

**CHANGING PATTERN OF INDIA'S HIGH TECHNOLOGY EXPORTS:
A STUDY OF COMPETITIVENESS OF PHARMACEUTICAL PRODUCTS**

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ABSTRACT

Export earnings of India have increased substantially over the years. For active participation in the global trading system export diversification is essential. Export diversification plays a main part in the economic growth of the developing countries. These countries try to improve place at the global level by increase its exports by exporting high technology products. India is no exception to this. The present study makes trying to look at the strength of pharmaceutical exports in India's high technology exports with the US and Russian Federation with the help of different indices like Revealed Comparative Advantage (RCA), Revealed Symmetric Comparative Advantage (RSCA) and Intra-Industry Trade (IIT) during 1991-2012. The empirical result of the study revealed that India has the maximum comparative advantage in pharmaceutical products with the US and Russian Federation. Further, the result of the study also highlights the positive impact of TRIPS on India's pharmaceutical exports. The study also finds that domestic companies are more R and D oriented than foreign companies. For India to become a top player in the international business of pharmaceutical sector, the government of India needs to sustain foreign investments in pharmaceuticals sector so that it would help to meet the practical knowledge and to generate employment.

KEYWORDS: High Technology, TRIPS, Patent, WTO and R&D

INTRODUCTION

Since the 1960s export promotion becomes the part of economic growth in many countries. For the growth of agriculture, industrial sector and easing the balance of payment situation diversification of exports is required. The pattern of economic development is related to structural changes in exports and expansion of export diversification worldwide. Developing countries realized that dependency on exports of primary products would hinder their development process. As a result, these countries shifted from low technology exports to medium and high technology exports (Samen, 2010). In spite of whether countries produce primary products or manufactured goods, it is the compatibility with world demand that

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will determine the growth of country (Ismail, 2013). The picture of global maps of exports has changed much with the influx of high technology product from the developing countries. The remarkable change in the export pattern has led economists to question whether the achievement of high technology exports from developing countries is real or just a 'statistical illusion' (Srholec, 2010). It is an active signal that the emerging economies are actively involved in the global value chain and compete with the developed countries (Fu et. al., 2010). The trade of high technology goods provides information about the overall competitiveness and place of an economy within the global technology market (Tebaldi, 2011). For instance, Falk (2009) most of the developed countries are not participating in the export of high technology products due to the technological gap. At the one end of the spectrum are Korea and Singapore, which have the ability to design, manufacture and export high technology items. Malaysia is somewhere in the middle while Thailand and Philippines seem to be at the other end with the low capability (Mani and Romijin, 2004). Like other countries, India's export growth is also associated with economic growth. To put its economy on a path of rapid and sustained growth, India embarked on a process of economic reform and continuous integration with the global economy in 1991 (Batra and Khan, 2005). The main purpose to launch the goal of economic reforms is that it would help to reach the new technology (Pohit and Basu, 2012). Although, India is progressing on the path of development, yet its export shares in the global market are still small, with a modest increase in export of medium and high- technology products (Nayak et. al., 2013). According to World Development- Indicators 2011, compiled by the World Bank, India's high technology exports were 6.87 per cent of its manufactured exports compared to 9.72 percent in the case of Brazil, 25.81 percent in the case of China, 31.4 percent in the case of Israel & Japan and 43.39 and 45.16 percent in the case of Malaysia and Singapore (WDI, 2011). Some of the areas where India is making an impact are computer software, automobiles, and pharmaceuticals.

According to Euro Statistics (2011), the high-tech product list, based on the calculations of R&D intensity by groups of product (R&D expenditure/total sales) involves highly skilled workers, advanced technology, and high cost. The products are divided into nine categories, namely Aerospace, Computers/Office Machine, Electronic-telecommunications, Pharmacy, Scientific Instruments, Electrical Machinery, Chemistry, Nonelectrical Machinery, and Armament. Organization for Economic Cooperation and Development (OECD, 2005) has developed a four-way classification-high technology, medium technology, low-medium technology and low technology. The classification is based on the expenditure on research and development on the gross output and value added of different types of industries that produce goods for exports India's pharmaceutical industry is one of the fastest growing segments of the Indian economy with an average annual growth rate of 14 percent during 2002-2005 (Green, 2007). The Pharmaceutical industry grew from mere US\$ 0.3 billion turnovers in 1980 to about US\$ 21.73 billion in 2009-10. The country ranks 3rd regarding the volume of production and 14th largest by value (Greece, 2007).

