

# RIS DISCUSSION PAPERS

**Export Performance of Indian Enterprises  
in Knowledge-based Industries:  
Recent Trends, Patterns and Implications**

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Other Developing Countries**

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*Abstract: Achieving higher export competitiveness in the high technology industries is becoming the focus of policy attention in both developed and developing countries, as these industries are by nature higher value-adding, faster growing segments of manufacturing and may generate significant knowledge spillovers vital for economic growth. The present paper finds that India's export structure continues to be dominated by low technology products. Economic reforms have helped in improvement of enterprise-level export performance across technology segment. However, this improvement in the post-reform period has been mainly limited to the domestic firms. Indian firms having foreign presence through establishing affiliates abroad had shown superior export performance than firms not having such investment.*

**Key words:** *Export intensity; FDI; Economic Reforms*

**JEL Classification:** *F1; F21*

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### **1. Introduction**

It needs little emphasis that the nation's competitive advantage in the global market crucially depends upon the growth and technological dynamism of firms belonging to knowledge-based industries. These high technology firms lead innovations and create knowledge, which results in enhancing nation's ability to sell more in the world market. Furthermore, the high technology industries are the faster growing and also have a higher value-addition than matured low technology industries where intense competition has shrunk margins as well as growth prospects. Technology or knowledge-intensive industries may also have significant intra-industry and inter-industry externalities vital for economic growth (NSF 1995; Guerrieri and Milana, 1995; Lall, 1999). In view of these governments in developed and developing countries tend to promote these industries with various policy measures such as pioneer industry programme.

The basic objective of India's liberalization policy pursued since 1991 has been to enhance the competitiveness of Indian enterprises by infusing greater competition in the

domestic market environment with liberalized imports. Hence, it is important to look into how liberalization has affected the export orientation of Indian enterprises. In the post-1991 period more emphasis is also put on foreign direct investment (FDI) as a harbinger of export improvement. With their captive access to new technologies, skills, brand names, aggressive advertising strategies, globally established marketing channels and distribution networks and long-standing experience of operating in international markets, affiliates of multinational enterprises (MNEs) can be instrumental in promoting exports from host developing countries, particularly knowledge-intensive industries.

Moreover, it has been argued that export competitiveness in knowledge-based industries may be more dependent on non-price factors such as firms' ability to customize the products for specific markets and provide after-sales-services. Hence, overseas presence may be a key factor in improving competitiveness in these industries (Kumar, 1998). Over the 1990s, Indian enterprises have made an effort towards establishing overseas presence with outward investment.

Against the backdrop of above facts, this paper examines the trends and patterns in the export-orientation of Indian manufacturing enterprises especially in the knowledge-intensive industries over 1988-2000 period to provide a background for the more detailed quantitative analysis of the export-competitiveness presented in subsequent papers.

The paper is structured as follows. Section 2 summarizes the trends and regional patterns in the global high technology exports as a background to the analysis. Section 3 maps trends in India's export structure and the structure of production over 1981-95. Section 4 summarized the patterns of firm-level export competitiveness during 1990s with respect to ownership, outward investment, economic reforms and technology intensity. Section 5 provides concluding remarks.

## **2. Developing countries and International Trade in Knowledge-based products**

The importance of technology-intensive products in the world trade can hardly be exaggerated. Since 1988 global high-technology trade has been growing at a rate nearly twice that of world merchandise or world trade as a whole. It has grown at a rate of 13 percent per year over 1988-2000 compared to a 7 percent growth rate of world merchandise trade. At

present one-fifth of the global trade in goods comprise high-technology goods (Table-1). As developing and least developed countries by and large lack resources, required scientific infrastructure, incentive framework, and focused public policy, much of knowledge or modern technologies is created in developed countries<sup>1</sup>. Given this concentration of technology generation activity in developed countries they account for about 84 percent of global high-technology exports. The rest 16 percent of world high technology exports are also largely accounted for by middle-income countries. Low-income countries account for a negligible 0.8 percent of high technology exports (Table-2). However it is important to note that the share of middle and low-income countries in the global high technology exports has increased between 1988 and 2000 by 9-percentage point (Table-2). In terms of growth rate, the high technology exports from middle and low-income country have grown at a rate of 25 percent and 30 percent per annum over 1988-2000 as compared to only 11 percent in the case of high-income countries.

**Table-1 World export of high technology products, 1988-2000 (In US \$ million)**

| <b>Year</b>                     | <i>High-technology exports</i> | <i>High-technology exports (% of manufactured exports)</i> | <i>Merchandise exports</i> | <i>Exports of goods and services</i> |
|---------------------------------|--------------------------------|--|----------------------------|--------------------------------------|
| 1988                            | 207142                         | 11.11  | 2762231                    | 3551335                              |
| 1989                            | 328187                         | 17.43  | 2996834                    | 3839897                              |
| 1990                            | 377850                         | 17.19  | 3432703                    | 4384471                              |
| 1991                            | 415060                         | 17.65  | 3512325                    | 4471431                              |
| 1992                            | 462232                         | 17.38  | 3760710                    | 5001462                              |
| 1993                            | 480424                         | 18.18  | 3746324                    | 4848306                              |
| 1994                            | 571882                         | 18.59  | 4243446                    | 5382298                              |
| 1995                            | 709111                         | 19.29  | 5078355                    | 6356240                              |
| 1996                            | 753308                         | 19.42  | 5347203                    | 6660179                              |
| 1997                            | 834998                         | 20.66  | 5537196                    | 6899404                              |
| 1998                            | 881625                         | 21.42  | 5446938                    | 6794415                              |
| 1999                            | 960790                         | 22.70  | 5654386                    | 7019193                              |
| 2000                            | 1003791                        | 19.97  | 6355992                    |                                      |
| <b>Compound Growth Rate (%)</b> |                                |  |                            |                                      |
| 1988-00                         | 12.66                          |  | 7.05                       | 6.73                                 |

Source: Based on World Development Indicators 2002, World Bank

Note: Growth rate is obtained from semi-log regression.

<sup>1</sup> It is estimated that about 84 percent of global resources spent on R&D has been accounted by just 10 countries (U.S., Japan, Germany, France, U.K., Italy, Canada, Netherlands, Sweden and Switzerland). They also account for as much as 94 per cent of the technological output in terms of patents taken in the U.S., and receive 91 percent of global cross-border royalties and technology license fees. (see Kumar 2003, Table-1, pp.210)

Furthermore, there are patterns of concentration in the high technology exports by developing countries. As much as 96 percent of the high technology exports from middle and low-income countries have been accounted by the East Asia and Pacific countries in 1988 followed by 3 percent by Europe and Central Asia and 2 percent by South Asia. The Latin America and Sub-Saharan Africa had negligible shares. However, Latin American countries increased their share of technology-intensive exports from developing countries impressively to 26 percent by 2000 from a low of less than 0.1 percent. The share of Europe & Central Asia also had increased from 3 percent in 1988 to 10 percent in 2000. However, still three-fourth of high technology exports from developing countries originates in East Asia and Pacific countries (Table-3).

**Table-2 High-technology exports by income groups, 1988-2000, (In US \$ million)**

| Year                     | High Income |       | Middle Income |       | Low Income |      | World   |
|--------------------------|-------------|-------|---------------|-------|------------|------|---------|
|                          | Value       | %     | Value         | %     | Value      | %    | Value   |
| 1988                     | 192447      | 92.91 | 14431         | 6.97  | 264        | 0.13 | 207142  |
| 1989                     | 307807      | 93.79 | 19964         | 6.08  | 416        | 0.13 | 328187  |
| 1990                     | 354599      | 93.85 | 22785         | 6.03  | 466        | 0.12 | 377850  |
| 1991                     | 385113      | 92.78 | 29329         | 7.07  | 618        | 0.15 | 415060  |
| 1992                     | 421030      | 91.09 | 40395         | 8.74  | 808        | 0.17 | 462232  |
| 1993                     | 430654      | 89.64 | 48495         | 10.09 | 1275       | 0.27 | 480424  |
| 1994                     | 502451      | 87.86 | 67453         | 11.79 | 1978       | 0.35 | 571882  |
| 1995                     | 611118      | 86.18 | 95257         | 13.43 | 2736       | 0.39 | 709111  |
| 1996                     | 638212      | 84.72 | 111507        | 14.80 | 3589       | 0.48 | 753308  |
| 1997                     | 695633      | 83.31 | 135470        | 16.22 | 3896       | 0.47 | 834998  |
| 1998                     | 722630      | 81.97 | 155671        | 17.66 | 3323       | 0.38 | 881625  |
| 1999                     | 778277      | 81.00 | 178434        | 18.57 | 4079       | 0.42 | 960790  |
| 2000                     | 847043      | 84.38 | 150982        | 15.04 | 5766       | 0.57 | 1003791 |
| Compound Growth Rate (%) |             |       |               |       |            |      |         |
| 1988-00                  | 11.21       |       | 24.59         |       | 29.50      |      | 12.66   |

Source: Based on World Development Indicators 2002, World Bank

Note: Growth rate is obtained from semi-log regression.

**Table-3 High technology exports by regions, 1988-2000 (In US \$ million)**

| Year | East Asia & Pacific |       | South Asia |      | Europe & Central Asia |      | Latin America & Caribbean |       | Middle East & North Africa |      | Sub-Saharan Africa |       | Total Developing region |
|------|---------------------|-------|------------|------|-----------------------|------|---------------------------|-------|----------------------------|------|--------------------|-------|-------------------------|
|      | Value               | %     | Value      | %    | Value                 | %    | Value                     | %     | Value                      | %    | Value              | %     | Value                   |
| 1988 | 14033               | 95.49 | 254        | 1.73 | 391                   | 2.66 | 9                         | 0.06  | 8                          | 0.05 | 0.32               | 0.002 | 14695                   |
| 1989 | 17067               | 83.75 | 334        | 1.64 | 742                   | 3.64 | 2230                      | 10.94 | 6                          | 0.03 | NA                 | NA    | 20380                   |
| 1990 | 20002               | 86.02 | 312        | 1.34 | 607                   | 2.61 | 2238                      | 9.62  | 61                         | 0.26 | 32                 | 0.136 | 23251                   |
| 1991 | 26746               | 89.31 | 382        | 1.28 | 136                   | 0.45 | 2581                      | 8.62  | 74                         | 0.25 | 28                 | 0.092 | 29946                   |
| 1992 | 34183               | 82.96 | 348        | 0.84 | 948                   | 2.30 | 5231                      | 12.70 | 67                         | 0.16 | 426                | 1.034 | 41203                   |

|      |        |       |      |      |       |      |       |       |     |      |      |       |        |
|------|--------|-------|------|------|-------|------|-------|-------|-----|------|------|-------|--------|
| 1993 | 41540  | 83.46 | 423  | 0.85 | 1205  | 2.42 | 5970  | 12.00 | 156 | 0.31 | 476  | 0.955 | 49770  |
| 1994 | 57973  | 83.50 | 627  | 0.90 | 1887  | 2.72 | 8257  | 11.89 | 171 | 0.25 | 515  | 0.742 | 69430  |
| 1995 | 81728  | 83.40 | 1004 | 1.02 | 3006  | 3.07 | 11360 | 11.59 | 148 | 0.15 | 746  | 0.762 | 97993  |
| 1996 | 92717  | 80.56 | 1243 | 1.08 | 5856  | 5.09 | 14310 | 12.43 | 175 | 0.15 | 795  | 0.691 | 115096 |
| 1997 | 109980 | 78.91 | 1232 | 0.88 | 8095  | 5.81 | 18847 | 13.52 | 197 | 0.14 | 1015 | 0.728 | 139365 |
| 1998 | 121234 | 76.25 | 1041 | 0.66 | 10852 | 6.83 | 24241 | 15.25 | 644 | 0.40 | 982  | 0.618 | 158995 |
| 1999 | 134979 | 73.96 | 1376 | 0.75 | 12537 | 6.87 | 31559 | 17.29 | 890 | 0.49 | 1172 | 0.642 | 182513 |
| 2000 | 100485 | 64.19 | NA   | NA   | 15567 | 9.94 | 40497 | 25.87 | NA  | NA   | NA   | NA    | 156548 |

