*	*6*	*11*	*6*	*10*	*32*	*38*	*44*	*26*
China	14	8	7	5	8	20	9	30	17	15	45	23
Africa–3	2	8	3	14	6	15	18	14	23	20	48	29
Central and South America–2	17	17	16	14	14	22	12	13	15	14	26	19
South Asia–3	3	2	1	1	1	2	3	3	12	8	81	85
South-East Asia–4	2	6	4	7	15	18	22	38	22	13	35	17
Turkey and Eastern Europe–3	12	15	8	15	10	17	18	16	21	19	31	18
High-income OECD	24	27	20	20	19	20	18	17	10	11	9	6

Source: United Nations COMTRADE Database (accessed through World Bank's WITS software), available at http://wits.worldbank.org/wits/

the sophistication level, it may be noted that the relatively less sophisticated SL5 and SL6 together still accounted for as much as two-thirds of India's manufactured exports in 2006. This is consistent with the earlier observation that the traditional groups 'manufactured materials' and 'miscellaneous manufactures' (most of which are grouped under SL5 and SL6) accounted for about two-thirds of India's exports in 2006 (see Table 16.1).

In China, the combined share of the least sophisticated SL5 and SL6 declined from 62 per cent in 1990 to 38 per cent in 2006, while the combined share of the middle level SL3 and SL4 increased substantially from 17 per cent to 50 per cent. However, the combined share of the most sophisticated SL1 and SL2 declined from 21 per cent to 13 per cent, while their share marginally increased in India from 13 per cent to 15 per cent. Thus, the entire increase in the sophistication level of China's exports is accounted for by the middle levels SL3 and SL4.

A general rise in the level of export sophistication can be seen in all the regional groups as well, except for South Asia–3. The shares of the least sophisticated SL5 and SL6 have declined in all the regional groups (with the exception of South Asia–3) while the shares of other sophistication levels have generally increased. Not surprisingly, high-income OECD is highly specialized in the most sophisticated SL1 and SL2 with a combined share of 47 per cent in 2006. As far as the middle-level categories (SL3 and SL4) are concerned, South-East Asia–4 ranks first with a combined share of 56 per cent, followed by China with a share of 50 per cent in 2006.

The preceding analysis uses data at a rather aggregate level of commodity classification, which may hide important heterogeneities within these commodity groups, for example, variation in the quality of the varieties within a commodity group. Use of finely disaggregated data enables us to analyse the issue in greater detail. In particular, the unit values (value divided by quantity) calculated using finely disaggregated data are more accurate as they do not suffer from the aggregation biases. Thus, the analyses in the following sections are based on highly disaggregated (10-digit level) US bilateral import data for 1989 and 2006. These two years are selected since they are respectively the earliest and the latest years for which comparable data are available.[5] We use the US data since these are available at the most finer a level of disaggregation.

MARKET SHARES AND PRODUCT PENETRATION OF COUNTRIES/REGIONAL GROUPS IN THE US MARKET

This section provides an overview of the performance of India, China, and the different regional groups in the US market, in terms of their shares in total US import value and the extent of their product penetration (see Table 16.4). As expected, the high-income OECD countries dominate the US import market in all industry groups (SITC 1-digit), though less so over time. While the high-income OECD countries accounted for as high as 70 per cent of the US manufacturing imports in 1989, this share fell to 48 per cent by 2006. This decline in the OECD share is largely due to the phenomenal rise of China's share in the US imports and to a lesser extent due to the increase in the share of Mexico. Between 1989 and 2006, China's share in the US imports increased from 3 per cent to 21 per cent while Mexico's share increased from 5 per cent to 11 per cent. During the same

[5] The US data are accessed from Robert Feenstra's homepage (http://cid.econ.ucdavis.edu/).

Table 16.4 Market Share and Product Penetration in Manufacturing

Country/Region	Market Share		Product Penetration		Intensive Margin	Extensive Margin
	1989	2006	1989	2006		
India	*0.7*	*1.5*	*25*	*54*	*54.2*	*45.8*
China	3.0	21.1	44	85	30.2	69.8
Africa–3	0.4	0.5	11	25	56.2	43.8
Central and South America–2	6.4	11.8	51	63	41.1	58.9
South Asia–3	0.4	0.7	12	21	36.9	63.1
South-East Asia–4	3.1	5.3	34	52	15.9	84.1
Turkey and Eastern Europe–3	0.4	0.7	19	43	35.3	64.7
High-income OECD	69.6	47.8	98	97	49.7	50.3

Source: Authors' Calculations using US Customs Service data (accessed from Robert Feenstra's homepage, http://cid.econ.ucdavis.edu/).

period, India's share increased from 0.7 per cent to 1.5 per cent. In both the years, India's share remained higher than that of South Asia–3, Turkey and Eastern Europe–3, and Africa–3 while the shares of South-East Asia–4 and Central and South America–2 remained significantly higher than that of India.