Objectives of the Study

1. To study the trends and growth of India's high technology exports with the rest of the world since liberalization.
2. To study the composition and direction of high technology exports of pharmacy products of India with her two among the top export partners over the period of 1991 to 2012.
3. To analyze the Indian competitiveness and intra-industry trade of pharmaceutical products with her top two partners.
4. To study the issues of TRIPS with respect to India's pharmaceuticals exports.

DATA AND METHODOLOGY

This section deals with different sources of data and methodology used in the study for analyzing the India's high technology exports of Pharmaceutical products with USA and Russian Federation.

Data Base

The study mainly covers the period of 12 years, i.e. 1991 to 2012. Keeping in mind the nature of study, secondary data have been taken from the following different sources:

1. Data for India high technology export performance have been collected from WITS for 1991-2013.
2. Data for different indices like Revealed Comparative Advantage, Revealed Symmetric Comparative Advantage and Grubel-Lloyd (G-L) index have been collected from WITS database.
3. Data related to R&D expenditure and export for different Indian companies has been selected from Prowess database published by Centre for Monitoring Indian Economy.

Methodology

Various trade indices have been calculated to assess the India's performance of pharmaceutical exports with her top two exporting partners.

Export Competitiveness

The degree of export specialization of India with the USA and Russian federation is calculated with the help of two indices, i.e. Balassa's Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) for the average of five years i.e. 1991-1995, 1996-2000, 2001-2005, 2006-2010 and 2006-2012 for pharmaceutical products.

Revealed Comparative Advantage Index

Balassa's index (1965) of revealed comparative advantage (RCA) has been used to assess a country's export potential. A variation of his formula was further interpreted by Donges and Riedel (1977); Browen (1983) and Vollrath (1991). The RCA indicates whether a country is in the process of extending the products in which it has export potential, as opposed to the situation in which the number of products that can have trade prospects with new partners. Countries with similar RCA profiles are unlikely to have high respective trade intensities unless intra-industry trade is involved. RCA measures, if estimated at high levels of product disaggregation, can focus attention on the other non-traditional products that might be successfully exported. The RCA index of the country i for the product j is often measured by the product's share in the country's exports in relation to its share in the world exports:

$$RCA_{ij} = (X_{ij}/X_{it}) / (X_{wj}/X_{wt})$$

Where X_{ij} and X_{wj} are the values of country's exports of product j and world exports of product j and where X_{it} and X_{wt} refer to the country's total exports and total world exports. A value of less than unity implies that the country has a revealed comparative disadvantage in the product. Similarly, if the index exceeds unity, the country is said to have a revealed comparative advantage in the product. If the value is equal to one, the country's specialization in a commodity is identical with the world specializing in that commodity (Balassa and Bauman, 1985). In the present study, RCA has been calculated for Indian pharmaceutical exports to USA and Russia Federation.

$$RCA_{ij} = (X_{ijb}/X_{itb}) / (X_{wjk}/X_{wt})$$

Where,

RCA_{ijb} - India's RCA in USA/Russia

X_{ijb} - India's exports of commodity j to USA/Russia

X_{itb} - Total exports of India to USA/Russia

X_{wjk} - World's exports of commodity j to USA/Russia

X_{wtk} - Total exports of world to USA/Russia

RCA suffers from the problem of asymmetry as the 'pure' RCA is basically not comparable on both sides of unity. A country is said to be under-specialized in a given sector if the values of index ranges from zero to one; while the value of the index ranges from one to infinity, if the country is specialized in that particular sector (Burange and Chanda, 2008). Dalum et al. (1998) recommended a methodology to make the index symmetric, and the new index is called 'revealed symmetric comparative advantage' (RSCA). Mathematically, it is:

$$RSCA = (RCA - 1) / (RCA + 1)$$

The range of value lies between -1 and +1. Commodity is said to have a comparative advantage in its exports if the RSCA value is positive and vice versa.

Intra – Industry Trade (IIT)

Intra-industry trade arises if a country, in the same period, imports and exports similar types of goods or services. Similarity means goods or services taken from the same sector/industry. IIT allows a country to take advantage of larger markets. Most commonly used index to measure the IIT is Grubel- Lloyd (G-L) index. G-L Index computes the ratio of net exports in a commodity category to its total trade, i.e.