Source: Based on World Development Indicators 2002, World Bank

The high technology exports from India more than quadrupled from US\$ 254 million in 1988 to US\$ 1245 million in 1999. However, the share of India in high technology exports of developing countries has fallen from 1.73 percent in 1988 to 0.68 percent in 1999. In contrast, China has emerged as an important player in high technology exports from developing countries, accounting for about 16 percent share in 1999. The share of high technology exports in total manufactured exports from India has increased marginally from 2 percent in 1992 to 4 percent in 1999 whereas that for China has grown substantially to 17 percent in 1999 from a mere 6 percent in 1992. This suggests that India has lagged behind most of the developing countries in strengthening and expanding its export competitiveness in high technology products (Table-4, Figure-1).

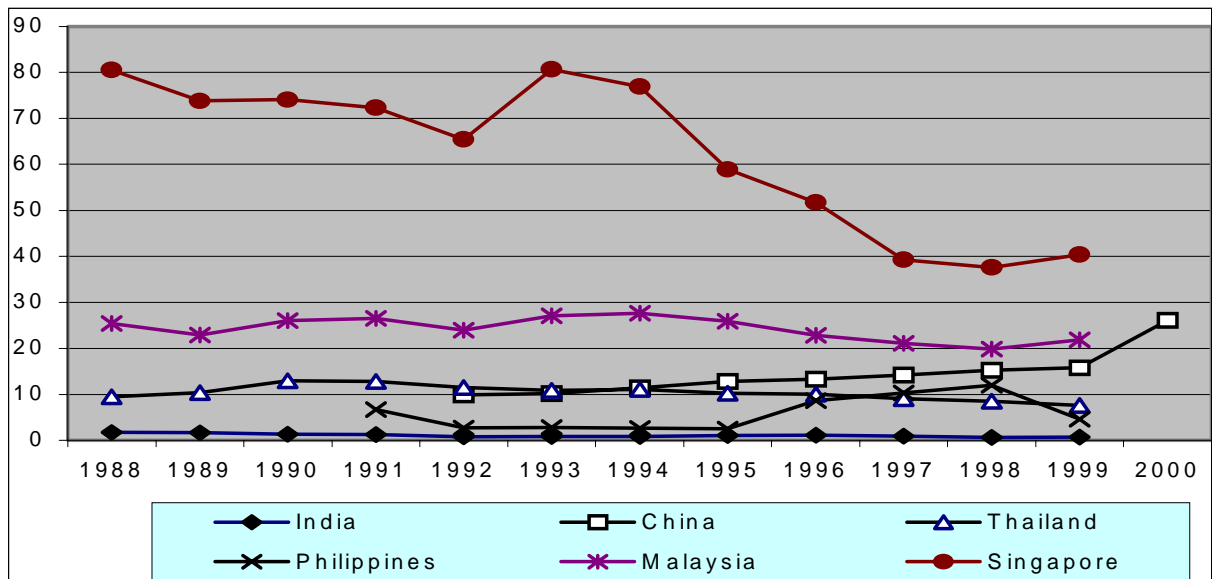
**Table-4 High-technology exports by selected Asian economies, 1988-2000 (In US \$ million)**

| Year   | India |                  | China |                  | Thailand |                  | Philippines |                  | Malaysia |                  | Singapore |                  |
|--|-------|------------------|-------|------------------|----------|------------------|-------------|------------------|----------|------------------|-----------|------------------|
|  | Value | % of man. export | Value | % of man. export | Value    | % of man. export | Value       | % of man. export | Value    | % of man. export | Value     | % of man. export |
| 1988   | 254   | 2.57             | NA    | NA               | 1393     | 16.0             | NA          | NA               | 3731     | 40.56            | 11831     | 37.0             |
| 1989   | 332   | 2.72             | NA    | NA               | 2117     | 19.0             | NA          | NA               | 4673     | 38.35            | 15037     | 40.0             |
| 1990   | 303   | 2.40             | NA    | NA               | 3009     | 21.0             | NA          | NA               | 6046     | 38.18            | 17217     | 40.0             |
| 1991   | 372   | 2.89             | NA    | NA               | 3834     | 21.0             | 2004        | 32.46            | 7948     | 38.19            | 21649     | 45.0             |
| 1992   | 327   | 2.15             | 4086  | 6.11             | 4734     | 22.0             | 1112        | 27.51            | 9882     | 37.64            | 26950     | 46.0             |
| 1993   | 396   | 2.42             | 5060  | 6.84             | 5399     | 20.0             | 1415        | 30.31            | 13484    | 41.10            | 40136     | 50.0             |
| 1994   | 596   | 2.97             | 7918  | 7.95             | 7689     | 24.0             | 1809        | 31.50            | 19161    | 44.24            | 53412     | 54.0             |
| 1995   | 1001  | 4.30             | 12563 | 10.05            | 10045    | 24.0             | 2464        | 34.94            | 25398    | 46.10            | 57763     | 55.0             |
| 1996   | 1239  | 5.12             | 15295 | 12.00            | 11517    | 29.0             | 9929        | 58.38            | 26309    | 44.38            | 59528     | 57.0             |
| 1997   | 1225  | 4.75             | 19788 | 12.68            | 12612    | 31.0             | 14354       | 66.44            | 29482    | 48.99            | 54688     | 59.0             |
| 1998   | 1030  | 4.09             | 24195 | 15.08            | 13510    | 34.0             | 19027       | 71.90            | 31634    | 54.88            | 59811     | 61.0             |
| 1999   | 1245  | 4.29             | 28849 | 16.76            | 13949    | 32.0             | 8465        | 58.60            | 39964    | 58.90            | 73643     | 63.0             |
| 2000   | NA    | NA               | 40837 | 18.58            | NA       | NA               | NA          | NA               | NA       | NA               | NA        | NA               |
| <i>% share in developing country high-technology exports</i> |       |                  |       |                  |          |                  |             |                  |          |                  |           |                  |
| 1988   | 1.73  |                  |       |                  | 9.48     |                  |             |                  | 25.39    |                  | 80.51     |                  |
| 1989   | 1.63  |                  |       |                  | 10.39    |                  |             |                  | 22.93    |                  | 73.78     |                  |

|      |      |       |       |       |       |       |
|------|------|-------|-------|-------|-------|-------|
| 1990 | 1.30 |       | 12.94 |       | 26.00 | 74.05 |
| 1991 | 1.24 |       | 12.80 | 6.69  | 26.54 | 72.29 |
| 1992 | 0.79 | 9.92  | 11.49 | 2.70  | 23.98 | 65.41 |
| 1993 | 0.80 | 10.17 | 10.85 | 2.84  | 27.09 | 80.64 |
| 1994 | 0.86 | 11.40 | 11.07 | 2.61  | 27.60 | 76.93 |
| 1995 | 1.02 | 12.82 | 10.25 | 2.51  | 25.92 | 58.95 |
| 1996 | 1.08 | 13.29 | 10.01 | 8.63  | 22.86 | 51.72 |
| 1997 | 0.88 | 14.20 | 9.05  | 10.30 | 21.15 | 39.24 |
| 1998 | 0.65 | 15.22 | 8.50  | 11.97 | 19.90 | 37.62 |
| 1999 | 0.68 | 15.81 | 7.64  | 4.64  | 21.90 | 40.35 |
| 2000 |      | 26.09 |       |       |       |       |

Source: Based on World Development Indicators 2002, World Bank

**Figure-1 Share in developing country high-technology exports (%), 1988 to 2000**



### 3. Structure of Indian manufacturing and exports

The process of industrialization is ordinarily associated with a shift of manufacturing value-added from low technology industries to medium technology industries and then to high technology industries. This technological shift in the composition of manufacturing value-added depends crucially on the ability of a country to develop its knowledge-based industries and the speed with which it can do so. It is important to note that technological shift is not an exogenous process as may be suggested by neoclassical approach to technological change rather it depends on strategic interventions by the state in achieving it.



Table-5 and Figure-2 show that the technological structure of Indian manufacturing has not change much during the last one and half decade. It continues to be dominated by a structure where more proportion of value-added is originating from medium-low and low technology industries. These lower technology categories together contributed about 64 percent of manufacturing value-added in 1981 as compared to 4 percent of high technology and 32 percent of medium-high technology industries. In 1995, the share of low technology and medium low technology industries was still as high as 59 percent as compared to 6 percent of high technology and 35 percent of medium-high technology industries. Clearly Indian manufacturing has not been able to diversify its production base in favour of high-technology intensive industries and this may be an important explanation for India's inability to expand its export share in high technology products in global markets. This very slow technological shift in manufacturing is definitely a worrying fact about Indian manufacturing.