Among the eighteen developing countries, India ranks fourth with respect to the market share in 2006, just behind China, Mexico, and Malaysia. The market shares are highly correlated with the size of countries (measured by GDP), with the spearman rank correlation being 0.77 for 2006. This is consistent with the theories of international trade that predict that a larger economy will export more in absolute terms than a smaller economy (Hummels and Klenov 2005). Given that India is the second largest country among the eighteen countries, her market share (with a rank of 4) is less than what would be expected, given India's relative size.

Product penetration of a country/regional group will be 100 per cent if all varieties are exported and close to 0 per cent if very few varieties are exported. It is clear from Table 16.4 that product penetration by the OECD is nearly 100 per cent in both the years, while that by other countries/regional groups had increased significantly over time. While China shows the largest increase, it is noteworthy that India's product penetration rate of 54 per cent in 2006 is higher than that of other regional groups, excluding Central and South America–2.

Product penetration rates of the eighteen individual countries are highly correlated with their size (measured by GDP), with the spearman rank correlation being as high as 0.92 for 2006. This is consistent with the prediction of monopolistic competition model of trade that larger countries would export a wider array of varieties (Krugman 1981). Among the eighteen countries, India ranks third in terms of product penetration in 2006 and ranks second in terms of the absolute change in product penetration between 1989 and 2006. Thus, India's product penetration rate is broadly consistent with her size.

A country's export can grow by increasing the export value of incumbent varieties (intensive margin) and/or by increasing the number of varieties exported (extensive margin). It is worthwhile to examine the relative importance of intensive margin and extensive margin by decomposing the export growth between 1989 and 2006. Intensive margin is defined as part of the growth that is attributable to continuously produced goods while extensive margin is the growth due to the net adding and dropping of products. Extensive margin accounts for about 46 per cent of India's export growth while it accounts for 70 per cent of China's export growth. Extensive margin is considerably more important than intensive margin in India's chemicals (89 per cent) and machinery (74 per cent) while intensive margin is more important in traditional labour-intensive export industries such as manufactured materials and miscellaneous manufacturing.[6] In the case of China's exports, extensive margins account for the major share in all industry groups (SITC 1-digit).

EXPORT SIMILARITY WITH THE HIGH-INCOME OECD COUNTRIES

The analysis in the third section, 'Trends and Patterns of Manufactured Exports', confirms that the high-income OECD countries specialize in the most sophisticated groups of products. This is as expected since the richer countries have a comparative advantage in knowledge-intensive

[6] Industry group-wise (SITC 1-digit) data are not reported in the table, but can be obtained from the author.

products. Thus, we assume that the sophistication level of a country's exports improves as its export basket becomes more similar to that of the high-income OECD countries. We compute an export similarity index (ESI), first suggested by Finger and Kreinin (1979) and used in Schott (2008). For any two US trading partners *a* and *b*, this index is just the sum of the two countries' minimum presence in each good.

$$ESI_t^{ab} = \sum_p \min\left(s_{pt}^a, s_{pt}^b\right)$$

where s_{pt}^a and s_{pt}^b are the shares of product *p* in the total manufactured exports of country *a* and country *b*, respectively, in year *t*. The index is bound by 0 and unity: it equals 0 if countries *a* and *b* have no products in common in year *t*, and it equals unity if their products are distributed identically across products.

The ESI values of each country/regional group with the high-income OECD are shown in Table 16.5 (column 2). The growing similarity of India's export bundle with that of the high-income OECD is evident from the significant increase of India's ESI from 0.07 in 1989 to 0.16 in 2006. Among the countries/regional groups shown Table 16.5, product mix overlap with the OECD is the highest for Central and South America–2, followed by Turkey and Eastern Europe–3 and China. As expected, values of the ESI are the lowest for South Asia–3 and Africa–3. Among the eighteen individual countries, India's rank with respect to the ESI has improved from seventh in 1989 to fourth in 2006 (just behind Mexico, China, and Brazil).[7] In terms of the absolute change of ESI between 1989 and 2006, India ranks second with an absolute change of 0.09 among the eighteen individual countries. Poland ranks first with an absolute change of 0.10.