$$IIT_j = 1 - \{ |X_{ij} - M_{ij}| / (X_{ij} + M_{ij}) \}$$

Where, X_{ij} and M_{ij} are country j 's exports and imports of industry i respectively. $IIT_j = 1$ if trade in all industries is intra-industry (i.e. $X_{ij} = M_{ij}$ for all i) and $IIT_j = 0$ if trade in all industries is inter-industry (i.e. either $X_j = 0$ or $M_j = 0$ for all i). As Grubel and Lloyd (1975) point out, this measurement of IIT will be affected by the size of the overall trade imbalance of the country. The greater the imbalance, the more significant will be the share of net trade and smaller share of IIT (Bruhart, 1995; Stone and Lee, 1995). IIT is driven by economies of scale and commodity gains. By being engaged in IIT, a country can reduce the number of similar products it produces and benefit from scale economies and specialization. A higher IIT value suggests that these sources of gains are being exploited. It also indicates that the adjustment cost would be lower when compared to inter-industry trade in the process of trade expansion. It is based on the Grubel-Lloyd (G-L) formula; G-L index for bilateral trade is used to find out the inter-industry trade between India and USA and Russian Federation. It is a modified form used by Sahoo et al., (2009). The formula is:

$$GL_i = 1 - \{ |X_{ij} - M_{ji}| / (X_{ij} + M_{ji}) \}$$

Where, GL_i - G-L Index for India-USA and India Russian Federation Bilateral Trade; X_{ij} -Exports of India's pharmaceutical product to USA and Russian Federation; M_{ji} - Imports of India's pharmaceutical product from USA and Russian Federation; Compound Growth Rate: To calculate the compound growth rate for different indicators used in the study, the following formula has been used is $Y = AB^t$. Where A and B are parameters, Y is the dependent variable, and t is time variable. The compound growth rate is equal to the estimated value of B , the compound growth rate is equal to $(\hat{B} - 1) \times 100$. \hat{B} is estimated value of B . Selection of Indian Companies: Indian companies have been selected to compare the R and D expenditure and their exports from Prowess database. There are nearly 5000 manufacturing firms in Bombay Stock Exchange (BSE) which are filtered on the basis of two steps, first we excluded those companies which have zero or less than zero sales during any year of study period, secondly, there is the exclusion of all those firms which have nil foreign equity in any year of study period.

GROWTH AND PERFORMANCE OF INDIA'S HIGH TECHNOLOGY EXPORTS

Table 1 depicts the growth and share of different components of India's high technology exports to the World for the period of 1991 to 2012. The average percentage share of pharmacy i.e. 34.92

percent seem to be the highest, followed by chemistry (30.51 percent), computer office machines (12.10 percent), aerospace (6.31 percent), scientific instruments (5.57 percent), electronics tele-com's (4.36 percent), non- electrical machinery (4.15 percent), electrical machinery (1.87 percent) and armaments (0.22 percent) during the whole study period. The compound growth rate in aerospace is found to be highest with 12.66 percent followed by armaments (12.59 percent), scientific instruments (12.02 percent), pharmacy (11.78 percent), electrical machinery (11.66 percent), non electrical machinery (11.54 percent), electronics tele-com's (11.16 percent), chemistry (11.07 percent) and computer office machines (10.91 percent) during the study period. From the above description of the Table 1, pharmaceutical products seem to be most important in terms of value as well as size.

Table 2 depicts the direction and volume of India's pharmaceutical exports with its top ten exporting countries. United Kingdom seems to have the lowest variations in imports of India's pharma products. On the other hand, the increasing share of USA in India's pharma products reflects the better trade relations of USA with India. Thus, it is evident that USA is the top most exporting destinations of India's pharmaceutical exports followed by Russian Federation with an average share of 30.30 percent and 17.5 percent respectively, in total exports since 1991 till 2012.

Table 3 shows the India's exports of pharmaceutical products to the USA for the period of 1991 to 2012. The compound growth rate is the highest of product 'Insulin retail pack' followed by 'Cortisone derivatives', 'Streptomycin's and their derivatives', 'Other hormones non retail', 'Insulin formulated and bulk', 'Antibiotics n.e.s retail', 'Penicillin/Strept retail' and 'Antibiotics n.e.s non retail'. Their compound growth rates found to be 19.06 percent, 18.42 percent, 16.60 percent, 15.93 percent, 15.49 percent, 14.82 percent, 14.60 percent and 13.61 percent respectively. The average share is the highest of product 'Antibiotics n.e.s retail' (33.40 percent) followed by 'Penicillin/strept retail' (19.00 percent), 'Other antibiotics, bulk' (8.76 percent) 'Other hormones non retail' (7.35 percent), 'Antibiotics n.e.s non retail' (6.61). These are important commodities in India's exports to USA throughout the period.