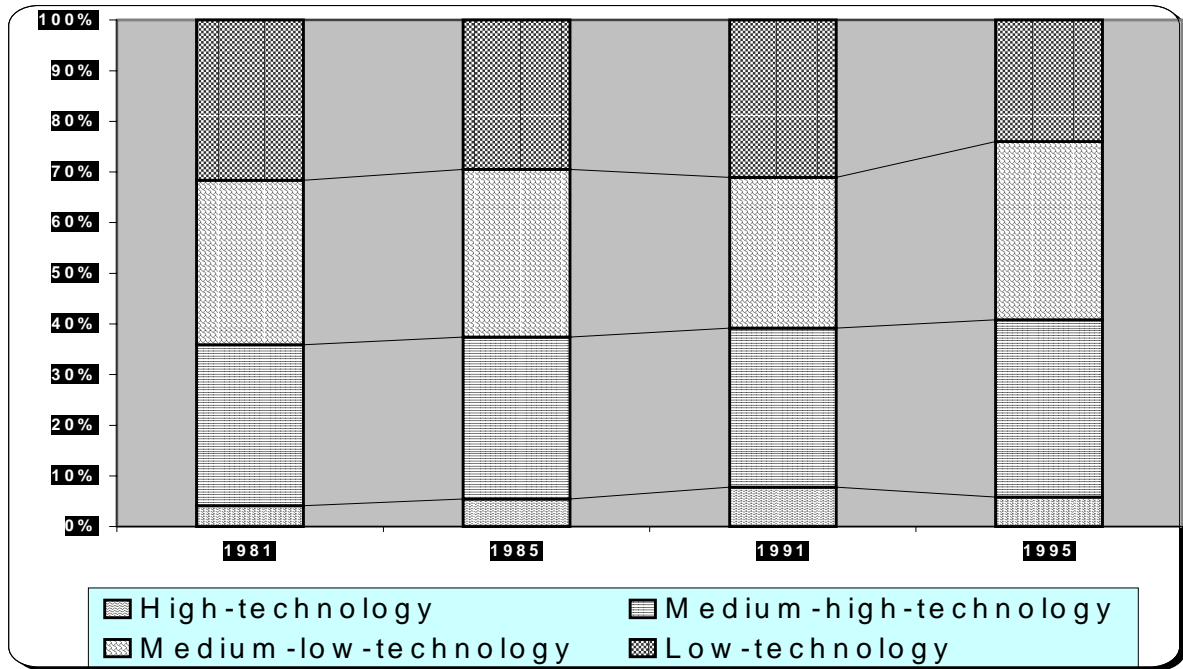
**Table-5 Structure of India's manufacturing value-added (%), 1981-1995**

| Industry                          | 1981         | 1985         | 1991         | 1995         |
|-----------------------------------|--------------|--------------|--------------|--------------|
| 1. Aerospace                      | 0.15         | 0.15         | 0.22         | 0.25         |
| 2. Computers, office machinery    | 0.12         | 0.19         | 1.03         | 0.64         |
| 3. Electronics-communications     | 0.85         | 1.83         | 2.73         | 1.74         |
| 4. Pharmaceuticals                | 2.98         | 3.28         | 3.82         | 3.21         |
| <b>High-technology</b>            | <b>4.09</b>  | <b>5.44</b>  | <b>7.80</b>  | <b>5.83</b>  |
| 5. Scientific instruments         | 0.63         | 0.74         | 0.79         | 0.74         |
| 6. Motor vehicles                 | 4.71         | 4.61         | 5.41         | 6.18         |
| 7. Electrical machinery           | 6.36         | 5.68         | 5.89         | 5.01         |
| 8. Chemicals                      | 10.94        | 11.38        | 11.05        | 15.77        |
| 9. Other transport equipment      | 3.10         | 2.71         | 3.28         | 2.98         |
| 10. Non-electrical machinery      | 6.03         | 6.84         | 4.96         | 4.28         |
| <b>Medium-high-technology</b>     | <b>31.78</b> | <b>31.96</b> | <b>31.38</b> | <b>34.95</b> |
| 11. Rubber and plastic products   | 2.14         | 3.31         | 3.29         | 2.56         |
| 12. Shipbuilding                  | 0.89         | 0.22         | 0.20         | 0.21         |
| 13. Other manufacturing           | 0.37         | 0.91         | 0.63         | 0.82         |
| 14. Non-ferrous metals            | 0.81         | 0.72         | 3.30         | 3.38         |
| 15. Non-metallic mineral products | 3.88         | 5.65         | 6.90         | 4.62         |
| 16. Fabricated metal products     | 2.93         | 2.66         | 2.80         | 2.61         |
| 17. Petroleum refining            | 8.21         | 8.45         | 7.36         | 13.21        |
| 18. Ferrous metals                | 13.28        | 11.19        | 5.29         | 7.78         |

|                                  |              |              |              |              |
|----------------------------------|--------------|--------------|--------------|--------------|
| <b>Medium-low-technology</b>     | <b>32.50</b> | <b>33.11</b> | <b>29.77</b> | <b>35.20</b> |
| 19. Paper printing               | 4.30         | 3.20         | 3.90         | 3.73         |
| 20. Textile and clothing         | 17.20        | 14.54        | 13.93        | 10.51        |
| 21. Food, beverages, and tobacco | 9.53         | 11.26        | 12.81        | 9.51         |
| 22. Wood and furniture           | 0.58         | 0.50         | 0.40         | 0.27         |
| <b>Low-technology</b>            | <b>31.62</b> | <b>29.50</b> | <b>31.05</b> | <b>24.02</b> |

Source: Authors' calculation based on World Bank data set on Trade and Production (2001)

**Figure-2 The structure of manufacturing value-added in India based on technology intensity (%)**



We now turn our attention to the structure of India's manufactured exports relative to that of production structure. In an ideal situation one would expect that the export share of different industries would reflect their respective shares in the production. With reference to this ideal benchmark situation we can define a sector as highly export-oriented when its export share is higher than its production share. This index of export orientation may take the value of unity for industries where their contribution to the country's manufactured exports is equal to their contribution to the manufactured production. The industry with a value of less than unity indicates that its contribution to the country's manufactured exports is less than its share in the manufactured production.

Symbolically we can express the index of export orientation as follows:

$$IEX = \left( \frac{X_i / \sum X_i}{V_i / \sum V_i} \right) \quad (1.1)$$

Where  $X_i$  is the export of  $i$ th industry and  $V_i$  is its value-added.

When  $IEX > 1$ , then the export orientation of  $i$ th industry is high.

$IEX = 1$ , then the export orientation of  $i$ th industry is normal.

$IEX < 1$ , then the export orientation of  $i$ th industry is low.

The composition of India's manufactured exports over 1981-1995 is provided in Table-6 and the constructed export orientation index in Table-7. It can be seen from Table-6 and Figure-3 that the share of low technology industries in total manufactured exports is continually declining and that of high technology industries is slowly increasing. However this technological shift in the composition has been very slow. The contribution of high-technology and medium-high technology industries towards manufactured exports in 1981 was about 15 percent rising to 18 percent in 1991 and has stagnated at the same level in 1995. While the share of low technology industries has declined from 66 percent in 1981 to 48 percent in 1995, that of medium-low-technology industries has risen to make up for low technology ones. Therefore, the export basket of India is still dominated by relatively low-technology products in that they comprise about 80 percent of India's manufactured exports. Within low technology industries dominant export contributors are industries producing food products including beverages and tobacco and textile products. However, the share of both these sectors in the total exports from the country is found to be declining during 1981-95 and the decline is significant in the case of the food products. Among medium-low technology industries other manufacturing that include jewellery, musical instruments, sporting & athletic goods, and else where not classified industries is by far the largest contributor to the total exports, followed by petroleum refining, and ferrous and fabricated metal products. In the case of medium-high technology industries, chemicals and motor vehicles are the major export contributing sectors. Pharmaceuticals and electronics are the two important sectors in the high-technology groups

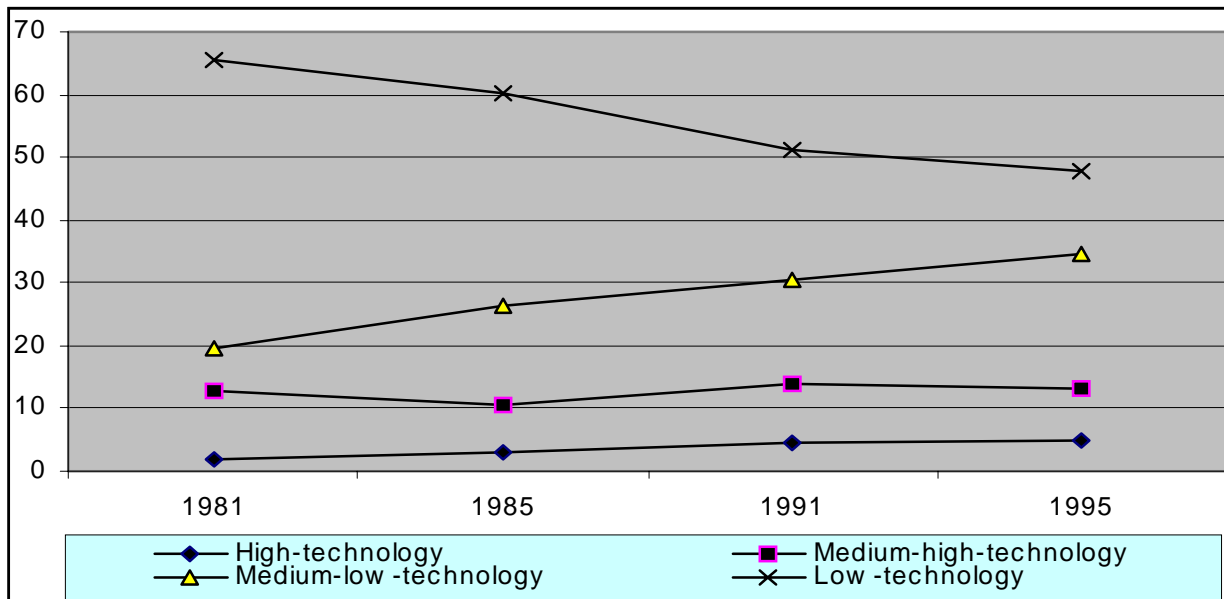
towards exporting. It is important to note that exports originating from high and medium-high technology industry appear to be more balanced over industries than in low or medium-low technology industries where major share of exports is contributed by a few dominant industries.

**Table-6 Structure of India's manufacturing exports (%), 1981-1995**

| Industry                          | 1981         | 1985         | 1991         | 1995         |
|-----------------------------------|--------------|--------------|--------------|--------------|
| 1. Aerospace                      | 0.10         | 0.27         | 0.12         | 0.03         |
| 2. Computers, office machinery    | 0.04         | 0.31         | 0.36         | 0.76         |
| 3. Electronics-communications     | 0.23         | 0.32         | 0.82         | 1.39         |
| 4. Pharmaceuticals                | 1.70         | 2.15         | 3.10         | 2.55         |
| <b>High-technology</b>            | <b>2.06</b>  | <b>3.05</b>  | <b>4.40</b>  | <b>4.72</b>  |
| 5. Scientific instruments         | 0.52         | 0.62         | 0.46         | 0.36         |
| 6. Motor vehicles                 | 2.82         | 1.80         | 2.13         | 2.05         |
| 7. Electrical machinery           | 1.90         | 1.72         | 1.35         | 1.01         |
| 8. Chemicals                      | 3.99         | 3.28         | 7.08         | 7.09         |
| 9. Other transport equipment      | 1.44         | 0.69         | 0.95         | 1.14         |
| 10. Non-electrical machinery      | 2.03         | 2.37         | 1.94         | 1.42         |
| <b>Medium-high-technology</b>     | <b>12.70</b> | <b>10.48</b> | <b>13.91</b> | <b>13.07</b> |
| 11. Rubber and plastic products   | 0.78         | 1.18         | 1.12         | 1.97         |
| 12. Shipbuilding                  | 0.06         | 0.03         | 0.13         | 0.02         |
| 13. Other manufacturing           | 11.25        | 19.14        | 17.71        | 18.59        |
| 14. Non-ferrous metals            | 0.22         | 0.61         | 1.20         | 0.88         |
| 15. Non-metallic mineral products | 0.74         | 0.56         | 0.76         | 1.36         |
| 16. Fabricated metal products     | 3.91         | 2.22         | 2.48         | 2.39         |
| 17. Petroleum refining            | 1.50         | 1.73         | 4.98         | 6.03         |
| 18. Ferrous metals                | 1.15         | 0.69         | 2.06         | 3.28         |
| <b>Medium-low-technology</b>      | <b>19.61</b> | <b>26.16</b> | <b>30.45</b> | <b>34.52</b> |
| 19. Paper printing                | 0.35         | 0.31         | 0.23         | 0.51         |
| 20. Textile and clothing          | 37.91        | 39.78        | 38.72        | 33.38        |
| 21. Food, beverages, and tobacco  | 26.99        | 20.02        | 12.19        | 13.66        |
| 22. Wood and furniture            | 0.38         | 0.20         | 0.10         | 0.14         |
| <b>Low-technology</b>             | <b>65.63</b> | <b>60.32</b> | <b>51.24</b> | <b>47.69</b> |