In general, the smaller the difference in any two countries' level of per capita income, the greater will be the degree of similarity in their export basket. Thus, we may expect that the value of the ESI (with the high-income OECD) of the relatively richer developing country would be higher than that of the poor countries. The spearman correlation coefficient between the ESI (with the high-income OECD) and per capita GDP of the eighteen countries is 0.50 for 2006. However, both India and China are clear exceptions to the general positive relationship between ESI and per capita GDP. Among the eighteen countries, while India ranks sixteenth with respect to the level of per capita GDP, her rank with respect to the value of ESI is fourth. China's ranks with respect to per capita GDP and ESI are eleventh and second respectively. Thus, exclusion of India and China leads to an increase of the spearman correlation coefficient from 0.50 to as high as 0.70, clearly suggesting that these two countries are outliers in the relationship between per capita GDP and ESI. In other words, India and China exhibit significantly greater overlap with the OECD than one would expect for a country with their levels of per capita GDP.

We have also computed the ESI of India with other countries/regional groups (not reported in Table 16.5). As expected, India's export basket is most similar to that of South Asia–3, though less so over time. India's ESI with South Asia–3 has declined from 0.23 in 1989 to 0.18 in 2006. In contrast, India's ESI with China and other regional groups increased in 2006 compared to 1989: from 0.13 to 0.16 with China; from 0.04 to 0.07 with Africa–3; from 0.06 to 0.13 with Central and South America–2; from 0.11 to 0.12 with South-East Asia–4; and from 0.15 to 0.16 with Turkey and Eastern Europe–3.

Export sophistication involves two dimensions—that is, *across* product sophistication and *within* product sophistication. For example, the rising ESI of India with the high-income OECD implies growing sophistication of India's exports in the across product dimension. The concern with within product sophistication arises mainly due to variation in the quality of the varieties (within a product) exported by different countries. Thus, while India's ESI with the high-income OECD is increasing over time, the latter may be exporting increasingly higher quality products compared to the former.

In order to gauge the changes in within product sophistication, we compute a quality overlap index (QOI) making use of the US import unit values, which are proxied for quality. The QOI compares the quality level of the high-income OECD export basket with that of the country/regional group under consideration. The index is defined only for the subsets of products for which both the high-income OECD and the country/regional group under consideration report positive export values for the given year. The index is defined as:

$$QOI_{pt}^a = 1 - \frac{\left|uv_{pt}^{oecd} - uv_{pt}^a\right|}{\left(uv_{pt}^{oecd} + uv_{pt}^a\right)}$$

where (uv_{pt}^{oecd}) is the unit value of US imports from the high-income OECD in product *p* and year *t*, and (uv_{pt}^a) is the unit value of US imports from country/regional group *a* in product *p* and year *t*. The value of this index ranges from 0 to unity. Higher the value of the index, the greater is the quality overlap between the high-income OECD and country/regional group *a* in product *p*. A value close to 0 indicates significant quality divergence between the high-income OECD and country/regional group *a* in product *p*.

[7] For India, we have computed the ESI for 1995 and 2001 as well. The values of the index are 0.8 and 0.11, respectively, for 1995 and 2001, indicating that the increase has been consistent over the years.

Table 16.5 Export Similarity Index, Quality Overlap Index, and Median Unit value Ratios

Country/Region	ESI		QOI		Median of Log UVR_{pt}^{oecd}		Median of Log UVR_{pt}^{india}	
	1989	2006	1989	2006	1989	2006	1989	2006
India	*0.07*	*0.16*	*0.62*	*0.61*	*−0.18 (65)*	*−0.20 (66)*	–	–
China	0.14	0.20	0.53	0.45	−0.29 (78)	−0.35 (79)	−0.11 (62)	−0.14 (65)
Africa–3	0.06	0.08	0.86	0.82	0.01 (49)	0.07 (44)	0.12 (41)	0.35 (27)
Central and South America–2	0.32	0.26	0.58	0.56	−0.13 (67)	−0.12 (62)	−0.01 (51)	0.04 (47)
South Asia–3	0.03	0.03	0.57	0.55	−0.30 (79)	−0.44 (79)	−11 (65)	−0.10 (62)
South-East Asia–4	0.15	0.17	0.63	0.49	−0.13 (62)	−0.23 (71)	0.09 (40)	−0.02 (53)
Turkey and Eastern Europe–3	0.10	0.21	0.70	0.57	−0.17 (68)	−0.04 (53)	0.03 (46)	0.21 (34)

Source: Authors' calculations using US Customs Service data (accessed from Robert Feenstra's homepage, http://cid.econ.ucdavis.edu/).