Table 4 portrays the India's import values of pharmaceutical products from USA for the period of 1991 to 2012. The overall compound growth rate is found to be greater for 'Pencillines/Strept retail' with 14.26 percent, followed by 'Hormone n.e.s retail pack' (14.13 percent), 'Antibiotics n.e.s non retail' (12.94 percent annual growth) and 'Glycosides and derivatives' (12.90), 'Insulin and salts' (12.29), 'Insulin retail pack' (11.91), 'Blood/Toxin/Cultures' (11.54) and 'Hormone n.e.s retail pack' (11.30) during 1991 to 2012. This shows the changing important pattern of India pharmaceutical products from USA.

Table 5 shows the India's exports of pharmaceutical products to the Russian Federation (US\$ thousand) from 1992 to 2012. The highest compound growth rate of exports is found for

'Antisera/blood fracture/vaccine' (13.38) followed by 'Blood/Toxin/Cultures' i.e. (13.15), 'Glands etc. and extracts' (12.26), 'Streptomycin's and derivatives' (12.04), 'Glycosides and derivatives' (11.91), 'Hormones ach retail pack' (11.87) and 'Penicillin/strept retail' (11.73). The average share of exports is the highest of 'Antibiotics n.e.s retail' (26.00 percent) followed by 'Antisera/blood fracture/vaccine' (19.18 percent), 'Hormone n.e.s retail pack' (14.48 percent), 'Insulin retail pack' (13.28 percent), 'Hormones ach retail pack' (8.52 percent), 'Penicillin/strept retail' (5.13 percent) and 'Blood/Toxin/Cultures' (4.46 percent). Hence it is concluded from the table that India's exports of pharma products are increasing, however the highest exports are of 'Antisera/Blood fracture/Vaccine'.

Table 6 depicts India's imports of pharmaceutical products from Russia Federation during 1992 to 2012. The Compound Growth rate of Indian pharmaceutical imports from Russian Federation has been found the highest for 'Glands etc. and extracts' (26.93) followed by 'blood/toxin/cultures' (11.98) and 'Other antibiotics, (bulk)' (10.77). The average share of imports is the highest of 'Other antibiotics, (bulk)' (49.69 percent) followed by 'Pencillines and derivatives' (29.27 percent) and 'Glands etc. and extracts' (20.04 percent). And others have a very less average share in imports. 'Blood/Toxin/Cultures', 'Antibiotics n.e.s retail', 'Insulin formulated, bulk', 'Other hormones non retail', 'Insulin retail pack' and 'Hormone n.e.s retail pack' have specialization and their imports are less as compared to 'Pencillines and derivatives', 'Other antibiotics (bulk)' and 'Glands etc. and derivatives' respectively. It is clear from the above analysis that greater RSCA value with Russian Federation has been in the 'Pencillines and derivatives', 'Penicillin non retail', 'Antibiotics n.e.s non retail', 'Antibiotic n.e.s retail' and 'Other hormones non retail' throughout the study period.

TRADE COMPETITIVENESS OF INDIA WITH THE USA AND RUSSIAN FEDERATION

Table 7 showed India's Revealed Comparative Advantage and revealed the symmetric comparative advantage in Pharmaceutical products with the United States of America and Russian Federation for the average of five years i.e. 1991-1995, 1996-2000, 2001-2005, 2006-2010 and 2006-2012 for pharmaceutical products.

During 1991-1995, among 21 pharmaceutical products, India has the greatest RCA and RSCA with the USA in 'Insulin and Its Salts' (12.73 percent). During 1996-2000, the highest RCA of India with USA is found for Insulin formulated bulk (46.15 percent). Similarly, during the 2001-2005 'Other hormones nonretail' have the highest revealed comparative advantage. During 2006-10, India has registered significant extent of competitive advantage for 'Insulin formulated bulk' i.e. 50.10 which is increased by 1.01 percent in 2006-12. It is clear that India has a greater power for 'Insulin formulated bulk' followed by 'Penicillin nonretail' and 'other hormones nonretail' throughout 2000-2012. The Table also shows India's Revealed Comparative Advantage and

RSCA in Pharmacy Sector with Russian Federation. In 1992-1995, India had greater RCA with Russian Federation in 'Insulin formulated. Highest comparative advantage has accounted in 'Other hormones nonretail' (189.58) in the 2006-2010. While in 2006-2012, India again registered significant extent of competitive advantage for 'Other hormones nonretail'. From the above description of Table 7, highest comparative advantage of India with Russian Federation is in the 'Insulin formulated bulk' during 1992-2005.