Source: Author's calculation based on World Bank data set on Trade and Production (2001)

**Figure-3 The composition of manufacturing exports from India based on technology-intensity (%)**



An examination of Table-8 and Figure-4 indicate that low-technology industries in Indian manufacturing are highly export oriented as compared to high technology industries. The value of export orientation index for low technology industry as a group is always greater than unity over 1980-1995. Clearly, the low technology industries have been contributing significantly towards India's manufacturing exports greater than their contribution to the manufacturing production. The export orientation index of high technology industries was equal to 0.5 in 1981 but showed an upward trend to reach 0.81 in 1995. In the case of medium-high technology category, the index remains below 0.5 and even declines in the early nineties.

Medium-high technology sectors that contribute around 35 percent of the total manufacturing value-added are able to contribute mere 13 percent of manufactured exports from India in 1995. There is not a single medium-high technology industry, which possess an index value of unity. Among high technology industries only computers and office machinery could manage to have a value nearly unity in 1995. This low export orientation of Indian high and medium-high technology industries implies that there exists vast potential to increase its export through fine-tuning the existing policy framework. It should be recognized that Indian high technology firms are competing with firms from developed countries who are forerunners in technology creation and have huge financial, managerial and human resources at their

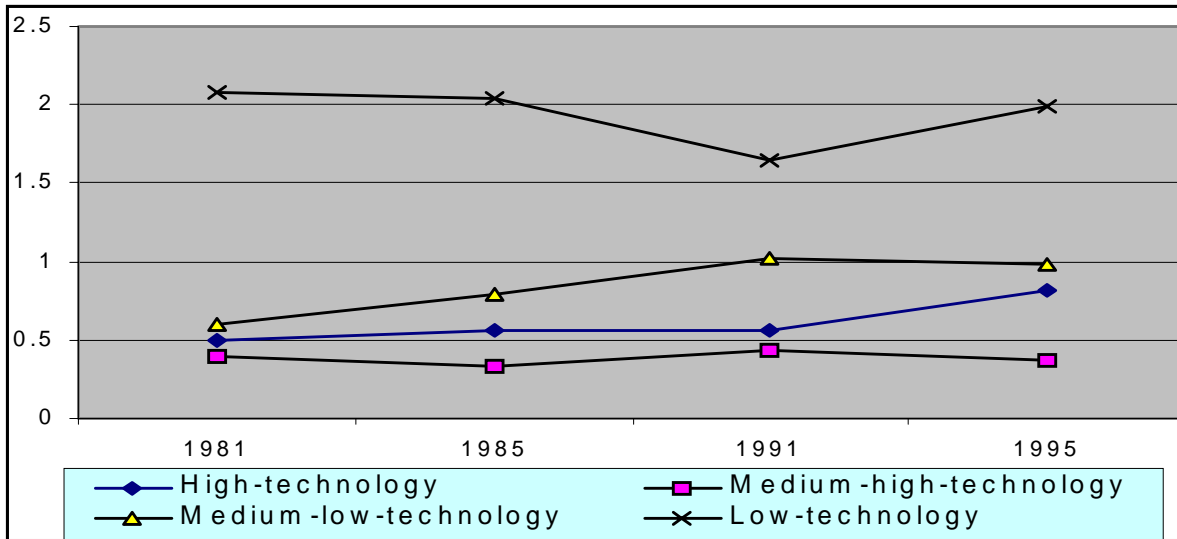
disposal. Indian high technology firms on the contrary are small sized and relatively lack both financial and knowledge resources. These firms operate in an imperfect technology market, hardly have information on the availability of different technologies, and in many instances do not have capability to choose the optimum one. Even if we assume that they have access to a range of new technologies, for competitiveness what matter in high technology industries is using available technology to create firm-specific technology and its continuous improvement through learning and incurring R&D activities. In sum, there exists ample scope for Indian high technology industries to contribute to manufacture exports from India provided appropriate policy intervention is made at various levels of market imperfection that characterizes market environment in a developing country.

**Table-8 The index of export orientation for Indian industries, 1981-1995**

| Industry                          | 1981  | 1985  | 1991  | 1995  |
|-----------------------------------|-------|-------|-------|-------|
| 1. Aerospace                      | 0.67  | 1.80  | 0.55  | 0.12  |
| 2. Computers, office machinery    | 0.33  | 1.63  | 0.35  | 1.19  |
| 3. Electronics-communications     | 0.27  | 0.17  | 0.30  | 0.80  |
| 4. Pharmaceuticals                | 0.57  | 0.66  | 0.81  | 0.79  |
| <b>High-technology</b>            | 0.50  | 0.56  | 0.56  | 0.81  |
| 5. Scientific instruments         | 0.83  | 0.84  | 0.58  | 0.49  |
| 6. Motor vehicles                 | 0.60  | 0.39  | 0.39  | 0.33  |
| 7. Electrical machinery           | 0.30  | 0.30  | 0.23  | 0.20  |
| 8. Chemicals                      | 0.36  | 0.29  | 0.64  | 0.45  |
| 9. Other transport equipment      | 0.46  | 0.25  | 0.29  | 0.38  |
| 10. Non-electrical machinery      | 0.34  | 0.35  | 0.39  | 0.33  |
| <b>Medium-high-technology</b>     | 0.40  | 0.33  | 0.44  | 0.37  |
| 11. Rubber and plastic products   | 0.36  | 0.36  | 0.34  | 0.77  |
| 12. Shipbuilding                  | 0.07  | 0.14  | 0.65  | 0.10  |
| 13. Other manufacturing           | 30.41 | 21.03 | 28.11 | 22.67 |
| 14. Non-ferrous metals            | 0.27  | 0.85  | 0.36  | 0.26  |
| 15. Non-metallic mineral products | 0.19  | 0.10  | 0.11  | 0.29  |
| 16. Fabricated metal products     | 1.33  | 0.83  | 0.89  | 0.92  |
| 17. Petroleum refining            | 0.18  | 0.20  | 0.68  | 0.46  |
| 18. Ferrous metals                | 0.09  | 0.06  | 0.39  | 0.42  |
| <b>Medium-low-technology</b>      | 0.60  | 0.79  | 1.02  | 0.98  |
| 19. Paper printing                | 0.08  | 0.10  | 0.06  | 0.14  |
| 20. Textile and clothing          | 2.20  | 2.74  | 2.78  | 3.18  |
| 21. Food, beverages, and tobacco  | 2.83  | 1.78  | 0.95  | 1.44  |
| 22. Wood and furniture            | 0.66  | 0.40  | 0.25  | 0.52  |
| <b>Low-technology</b>             | 2.08  | 2.04  | 1.65  | 1.99  |

Source: Author's calculation based on World Bank data set on Trade and Production (2001)

**Figure-4 The index of export orientation for Indian industries, 1981-1995**



#### **4. Foreign Ownership, Outward-Orientation and Patterns of Export Competitiveness in Indian Manufacturing**

In this section we will analyze trends and patterns of export competitiveness in Indian manufacturing based on an exclusive firm-level data set constructed at R.I.S. from different sources. Detail about the data set has been discussed in the appendix. Three important dimension of export competitiveness will be taken up for the analysis. First, the section will compare the export performance of foreign and domestic firms. Existing literature indicate that MNEs have played an important role in expanding exports from many developing countries. For example the dramatic export success of China, Costa Rica, Hungary, Ireland and Mexico can be trace back their reliance on export-oriented FDI (UNCTAD, 2002). The particular question that will be address here is: how have foreign firms performed with respect to export competitiveness in the nineties? Are they more export competitive than domestic firms? Second, the role of outward foreign direct investment in promoting export from Indian manufacturing will be investigated. Are outward investing firms more export oriented than non-outward investing firms? Theoretically firms having affiliates are better place to ensure after-sales services to global buyers than non-investing firms. Further, they have easy access to information on the impulses of global market forces, technological development abroad in the form of new product, process and new organizational skill. Given these advantages outward investing firms are expected to do better than non-investing firms in the global market. Thirdly,

the analysis will be bi-furcated into pre-reform (1989-90 to 1992-93) and post-reform (1993-94 to 2000-01) scenarios. The reforms of trade, investment and industrial regime undertaken in 1991 likely to have effects on the trends of export competitiveness of Indian manufacturing enterprises. All above three dimensions of the analysis will be carried out with respect to technology –sub-samples to see how the trends in export competitiveness differ between high technology and low technology segment of Indian manufacturing.

#### 4.1. Overall Manufacturing

The export intensity of Indian manufacturing firms included in the data set has shown distinct improvement in the 1990s. The estimated export intensity of total manufacturing had become more than doubled between 1989 and 1998. It was just 4.6 percent in 1989 but consistently has risen to 12 percent in 1998 (Table-9, Figure-5). From a period wise analysis it can be seen from Figure-6 that the sample firms have exported, on an average, nearly about 6 percent of their sales over the pre-reform period (1990-93) but about 10 percent of sales in post-reform period (1994-01). Therefore the average export intensity is much higher in the post reform period by about 4-percentage point. The expectation that liberalization will improve the export competitiveness of Indian enterprises thus seems to be supported by the trend in export competitiveness. The trade regime that is outward looking and specifically promotes trade related infrastructure, provides fiscal and technological incentives for exporting, reduces administrative and legal restrictions etc. have greater potential for inducing firms to participate in international trade.