Notes: The values in parentheses under column (4) are the percentage shares of the total number of products where the unit values are higher for OECD than the given country/regional group. The values in parentheses under column (5) are the percentage shares where the unit values are higher for India than the given country/region.

Table 16.5 (column 3) shows the weighted averages of the QOI, where the weights being the value share of product *p* in country/regional group *a*'s exports to the US. What is immediately noticeable from the table is an across-the-board decline in the value of the QOI in 2006 over 1989. This indicates a growing divergence in the qualities of the products exported by the high-income OECD and other countries/regional groups. Further analysis later shows that, for the most part, this divergence is attributable to the faster quality growth of the high-income OECD export bundle compared to that of other countries/regional groups. Thus, while the export bundles of developing countries are becoming more similar to that of the high-income OECD, the latter is upgrading the quality of its products at a faster rate as a response to competition.[8]

Interestingly, values of the QOI for India are higher than that of China in both the years. Among the eighteen individual countries, India's rank with respect to the QOI improved from ninth in 1989 to sixth in 2006. China's rank remained very low at seventeenth in both the years, the only countries below China being Tunisia in 1989 and Hungary in 2006.

The results show relatively high values of QOI for Africa–3, which is mainly due to South Africa. It may, however, be noted that product penetration by Africa–3 is one of the smallest (Table 16.4) and that the QOI is defined only for this small subset of products.[9] Further, exports of Africa–3 mostly belong to the group of 'homogenous' products while other countries/regional groups mainly export differentiated products (Table 16.2). If quality variation is less pervasive in homogenous products compared to differentiated products, the relatively high quality overlap between Africa–3 and the high-income OECD (measured by QOI) may not be surprising.[10]

While it is expected that the high-income OECD countries would export higher quality products compared to other countries/regional groups, the QOI is not helpful to make this kind of comparison. We attempt to compare the high-income OECD unit values in each of the products with those of other countries/regional groups using the unit value ratios defined as:

$$UVR_{pt}^{oecd} = \frac{uv_{pt}^{a}}{uv_{pt}^{oecd}}$$

Value of the unit value ratio in product *p* and time $t(uvr_{pt}^{oecd})$ will be less (more) than unity if the unit value of country/regional group *a* in product *p* and time $t(uv_{pt}^{a})$ is lower (higher) than that of the high-income OECD (uv_{pt}^{oecd}). We took the log of the unit value ratios, and therefore any ratio less than 0 indicates that the quality of the product *p* imported from the high-income OECD is higher than that from country/regional group *a*, and vice-versa for any ratio greater than 0. As in the case of the QOI, unit value ratios are defined only for the subsets of products for which both

[8] Schott (2008) makes a similar observation.

[9] Product penetration by high-income OECD is nearly 100 per cent (Table 16.4), which implies that it has an export presence in almost all products. Thus, the number of products for which the QOI is defined for each country/regional group can easily be understood from the extent of their product penetration.

[10] Lall et al. (2006) reported a relatively high level of export sophistication for sub-Saharan Africa (with and without South Africa) and noted that this is 'not based on technological sophistication but the distribution of certain resource based products in richer countries' (p. 13). It is likely that these resource-based products are also what are termed as 'homogenous' products.

the high-income OECD and the country/regional group under consideration report positive export values for the given year.

The medians of log unit value ratios are reported in Table 16.5 (column 4). It is evident that the median ratios are negative for all countries/regional groups, except for Africa–3 where it is a small positive. Thus, as expected, the high-income OECD generally exports higher quality products as compared to other countries/regional groups. Percentage shares of the total number of products for which the OECD reports higher unit values than the given country/regional group are shown in parentheses under column (4) in Table 16.5.[11] It is again clear that in the majority of the cases, OECD products show higher levels of quality than other countries/regional groups (except for Africa–3). India reports higher unit values than high-income OECD in about 34 per cent of the total number of products in 2006. This compares better than China, which reports higher unit values than the high-income OECD in about 21 per cent of the total number of products in 2006.