Intra-Industry Trade Index (IIT)

Table 8 highlight values of intra-industry trade measured by the GL index between India and USA, India and Russian Federation for the average of 1991-1995, 1996 -2000, 2001-2005 and 2006- 2012. During 1991-1995, the level of intra-industry trade shows that it is the highest for 'Hormones n.e.s retail pack'. 'In 2006-2012, it is found to be highest for 'other antibiotics (bulk).' During 1992-1995, intra-industry trade between India and Russia Federation is found zero for other hormones/devices, etc., glands, etc. and extracts, Antibiotic n.e.s retail, retail insulin pack, other hormones nonretail and hormone n.e.s retail pack as for these commodities India does not depend on Russia. It is found to be the highest for 'Pencil lines and derivatives.' During 2006-2012 largest intra-industry trade between India and Russian Federation is found in 'Other Antibiotic bulk.'

TRIPS ISSUES AND INDIAN PHARMACEUTICAL EXPORTS

India has a competitive strength in the export of pharmaceutical products which is one of the categories of the high technology sector. Due to many factors, such as an increase in their production, their low prices at the international market, an increase in their R&D expenditure, etc. India has a unique position in the pharmaceutical industry in the world as especially in the production of generic medicines, which offer drugs at lower prices. For all this, credit goes to the India Patents Act that of 1970 (Deolalikar & Evenson, 1989). The pharmaceutical industry is one of the world's most research-intensive industries, which is making enormous contributions to health care. To offer incentives to innovators to undertake research, many countries, especially the developed ones a tradition of strong patent protection. The patent system has become more prevalent after the establishment of Trade-Related Intellectual Property Rights (TRIPS). The Agreement of the World Trade Organization (WTO), made it compulsory for WTO members to include drugs/medicines in their regime for product and process patents (Nair, 2008). India signed the TRIPS Agreement in April 1994. In March 2005, India fulfilled the amendment of the Patent Act of 1970 to meet the terms of the TRIPS Agreement. It introduced product patents for drugs, foods, and chemical product. An immediate consequence of the TRIPS agreement was to be a sharp increase in the prices of invented drugs (Ramani & Maria, 2005). After 2005, India's leading pharmaceutical companies recognized that if they want to survive as global players they require R&D capabilities. On the other side pharmaceutical companies also work at lower profit

margins than their western counterparts. Traditionally, the majority of India's pharmaceutical R&D spending was concentrated on reverse engineering. To comply with the WTO's TRIPS agreement, India has reintroduced product patent protection in pharmaceuticals from 1st January 2005. As a result the most important Indian pharmaceutical company is focusing on R&D. Many MNCs began re-entering the Indian pharmaceutical market by setting up their manufacturing and R&D facilities (Correa, 2000). R&D expenditure and R&D intensity of Indian domestic companies is higher as compared to foreign firms. Since, the TRIPS Agreement, it has increased not only in the Indian domestic companies, but also of Indian foreign companies but not in great extent. After the implementation of TRIPS in India, foreign pharmaceutical companies are putting less investment in Indian Pharma Industry due to two reasons. Firstly, they are not much confident about the returns and profits. Secondly, they are getting no incentives for development of Indian R&D and train Indian people with the high-tech knowledge or are pretentious about their R&D activities based in India. Therefore, R&D intensity could not grow faster. The result of all other firms revealed that with an increase in the intensity of R&D of the firms, export performance of these companies has also increased such as Cipla Ltd., Merck Ltd., Mylan Laboratories Ltd. and Biocon Ltd. Export performance of Cipla Ltd., Merck Ltd., Mylan Laboratories Ltd. and Biocon Ltd. also has gone up during the same period proportional to the R&D intensity. Since TRIPS enforcement in India, firms have started to spend more money on R and D. This is evident from Table 9 that companies like Cipla Ltd. and Biocon Ltd are not investing in Rand D till 2004, but since 2005, their intensity sharply increased. Highest average share in R & D intensity during 2000- 2012 is found for Ranbaxy. The average share of exports is also higher for Indian Ranbaxy Laboratories.

Table 1: India's High Technology* Exports with World (US\$ Thousands)