**Table- Export intensity of Indian manufacturing firms, 1989-90 to 2000-01.**

| Year | All firms | Foreign firms | Domestic firms | Outward investing firms | Non-outward investing firms |
|------|-----------|---------------|----------------|-------------------------|-----------------------------|
| 1990 | 4.60      | 6.98          | 4.29           | 6.61                    | 4.25                        |
| 1991 | 4.71      | 6.98          | 4.40           | 7.56                    | 4.21                        |
| 1992 | 5.74      | 9.10          | 5.29           | 9.04                    | 4.98                        |
| 1993 | 7.07      | 9.37          | 6.75           | 10.51                   | 6.18                        |
| 1994 | 8.41      | 9.88          | 8.21           | 12.98                   | 7.12                        |
| 1995 | 8.61      | 9.74          | 8.47           | 12.08                   | 7.47                        |
| 1996 | 9.25      | 8.75          | 9.32           | 12.62                   | 7.99                        |
| 1997 | 9.68      | 9.38          | 9.72           | 12.32                   | 8.55                        |
| 1998 | 10.33     | 10.50         | 10.30          | 12.70                   | 9.27                        |
| 1999 | 9.66      | 8.30          | 9.87           | 11.55                   | 8.82                        |
| 2000 | 9.45      | 8.00          | 9.68           | 11.63                   | 8.44                        |
| 2001 | 10.01     | 8.10          | 10.31          | 12.12                   | 8.89                        |



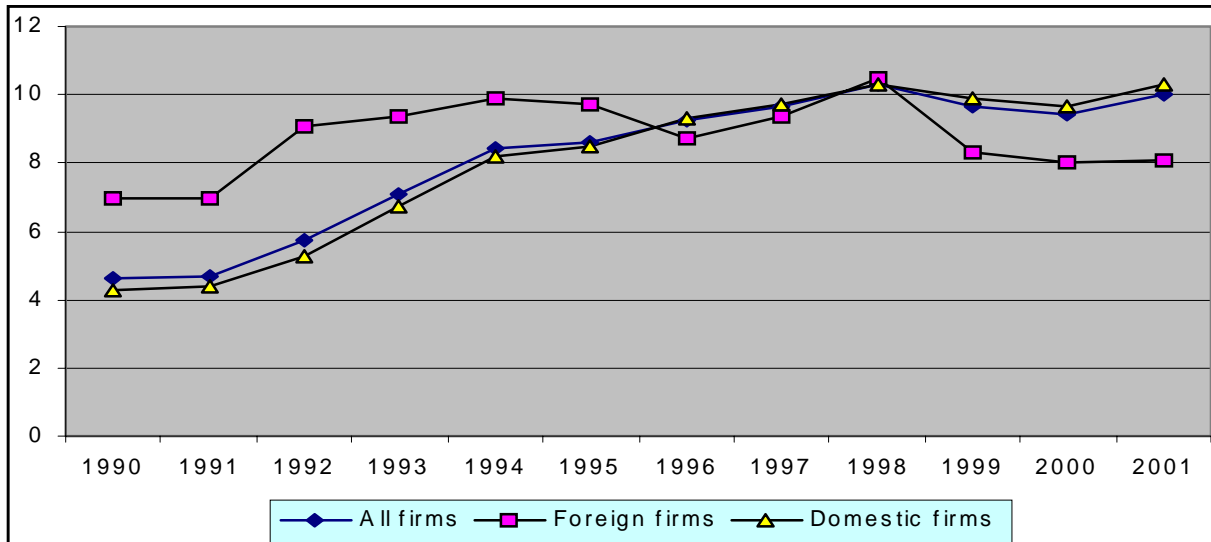
| Period-wise average |      |      |      |       |      |
|---------------------|------|------|------|-------|------|
| 1990-93             | 5.71 | 8.32 | 5.36 | 8.91  | 5.03 |
| 1994-01             | 9.53 | 8.91 | 9.62 | 12.16 | 8.42 |

Source: Author's estimation based on RIS-DSIR database (2002)

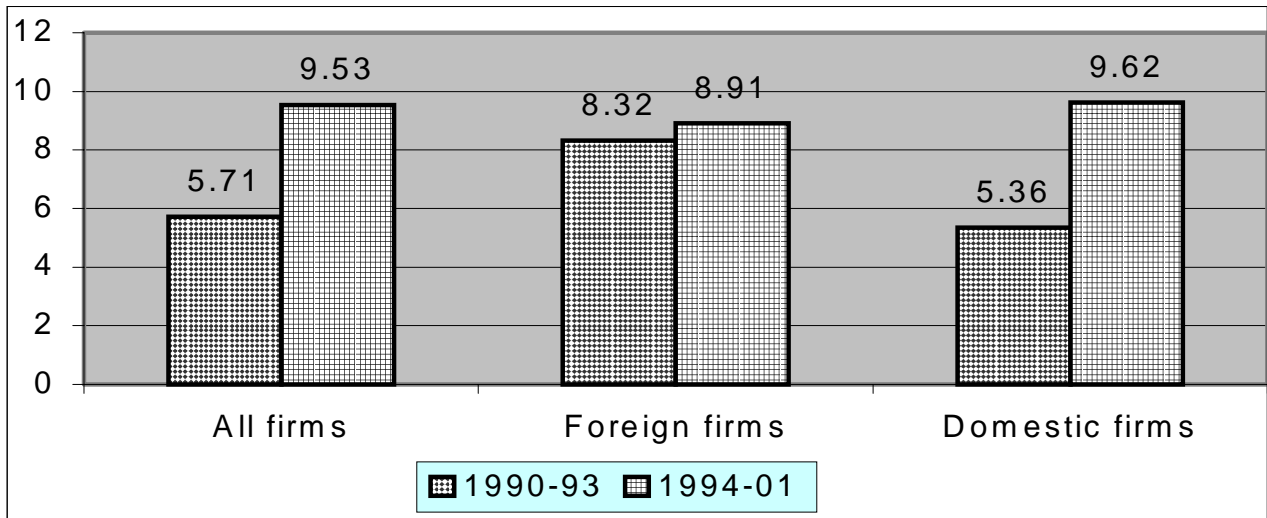
Note: export-intensity is the weighted average of export intensity of firms weighted by respective sales.

This improved export activity of Indian manufacturing has been largely contributed by the significant rise in the export intensity of the domestic enterprises. The export intensity of domestic enterprises has grown from a low level of 4.3 percent in 1990 to 10.3 percent in 2001. On the contrary, export activity of foreign firms is marginal factor in the aggregate export intensity improvement. Their export intensity is found to have continuously hovering around 8 percent per year over 1990-2001. It is often argued in the literature that foreign firms can play the role of export catalysts for developing countries in the global manufacturing markets. The more outward oriented a country's regime is, the more effective is the export catalyst role of foreign firms. However the results presented in Table-9 indicate that the export behaviour of foreign affiliates in Indian manufacturing depend little on the policy regime. There has not been any substantial change in the export intensity of foreign firms between pre-reform and post-reform period. Rather the policy regime shift in India seems to have affected the export intensity of domestic firms significantly. In the pre-reform period, domestic firms had exported about 5 percent of their sales where as exports accounted about 10 percent of their sales in the post-reform period (Figure-6). It is important to note that the export intensity of domestic firms, which was below than that of foreign firms by 2-percentage point in the pre- reform-period, has exceeded that of foreign firms by 1-percentage in the post-reform period. Obviously the present finding contradict the much hyped expectation that the operating foreign firms in Indian manufacturing will improve their export efforts relatively higher than that of domestic firms because of their global presence and superior bundle of both proprietary and non-propriety assets under an increasingly liberalizing investment and trade regime.

**Figure-5 Export Intensity in Indian manufacturing by ownership, 1990-2001**



**Figure-6 Liberalization and Export Intensity in Indian manufacturing by ownership, 1990-93 and 1994-01**

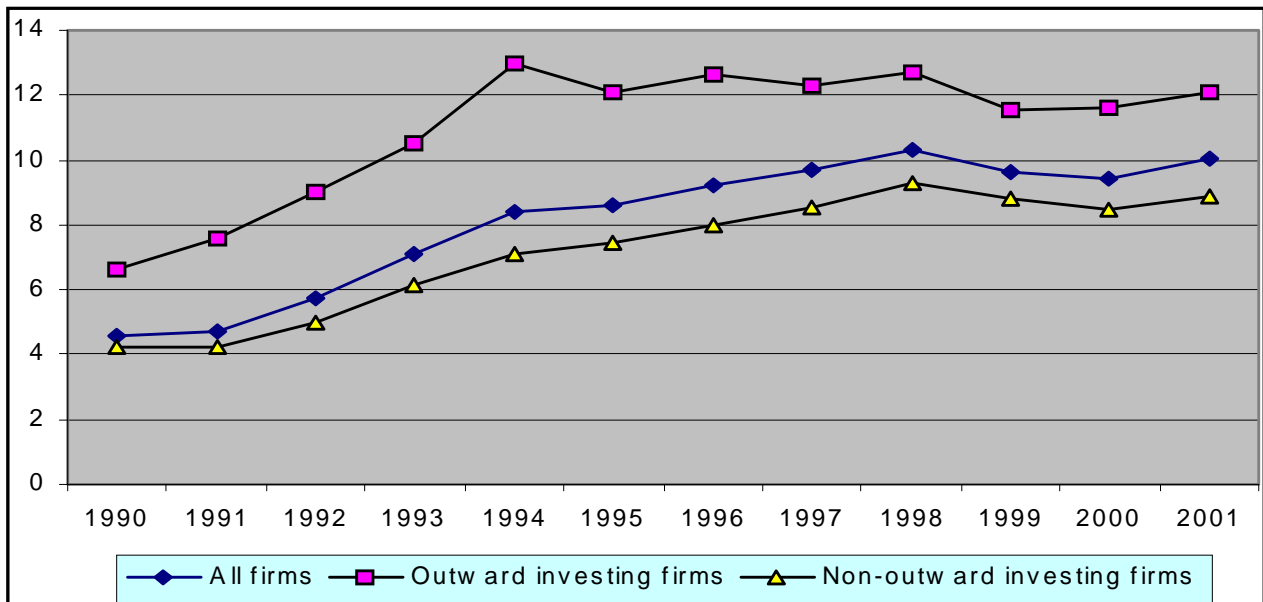


The case of Indian manufacturing firms with outward investment merit special attention. Theoretically, firms undertaking investment abroad are expected to display greater export competitiveness than firms not undertaking such investment. The main reasons for such expectation is that firms' presence in the foreign market ensure flexibility, reliability and