Higher absolute values of the unit value ratios in 2006 compared to 1989 indicate faster quality upgrading in the high-income OECD. This is the case with India, China, South Asia–3, and South-East Asia–4. As noted by Schott (2008), the widening quality gaps between the high-income OECD and other countries/regional groups might indicate international product cycling, that is, the former seems to be specializing in even more sophisticated varieties as a response to globalization. These responses are consistent with more direct evidence of quality upgrading observed in firm-level data (e.g., Bernard, Jensen, and Schott 2006).

Finally, we attempt to compare the Indian unit values with those of other countries/regional groups using the unit value ratios defined as:

$$UVR_{pt}^{india} = \frac{uv_{pt}^{a}}{uv_{pt}^{india}}$$

Log value of these ratios will be less than 0 if India's export unit values are higher than that of other countries/regions.[12] The median values of the ratios and the percentage shares of the total number of products for which India reports higher unit values than the given country/regional group are shown in column (5) of Table 16.5. It is evident that in both the years, India's export unit values are distinctly higher than those of China and South Asia–3 and are marginally higher than South-East Asia–4 in 2006. India's export unit values are higher than that of China in as many as 65 per cent of the total number of products in 2006.

That India exports relatively higher quality products than China, despite the spectacular export performance of the latter, is intriguing. A plausible explanation for this may be found in the relatively high capital and skill intensity of exports and industrial output in India. Despite her comparative advantage in unskilled labour-intensive goods, the fast growing exports from India are either skilled labour-intensive or capital-intensive (Panagariya 2008). This outcome, according to Kochhar et al. (2006) and Panagariya (2008), is a consequence of distortionary policies in India, particularly those related to the firing and hiring of labour. Thus, if the unit value of a product variety increases with the capital and skill embodied in that variety, it may be argued that the relatively high export unit values of India are reflections of her distorted specialization in capital- and skill-intensive varieties/process.

CONCLUSION

Trade liberalization is expected to bring about an improvement in the sophistication level of a country's export basket. The present chapter, using highly disaggregated trade data, is an attempt to analyse the changes in the relative sophistication of India's exports of manufactures during the pre- and post-liberalization periods. We have also compared the Indian experience with the experiences of other selected developing countries/regional groups.

The rising share of differentiated products in India's export basket is suggestive of growing export sophistication. Analysis using a more direct measure of export sophistication proposed by Lall et al. (2006) has confirmed a slow but definite increase in the sophistication level of India's export basket in 2006 compared to 1990. This analysis was carried out using data at a rather aggregate level of commodity classification, that is, at the 3-digit level of SITC. Since the aggregate data may hide important heterogeneities within the commodity groups (for example, variation in quality), we have also made use of the highly disaggregated (10-digit level) US bilateral import data.

We assume that the sophistication level of a country's exports improves as its export basket becomes more similar to that of the high-income OECD countries. Growing similarity of India's export bundle with that of the high-income OECD is evident from the consistent and significant increase of the former's ESI with the latter over the years. Among the eighteen selected developing countries, India's rank with respect to the ESI has improved from seventh in

[11] Total number of products here represents the subsets of products for which both the high-income OECD and the country/regional group under consideration report positive export values for the given year.

[12] These ratios are defined only for the subsets of products for which both India and the country/regional group under consideration report positive export values for the given year.

1989 to fourth in 2006. In terms of the absolute change of ESI between 1989 and 2006, India ranks second among the eighteen countries.

The analyses using the US import unit values suggest that the high-income OECD generally exports higher quality products as compared to other countries/regional groups. While the ESI captures sophistication in the across product dimension, the QOI of the individual countries captures sophistication in the within product dimension. The analysis showed that while the export bundles of developing countries (including India) are becoming more similar to that of the high-income OECD, the latter is upgrading the quality of its products at a faster rate as a response to competition.

While China shows a higher level of sophistication than India in the across product dimension (as measured by ESI), India ranks above China with respect to sophistication in the within product dimension (measured by QOI). We have also compared the Indian unit values with those of other developing countries/regions using the unit value ratios. It is evident that India's export unit values are distinctly higher than those of China and South Asia–3. We have argued that this could be a consequence of distortionary policies in India that encourage specialization in capital- and skill-intensive varieties/process at the cost of unskilled labour-intensive activities where the country holds its true comparative advantage.

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