Year	Computer office Machines	Scientific Instruments	Aerospace	Electronics Telecom's	Chemistry	Non Electrical Machinery	Armaments	Electrical Machinery	Pharmacy
1991	60443.978 (10.8)	26506.96 (4.77)	18274.01 (3.29)	25103.65 (4.52)	223272.1 (40.22)	27977.082 (5.04)	180.572 (0.03)	42248.5 (7.61)	131142.43 (23.62)
1992	70802.705 (11.68)	20514.59 (3.39)	11603.75 (1.91)	49074.19 (8.10)	281444.1 (46.45)	23233.443 (3.83)	1054.75 (0.17)	11559.361 (1.91)	136669.23 (22.55)
1993	111017.25 (15.89)	23999.94 (3.44)	23945.25 (3.43)	36781.41 (5.27)	291039.7 (41.66)	38060.447 (5.45)	674.494 (0.10)	9817.241 (1.41)	163223.71 (23.37)
1994	150479.176 (17.47)	28400.57 (3.30)	13365.99 (1.55)	20602.83 (2.39)	366789.8 (42.58)	26258.005 (3.05)	409.521 (0.05)	10018.582 (1.16)	245080.06 (28.45)
1995	217242.911 (18.18)	30743.33 (2.57)	10057.6 (0.84)	229700.06 (19.22)	340698.9 (28.51)	288363.113 (2.37)	324.507 (0.03)	13865.273 (0.65)	323828.56 (27.10)
1996	283565.916 (23.45)	49420.04 (4.09)	19229.04 (1.59)	27240.57 (2.25)	427611.1 (35.36)	32776.541 (2.71)	1006.055 (0.08)	7849.234 (0.89)	360752.47 (29.83)
1997	252266.247 (19.03)	46015.14 (3.47)	56506.25 (4.26)	38925.69 (2.94)	458923.5 (34.61)	47331.342 (3.57)	3880.942 (0.29)	11810.55 (1.32)	410209.55 (30.94)
1998	65087.905 (6.46)	52774.61 (5.24)	19278.61 (1.91)	39057.91 (3.88)	367419.9 (36.47)	45253.099 (4.49)	472.145 (0.05)	13299.978 (1.50)	404926.88 (40.19)
1999	118439.239 (9.76)	65662.51 (5.41)	43971.1 (3.62)	31028.36 (2.56)	425650.2 (35.06)	42585.918 (3.51)	1002.419 (0.08)	18232.041 (1.02)	467326.52 (38.50)
2000	196125.712 (13.02)	86557.16 (5.75)	62724.9 (4.16)	26845.8 (1.78)	499229.4 (33.14)	49112.421 (3.26)	1461.437 (0.10)	15382.631 (1.25)	568824.9 (37.76)
2001	348658.33 (19.19)	104332.1 (5.74)	98981.48 (5.45)	47008.2 (2.59)	467308.4 (25.72)	78487.791 (4.32)	7510.876 (0.41)	22696.348 (1.25)	641650.51 (35.32)
2002	262653.762 (13.80)	100469.9 (5.28)	118620.5 (6.23)	55638.06 (2.92)	507754.4 (26.68)	93821.463 (4.93)	2613.573 (0.14)	23885.465 (1.43)	737807.92 (38.77)
2003	339178.997 (15.05)	116103.8 (5.15)	103458.4 (4.59)	59907.22 (2.66)	601916.4 (26.71)	93437.602 (4.15)	4337.743 (0.19)	32121.099 (1.38)	902823.58 (40.07)
2004	387150.935 (15.19)	17926.1 (0.70)	107014.3 (4.20)	108061.9 (4.24)	747094.1 (29.30)	130894.787 (5.13)	4628.053 (0.18)	35234.483 (1.43)	1011378.4 (39.67)
2005	385087.128 (11.58)	217214.5 (6.53)	136555.6 (4.11)	170172.4 (5.12)	1002699 (30.14)	210659.368 (6.33)	929.327 (0.03)	58205.066 (1.38)	1144836 (34.42)
2006	407037.056 (10.66)	274318.4 (7.18)	87840.19 (2.30)	119344.2 (3.12)	1156211 (30.27)	142541.634 (3.73)	5257.408 (0.14)	93103.112 (1.75)	1534071.2 (40.16)
2007	346905.687 (6.79)	354951.7 (6.94)	441440.3 (8.63)	158519.2 (3.10)	1297377 (25.38)	209102.65 (4.09)	4320.827 (0.08)	85649.333 (2.44)	2214139.8 (43.31)
2008	354813.511 (4.63)	471756.8 (6.15)	1726497 (22.52)	335957.5 (4.36)	1573699 (20.53)	383090.719 (5.00)	43528.586 (0.57)	109302.257 (1.68)	2669985 (34.83)
2009	415324.201 (6.59)	608021.9 (9.64)	398957.8 (6.33)	412857.5 (6.55)	1205003 (19.11)	364678.558 (5.78)	44312.978 (0.70)	146754.35 (1.43)	2709212.4 (42.97)