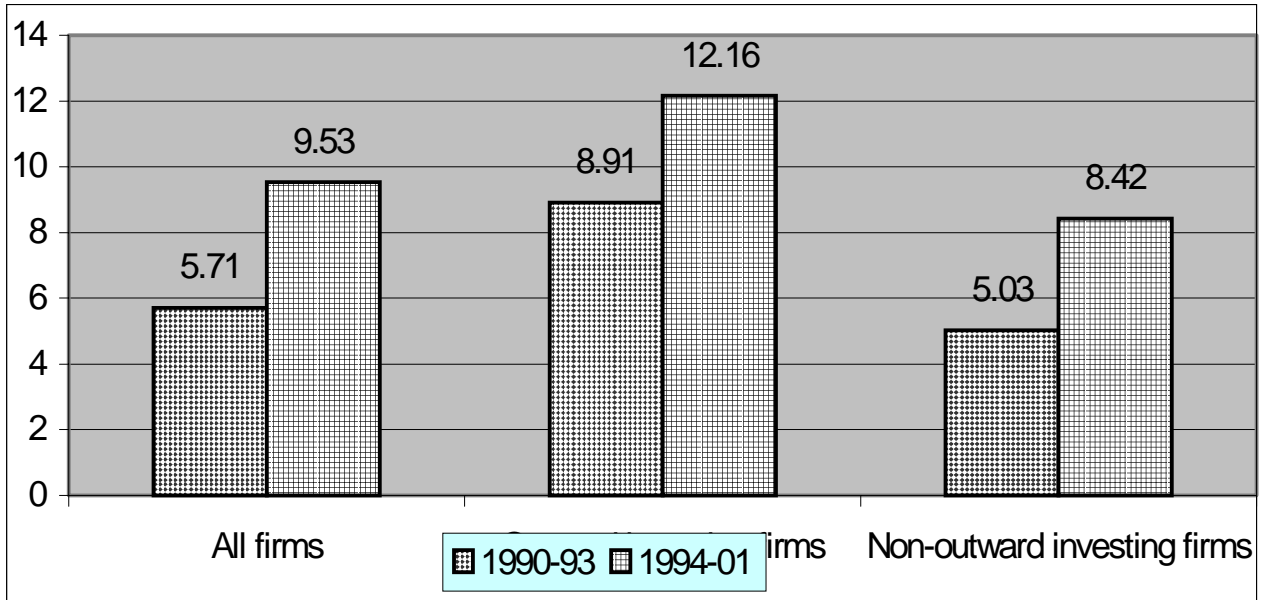
timeliness in dealing with global buyers that is crucial for export success. Firms not undertaking such investment have to rely on some distributing agents in the foreign market and thus may not be able to assure better with -sales and after- sales services to the foreign customers.

True to the above expectation outward-investing firms had shown higher export competitiveness than firms not investing abroad. Over the period 1990-93 they had exported about 10 percent of their sales which is 5-percentage point higher than what firms not investing abroad had exported (Table-9, Figure-7). The curve of export intensity of outward investing firms was lying higher than that of average manufacturing and firms without outward investment for each year of the study period. The export intensity of both outward investing and non-outward investing firms is observed to have affected favorably by reforms. The export intensity of these two groups of firms in the post-reform period is higher than the achieved intensity in the pre-reform period (Figure-8).

**Figure-7 Export Intensity in Indian manufacturing by outward investment, 1990-2001**



**Figure-8 Liberalization and Export Intensity in Indian manufacturing by outward investment, 1990-93 and 1994-01**



#### 4.2. Technology Intensity-based Sub-samples

Previous analysis of the export competitiveness of Indian manufacturing indicates that the firms of all categories had performed better in exporting larger share of their sales in the post reform period as compared to the pre reform period. This may reflect the changing imagination, outlook, strategies and capabilities of Indian enterprises to expand their global operation in an outward looking regime as compared to the restrictive phase of domestic business environment. This aggregative analysis however hides one important aspect of the pattern of exporting that characterizes developing countries. As majority of developing countries does not have strong base in the knowledge-based industries they continue with the export of low technology consumer goods. It is therefore important to look into how Indian firms have performed in the knowledge-based industries and whether liberalization has helped them in improving their export competitiveness.

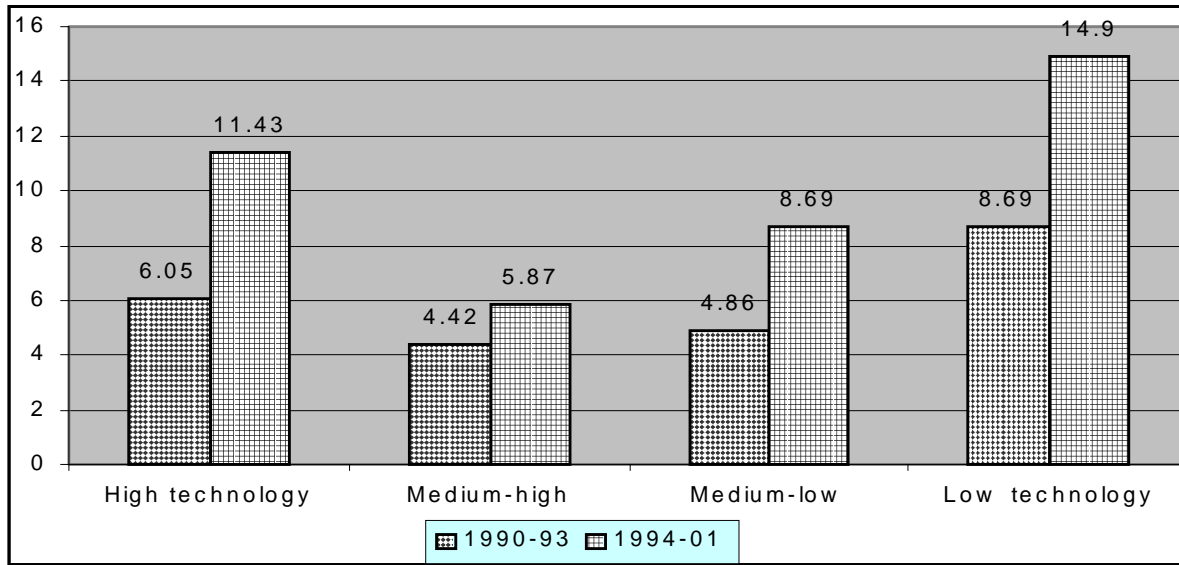
Foreign firms with their intangible assets like technology, skill, management strategy, organizational efficiency, brand names, world wide distribution networks and tangible assets like financial resources, modern machinery and intermediate inputs, raw materials etc., are predicted to contribute to the development of knowledge-based industries relatively more than to the development of low technology consumer goods industries. Foreign firms can be

instrumental in building up high technology segment of their manufacturing sector which are specifically those industries where developing countries, in general, lack required technology, skill and entrepreneurial competencies. Therefore theoretically the export competitiveness of foreign firms is predicted to be substantially higher in the high technology industries than the low technology industries.

The outward-investing firms as compared to the firms not investing abroad can be expected to enjoy distinct advantages in improving the export performance of developing countries in the high technology products. The presence of affiliates in the foreign market make it easier to learn from and interact with the dynamics of foreign market, new technology, and provides after sales services vital for export success in the knowledge-intensive goods.

Table- 10 to 13 in the appendix and Figure-9 to 13 in the text present export intensity of enterprises over the four technology categories, namely, high, medium-high, medium-low and low technology industries. It is obvious that Indian enterprises had achieved maximum export performance in the low technology industries, followed by high technology, medium-low and medium-high technology industries. Firms in the low technology industries had exported about 15 percent of their total sales during 1994-01 as compared to 11 percent in high technology, 9 percent in medium-low and only 6 percent in medium-high technology industries over the same period. The emergence of high technology firms as having second position in terms of export intensity may be because of Indian pharmaceutical industry in which India enjoys comparative advantages in the global market. Otherwise the finding suggests that the global competitiveness of Indian manufacturing is still confined to low technology and medium-low technology products. The export intensity of Indian firms belongs to medium-high technology industry is continue to be lowest compared to that of other technology groupings. It is important to note that the Indian firms had performed better in exporting in the post reform period relative to the pre reform period over all the four categories of technology classification. The average export intensity of low technology industries had increased by 6 percentage points from 9 percent during 1990-93 to become 15 percent in 1994-01. The increase was 5-percentage point in the case of high technology industry, 4-percentage point in the case of medium-low technology industry and only 1-percentage point in the case of medium-high technology segment.

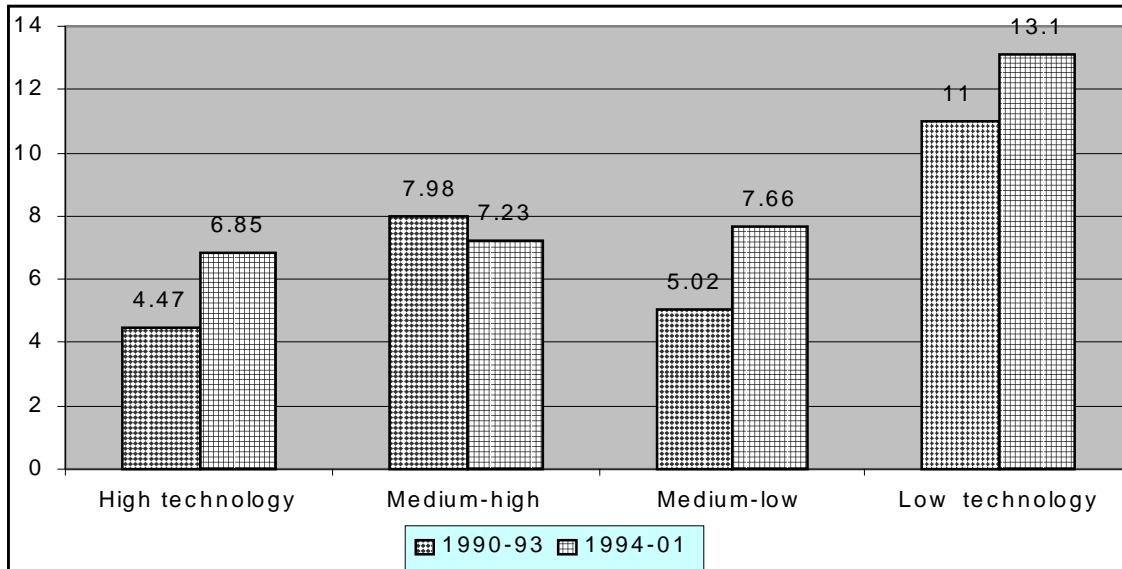
**Figure-9 Export intensity of Indian manufacturing firms across technology intensity**



The export behavior of foreign enterprises based on technology sub-samples reveals that they had exhibited higher export propensity in the low technology industries than in high technology industries. The foreign firms belonging to the low technology industry, on the average, have exported nearly 13 percent of their sales in the period 1994-01 which is nearly twice than what high technology foreign firms have exported (6.85 percent). Over the same period, the medium-low technology foreign firms had exported about 8 percent of their sales and the medium-high technology foreign firms about 7 percent. Thus, the export behavior of foreign firms had followed the general trend observed in the case of all firms as discussed above.