2010	467178.974 (5.90)	610025.4 (7.70)	1806676 (22.81)	41827.9 (0.53)	1706469 (21.55)	368224.701 (4.65)	11659.119 (0.15)	174488.064 (2.20)	2732334 (34.50)
2011	511383.388 (5.92)	852026.1 (9.86)	467985.9 (5.42)	385970.1 (4.47)	1959916 (22.68)	298214.155 (3.45)	75804.839 (0.88)	261034.607 (3.02)	3827988.1 (44.30)
2012	494401.995 (4.99)	1018081 (10.28)	1939925 (19.59)	332199.4 (3.36)	1886630 (19.06)	233228.452 (2.36)	35234.872 (0.36)	233157.536 (2.36)	3727534 (37.65)
CGR	10.91	12.02	12.66	11.16	11.07	11.54	12.59	11.66	11.78
Average share (1991-2012)	12.10	5.57	6.31	4.36	30.51	4.15	0.22	1.87	34.92

Source: Calculated from WITS, 2012,

Note: Details classifications of high technology product is in APPENDIX A

Table 2: Direction of India's Pharmaceutical Exports with Top Ten Countries (US\$ Thousands)

Year	United States	Russian Federation	United Kingdom	Nigeria	Germany	South Africa	Brazil	Vietnam	Ukraine	Netherlands
1991	27116 (21.86)	-	12624 (10.18)	17653 (14.23)	57926 (46.7)	1 (0.00)	512 (0.41)	985 (0.79)	-	7219 (5.82)
1992	25603 (12.24)	49761 (23.8)	13982 (6.69)	34067 (16.29)	69513 (33.25)	860 (0.41)	597 (0.29)	1577 (0.75)	-	13131 (6.28)
1993	36814 (14.76)	84508 (33.89)	12958 (5.20)	27426 (11.00)	55153 (22.12)	2667 (1.07)	3994 (1.60)	5422 (2.17)	5620 (2.25)	14784 (5.93)
1994	40119 (13.75)	84981 (29.09)	13406 (4.59)	26546 (9.09)	65069 (22.27)	4484 (1.53)	2268 (0.78)	21297 (7.29)	7914 (2.71)	26050 (8.92)
1995	56095 (16.53)	86292 (25.43)	19072 (5.62)	34787 (10.25)	66556 (19.61)	6032 (1.78)	3353 (0.99)	25328 (7.46)	7722 (2.28)	34089 (10.05)
1996	69368 (18.32)	106803 (28.21)	23086 (6.10)	34269 (9.05)	60357 (15.94)	8230 (2.17)	7067 (1.87)	27829 (7.35)	9510 (2.51)	32052 (8.47)
1997	79528 (19.06)	99910 (23.94)	38192 (9.15)	39947 (9.57)	60936 (14.60)	10947 (2.62)	10787 (2.59)	25719 (6.16)	16758 (4.02)	34535 (8.28)
1998	91166 (26.42)	43289 (12.55)	24599 (7.13)	48184 (13.96)	41952 (12.16)	9329 (2.70)	14920 (4.32)	33594 (9.74)	7419 (2.15)	30594 (8.87)
1999	82918 (19.26)	109313 (25.39)	24975 (5.80)	63220 (14.68)	38182 (8.87)	11842 (2.75)	19095 (4.44)	33296 (7.73)	12212 (2.84)	35473 (8.24)
2000	84828 (18.88)	93660 (20.85)	25022 (5.57)	71628 (15.94)	46478 (10.35)	14140 (3.15)	28735 (6.40)	34150 (7.60)	19296 (4.30)	31286 (6.96)
2001	173642 (30.01)	105378 (18.22)	31393 (5.43)	72381 (12.51)	50218 (8.68)	14352 (2.48)	41728 (7.21)	40273 (6.96)	27688 (4.79)	21467 (3.71)

Continued...