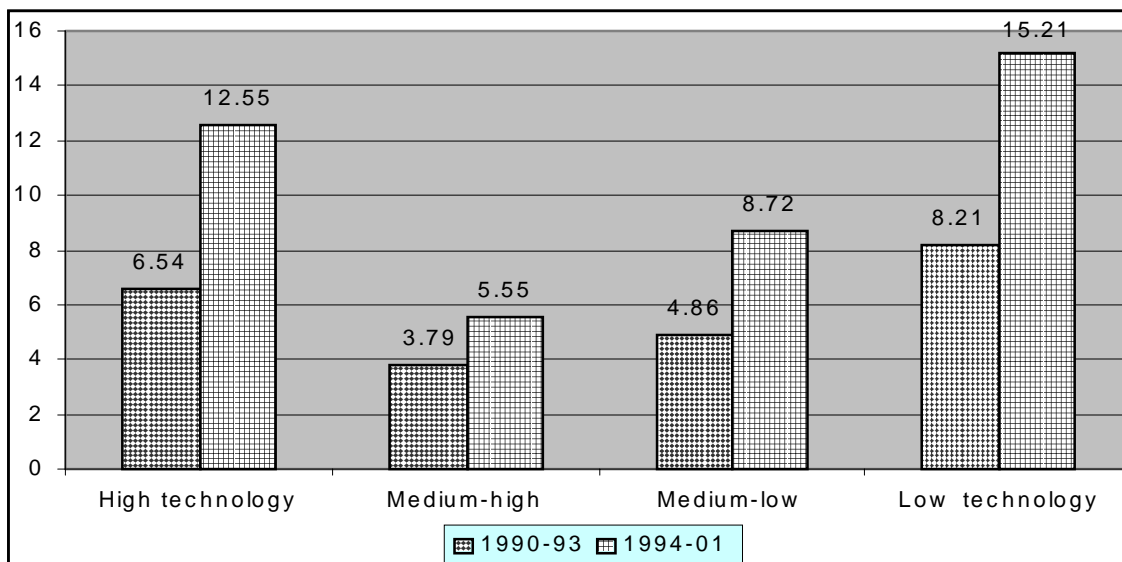
The trend in export intensity shows that foreign firms barring those in medium-high technology segment have improved their performance during 1994-01 as compared to 1990-1993. The export intensity of medium-high technology foreign firms has decreased from 8 percent in 1990-93 to 7 percent in 1994-01. For medium-low technology foreign firms it has increased from a low of 5 percent in 1990-93 to 8 percent in 1994-01. The high technology and low technology foreign firms also displayed rising export intensities and they had exported about 2-percentage point higher in the post reform period than in the pre reform period.

**Figure-10 Export intensity of foreign firms across technology intensity**



The export intensity performance of domestic enterprises reveals the story similar to that observed in the case total manufacturing. Domestic firms in the low technology industries reportedly had highest export intensity at 15 percent, followed by 13 percent in high technology industries, 9 percent in medium-low technology industries, and 6 percent in medium-high technology over the period 1994-01. Between 1990-93 and 1994-01, the export intensity of low technology domestic firms had increased by an impressive 7-percentage point from 8 percent to 14 percent and by 6-percentage point from 7 percent to 13 percent in the case of high technology industries.

**Figure-11 Export intensity of domestic firms across technology intensity**



The above discussion suggests that firms operating in India irrespective of their nature of ownership had exhibited relatively higher export competitiveness in the low technology industries than in high technology industries. We can think of three major factors that can explain this low export competitiveness of Indian enterprises in high technology industries. Firstly, abundant cheap labor and scarce capital mark the resource endowment of the economy, which generally favor the production of low and medium technology manufactured goods rather than high technology products. Secondly, being a technology follower country Indian enterprises depends heavily on foreign technology from basic machinery to operating knowledge to required menu of intermediate inputs. In majority of cases the imports of foreign technology through technology contracts comes with export restriction along with many other limitations (UNCTC, 1984; Kumar, 1985). Further, as the source of knowledge lies with the enterprises in the advanced countries this foreign knowledge acquisition hardly helps developing country firms in improving their export competitiveness. Thirdly the access to and provision of general infrastructure services like, roads, ports, airports, power, communication facilities, etc are relatively limited in India as compared to developed countries.

### **4.3. Foreign versus Domestic Firms**

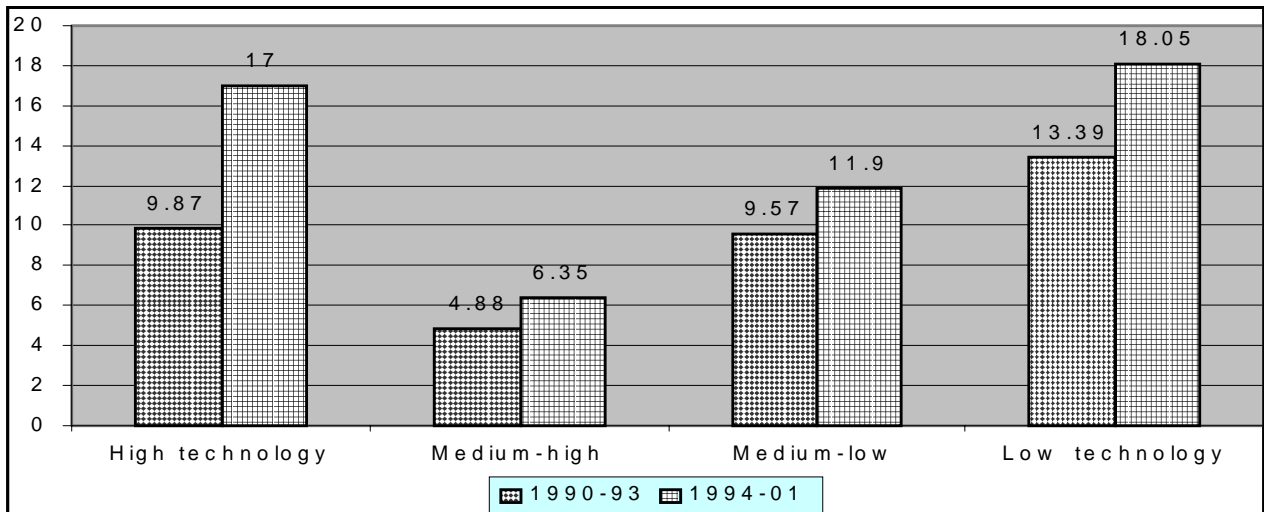
The literature on FDI generally placed foreign firms better in comparison to domestic firms with regard to export activity. The empirical findings on the export competitiveness of foreign and domestic firms, however, seems to contradict the above theoretical contention in the case of the high technology and low technology industries where foreign firms were observed to have shown consistently lower export performance than domestic firms. Over the period 1994-01 foreign enterprises had exported about 7 percent of their sales in high technology and medium-high technology industries each, 8 percent and 13 percent in medium-low and low technology manufactured goods industries respectively. The corresponding average export intensities of domestic firms were 13 percent, 6 percent, 9 percent and 15 percent respectively. Therefore, foreign firms had not performed better in high technology industries as compared to the performance of domestic firms in the post reform period.



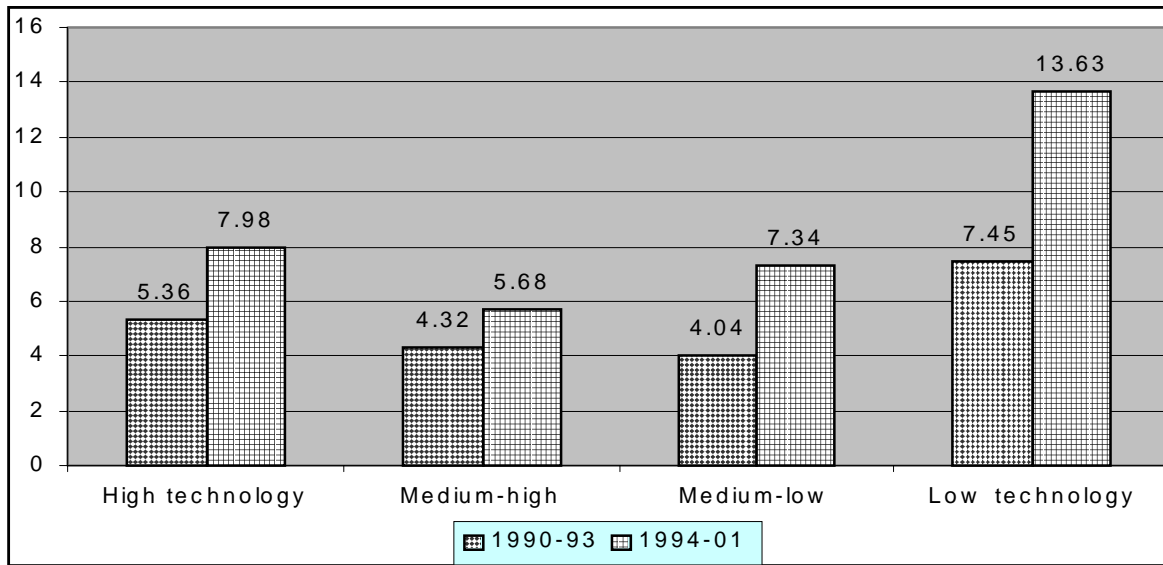
#### 4.4. Outward Investment and Export Competitiveness

The role of outward investment in the export competitiveness of knowledge-based industries is also observed to follow the same general pattern as obtained in the case of all firms, and domestic firms. Firms investing as well as not investing abroad have shown higher export intensity in the low and high technology industries as compared to the medium-high and medium-low technology industries. However, the firms investing abroad distinctly had higher export intensity than firms not investing across all the technology segments and both in pre and post-reform periods. For example, in the high technology industries outward-investing firms had exported about 17 percent of their turnover in 1994-01 as compared to 8 percent of firms not investing abroad. The export intensity ratio between these two groups of firms in medium-high, medium-low and low technology industries was estimated to be 6.4:5.7 percent, 12:7 percent and 18:14 per cent respectively. Hence, outward investment definitely helps firms in improvising their export performance vis-à-vis firms not investing abroad. The export intensity of both groups of firms are observed to be higher in the post reform period as compared to pre reform period. It is important to note that export intensity improvement is highest for outward investing firms in the case of high-technology segment (7-percentage point) whereas for firms not investing abroad the improvement is highest in case of low-technology segment (6-percentage point).

**Figure-12 Export intensity of outward investing firms across technology intensity**



**Figure-13 Export intensity of non-outward investing firms across technology intensity**



## 5. Conclusions

This paper has analyzed the trends and patterns of export competitiveness in Indian manufacturing in the 1990s with particular emphasis on the high-technology industries. In the global context it is found that high technology exports activity is highly concentrated in the industrialized countries. The contribution of developing countries towards global high technology exports is marginal and concentrated in a very few developing countries. As compared to China, India has performed poorly in the high technology markets. Further explorations suggest that the technology profile of Indian manufacturing has not changed significant technological shifts with three-fifth of MVA still contributed by low and medium-low technology industries.

Findings on firm level export competitiveness suggest that the implementation of economic reforms has had a favorable impact on the export orientation of Indian manufacturing firms. However much of this export improvement was due to rise in the export activity of domestic firms rather than foreign affiliates. The economic reforms have intensified competitive pressures and this seems to compelled domestic firms to enter into global markets. As compared to firms not undertaking outward direct investment, Indian firms having foreign affiliates have shown substantially better export performance. This suggests that foreign

presence is an important factor for achieving export success as it enhances the capability of exporting firms to ensure better after-sales services and interaction with global buyers.

The trends in export competitiveness vary significantly between different technology segments of Indian manufacturing. The low technology industries like food, textile, wood and paper still remain as the most important sources of export in the Indian manufacturing. The export intensity of high technology firms like pharmaceuticals and electronics stood second in the ranking based on export intensity while that of medium-high technology firms from chemicals, electrical machinery, non-electrical machinery and transport equipment stood last. The export intensity of medium-low technology firms from rubber, plastic, cement, metal, and other non-metallic products stood third in the ranking. The average export intensity of firms over different technology has been observed to be higher in the post-reform period as compared to pre-reform period.

By ownership, both the domestic and foreign firms have shown general pattern as observed in the case of total manufacturing. Firms irrespective of their ownership had shown higher export intensity in the case of low technology segment of manufacturing than in high technology segment. The country's resource endowment basically cheap labour favors the production of low technology industries. Another important finding is that domestic firms are more export dynamic than foreign firms in high technology industries, especially true in the post-reform period. This contradicts the general perception that foreign firms may be instrumental in achieving export success in high technology segment of world market. It may be the fact that the export decision and activity of foreign affiliates in Indian manufacturing is being restricted by their parents to ensure that the exports from India should not substitute exports from the home country and from affiliates in other locations. Here appropriate policy intervention is required so as to induce these MNE affiliates to use the country as an export platform rather than serving only the domestic market.

The outward investing manufacturing firms have shown substantial progress in the export competitiveness in high technology industries on account of economic reforms. On the other hand highest export intensity improvement of firms without outward investment is observed in the case of low technology segment. Therefore it suggests that outward investment is a strategic tools to achieve export competitiveness in general and in particular in high technology industries.

Finally, it should be noted that the above findings are based on mere comparison of export intensity between periods or groups without controlling for several extraneous factors. For example the export performance differential between foreign and domestic firms has not been adjusted to firm size, technology, advertising activities etc that characterized both these groups of firms. Therefore above findings needs to be viewed with above limitations. This limitation will be address in other papers that will follow the present one.

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## Appendix-A

**Table-10 Export intensity of Indian manufacturing firms in low technology, 1989-90 to 2000-01.**

| Year                | All Firms | Foreign Firms | Domestic Firms | Outward investing firms | Non-outward investors |
|---------------------|-----------|---------------|----------------|-------------------------|-----------------------|
| 1990                | 6.25      | 7.30          | 6.03           | 8.98                    | 5.65                  |
| 1991                | 6.74      | 8.38          | 6.40           | 11.02                   | 5.82                  |
| 1992                | 9.21      | 12.23         | 8.59           | 14.04                   | 7.78                  |
| 1993                | 10.98     | 13.78         | 10.37          | 16.00                   | 9.47                  |
| 1994                | 12.62     | 15.61         | 12.05          | 18.97                   | 10.57                 |
| 1995                | 13.58     | 15.45         | 13.28          | 19.10                   | 11.71                 |
| 1996                | 14.62     | 13.74         | 14.75          | 17.97                   | 13.36                 |
| 1997                | 16.22     | 13.89         | 16.60          | 19.33                   | 14.93                 |
| 1998                | 16.63     | 17.87         | 16.41          | 19.50                   | 15.44                 |
| 1999                | 15.16     | 11.76         | 15.78          | 16.73                   | 14.54                 |
| 2000                | 14.37     | 9.93          | 15.17          | 16.75                   | 13.38                 |
| 2001                | 14.67     | 9.83          | 15.60          | 17.37                   | 13.34                 |
| Period-wise average |           |               |                |                         |                       |
| 1990-93             | 8.69      | 11.00         | 8.21           | 13.39                   | 7.45                  |
| 1994-01             | 14.90     | 13.10         | 15.21          | 18.05                   | 13.63                 |

Source: Author's estimation based on RIS-DSIR database (2002)

Note: export-intensity is the weighted average of export intensity of firms weighted by respective sales.

**Table-11 Export intensity of Indian manufacturing firms in medium-low technology, 1989-90 to 2000-01.**

| Year                | All Firms | Foreign Firms | Domestic Firms | Outward investing firms | Non-outward investors |
|---------------------|-----------|---------------|----------------|-------------------------|-----------------------|
| 1990                | 4.23      | 5.40          | 4.22           | 7.10                    | 3.90                  |
| 1991                | 3.77      | 4.59          | 3.75           | 8.55                    | 3.16                  |
| 1992                | 4.32      | 4.81          | 4.32           | 9.46                    | 3.32                  |
| 1993                | 6.48      | 5.32          | 6.50           | 10.91                   | 5.45                  |
| 1994                | 8.21      | 6.21          | 8.25           | 13.99                   | 6.70                  |
| 1995                | 7.32      | 5.14          | 7.36           | 9.94                    | 6.46                  |
| 1996                | 8.27      | 4.28          | 8.34           | 12.58                   | 6.61                  |
| 1997                | 8.18      | 7.87          | 8.18           | 11.41                   | 6.87                  |
| 1998                | 9.43      | 7.99          | 9.46           | 12.57                   | 8.08                  |
| 1999                | 8.28      | 6.14          | 8.33           | 11.62                   | 6.83                  |
| 2000                | 9.35      | 9.16          | 9.35           | 12.29                   | 8.00                  |
| 2001                | 9.67      | 10.92         | 9.64           | 11.44                   | 8.65                  |
| Period-wise average |           |               |                |                         |                       |
| 1990-93             | 4.86      | 5.02          | 4.86           | 9.57                    | 4.04                  |
| 1994-01             | 8.69      | 7.66          | 8.72           | 11.90                   | 7.34                  |

Source: Author's estimation based on RIS-DSIR database (2002)

Note: export-intensity is the weighted average of export intensity of firms weighted by respective sales.

**Table-12 Export intensity of Indian manufacturing firms in medium-high-technology, 1989-90 to 2000-01.**

| Year                | All Firms | Foreign Firms | Domestic Firms | Outward investing firms | Non-outward investors |
|---------------------|-----------|---------------|----------------|-------------------------|-----------------------|
| 1990                | 3.63      | 7.48          | 2.99           | 3.86                    | 3.58                  |
| 1991                | 4.06      | 6.78          | 3.57           | 3.70                    | 4.14                  |
| 1992                | 4.53      | 8.72          | 3.79           | 4.88                    | 4.45                  |
| 1993                | 5.08      | 8.51          | 4.46           | 6.20                    | 4.81                  |
| 1994                | 5.56      | 7.94          | 5.10           | 6.72                    | 5.25                  |
| 1995                | 5.92      | 7.90          | 5.54           | 7.25                    | 5.51                  |
| 1996                | 5.78      | 7.27          | 5.46           | 7.23                    | 5.30                  |
| 1997                | 5.73      | 7.69          | 5.28           | 6.45                    | 5.43                  |
| 1998                | 5.98      | 7.15          | 5.72           | 6.65                    | 5.69                  |
| 1999                | 6.05      | 7.00          | 5.84           | 6.36                    | 5.92                  |
| 2000                | 5.66      | 7.20          | 5.27           | 5.32                    | 5.81                  |
| 2001                | 6.10      | 6.57          | 5.98           | 6.03                    | 6.13                  |
| Period-wise average |           |               |                |                         |                       |
| 1990-93             | 4.42      | 7.98          | 3.79           | 4.88                    | 4.32                  |
| 1994-01             | 5.87      | 7.23          | 5.55           | 6.35                    | 5.68                  |

Source: Author's estimation based on RIS-DSIR database (2002)

Note: export-intensity is the weighted average of export intensity of firms weighted by respective sales.

**Table-13 Export intensity of Indian manufacturing firms in high- technology, 1989-90 to 2000-01.**

| Year                | All Firms | Foreign Firms | Domestic Firms | Outward investing firms | Non-outward investors |
|---------------------|-----------|---------------|----------------|-------------------------|-----------------------|
| 1990                | 5.94      | 5.46          | 6.10           | 13.92                   | 4.99                  |
| 1991                | 5.34      | 5.30          | 5.36           | 16.00                   | 4.30                  |
| 1992                | 6.58      | 4.92          | 7.10           | 7.88                    | 6.30                  |
| 1993                | 6.14      | 2.86          | 7.11           | 8.35                    | 5.58                  |
| 1994                | 7.78      | 4.05          | 8.78           | 13.12                   | 6.18                  |
| 1995                | 8.94      | 5.33          | 9.86           | 15.93                   | 6.38                  |
| 1996                | 10.46     | 5.39          | 11.61          | 15.49                   | 7.84                  |
| 1997                | 12.16     | 6.94          | 13.37          | 17.76                   | 8.75                  |
| 1998                | 11.62     | 7.61          | 12.63          | 16.32                   | 8.52                  |
| 1999                | 11.80     | 6.45          | 13.27          | 15.42                   | 9.41                  |
| 2000                | 11.70     | 7.17          | 12.91          | 17.92                   | 7.06                  |
| 2001                | 13.56     | 9.65          | 14.31          | 19.20                   | 8.80                  |
| Period-wise average |           |               |                |                         |                       |
| 1990-93             | 6.05      | 4.47          | 6.54           | 9.87                    | 5.36                  |
| 1994-01             | 11.43     | 6.85          | 12.55          | 17.00                   | 7.98                  |

Source: Author's estimation based on RIS-DSIR database (2002)

Note: export-intensity is the weighted average of export intensity of firms weighted by respective sales.

### *Appendix B: The Dataset*

The dataset used in the present study has been drawn from **RIS-DSIR database** constructed from different sources at the Research and Information System for the Non-aligned and Other Developing Countries, as a part of the Department of Scientific and Industrial Research (DSIR) research project ‘A Strategic Approach to Strengthening the International Competitiveness in Knowledge-based Industries: Some Explorations into the Role of FDI Inflows, Outward Investments, and Enterprise Level Technological Effort in Promotion of India’s Knowledge Intensive Exports’. The dataset, which covers firm-level data on various financial variables like exports, imports, sales, R&D, outward investment, etc. of more than 500 Indian manufacturing companies, has been compiled from the *PROWESS database* (2002), the Ministry of Commerce, the Ministry of Finance, and the India Investment Centre.

### *Appendix C: Technological Classification of Indian Manufacturing Industry*

| <i>Technology category</i> | <i>Industry</i>  |
|----------------------------|--|
| Low technology             | 1. Food, beverages & tobacco products<br>2. Textile, leather & footwear<br>3. Wood, paper & paper products                     |
| Medium-low technology      | 4. Rubber & plastic products<br>5. Other non-metallic mineral products<br>6. Cement & glass<br>7. Basic metal & metal products |
| Medium-high technology     | 8. Chemicals excluding pharmaceuticals<br>9. Electrical machinery<br>10. Non-electrical machinery<br>11. Transport equipments  |
| High technology            | 12. Pharmaceuticals<br>13. Electronics   |

Note: The above technological classification is based on OECD (2001) ‘OECD Science, Technology and Industry Scoreboard, 2001’