2002	207538 (30.17)	97152 (14.13)	52115 (7.58)	73835 (10.74)	65272 (9.49)	20171 (2.93)	57483 (8.36)	47180 (6.86)	28368 (4.12)	38683 (5.62)
2003	338467 (39.23)	126717 (14.69)	61612 (7.14)	73466 (8.52)	64498 (7.48)	24782 (2.87)	45451 (5.27)	53011 (6.14)	37930 (4.40)	36829 (4.27)
2004	352427 (35.33)	152741 (15.31)	86955 (8.72)	92514 (9.27)	64181 (6.43)	37479 (3.76)	59887 (6.00)	52371 (5.25)	65710 (6.59)	33309 (3.34)
2005	309256 (26.46)	213262 (18.25)	132362 (11.33)	110339 (9.44)	83149 (7.11)	50493 (4.32)	74524 (6.38)	64098 (5.48)	84279 (7.21)	46987 (4.02)
2006	497561 (32.72)	274882 (18.08)	130523 (8.58)	132930 (8.74)	80345 (5.28)	70836 (4.66)	108038 (7.10)	74252 (4.88)	105516 (6.94)	45758 (3.01)
2007	902080 (41.68)	279680 (12.92)	195767 (9.05)	142952 (6.61)	143122 (6.61)	111604 (5.16)	112940 (5.22)	99069 (4.58)	118693 (5.48)	58209 (2.69)
2008	1037176 (39.49)	340272 (12.96)	210115 (8.00)	204573 (7.79)	132221 (5.03)	197179 (7.51)	164153 (6.25)	106002 (4.04)	150743 (5.74)	83891 (3.19)
2009	1320730 (46.94)	265978 (9.45)	251418 (8.94)	180602 (6.42)	126908 (4.51)	193522 (6.88)	157105 (5.58)	122260 (4.35)	107984 (3.84)	87178 (3.10)
2010	1812120 (50.60)	296240 (8.27)	308383 (8.61)	193950 (5.42)	187132 (5.23)	257183 (7.18)	143994 (4.02)	123956 (3.46)	122879 (3.43)	135640 (3.79)
2011	2485558 (50.87)	534018 (10.93)	401347 (8.21)	277732 (5.68)	225899 (4.62)	318903 (6.53)	157038 (3.21)	167988 (3.44)	132267 (2.71)	185449 (3.80)
2012	3137276 (55.79)	490932 (8.73)	395117 (7.03)	287755 (5.12)	269031 (4.78)	315593 (5.61)	203849 (3.63)	174953 (3.11)	165268 (2.94)	183165 (3.26)
CGR	12.59	11.1	11.99	11.31	10.67	14.24	13.09	12.03	12.16	11.19
Average Share(1991-2015)	30.02	17.5	7.48	10.02	12.78	3.55	4.18	5.26	3.66	5.53

Source: Calculated from World integrated Trade Solution (WITS), 2012.

Note: Ukraine imports from India's pharmaceutical products started in 1993 before that a referendum on the act of declaration of independence was held in Ukraine on 1st December 1991.

Table 3: India's Pharmaceutical Exports to USA (US\$ Thousands)

Year\ commodity codes→	54131	54132	54133	54139	54151	54152	54153	54159	54161	54162	54163	54164	54211	54212	54213	54219	54221	54222	54223	54224	54229
1991	-	-	-	190 (17.6)	-	-	-	171 (1.58)	-	6 (0.56)	66 (6.12)	92 (8.53)	5 (0.46)	39 (3.61)	626 (58.02)	17 (1.58)	-	10 (0.93)	11 (1.02)	-	-
1992	60 (5.45)	-	-	28 (2.55)	-	-	-	-	-	-	-	94 (8.55)	6 (0.55)	-	449 (40.82)	346 (31.45)	-	-	20 (1.82)	-	97 (8.82)
1993	219 (10.3)	-	-	426 (20.2)	35 (1.66)	-	-	-	-	-	-	237 (11.24)	6 (0.28)	-	464 (22.00)	461 (21.86)	-	-	-	-	261 (12.3)

1994	109 (2.34)	-	-	426 (9.14)	18 (0.39)	-	-	-	24 (0.51)	205 (4.40)	261 (5.60)	24 (0.51)	718 (15.40)	1485 (31.86)	1019 (21.86)	-	104 (2.23)	-	268 (5.75)	
1995	653 (9.22)	-	-	813 (11.4)	-	-	28 (0.40)	-	209 (2.95)	566 (7.99)	289 (4.08)	27 (0.28)	378 (5.33)	2504 (35.34)	1489 (21.01)	-	81 (1.14)	49 (0.69)	-	
1996	1175 (12.0)	-	-	1474 (15.0)	-	-	21 (0.21)	-	110 (1.12)	789 (8.06)	248 (2.53)	45 (0.46)	749 (7.65)	2870 (29.30)	1827 (18.65)	20 (0.20)	28 (0.29)	-	369 (3.77)	
1997	239 (3.37)	-	-	701 (9.87)	-	-	-	-	717 (10.1)	1033 (14.55)	408 (5.75)	692 (9.75)	12 (0.17)	1187 (16.72)	1433 (20.18)	-	11 (0.15)	-	152 (2.14)	
1998	673 (6.48)	-	-	1466 (14.1)	-	-	253 (2.44)	-	936 (9.01)	716 (6.89)	252 (2.43)	142 (1.37)	-	2213 (21.30)	3158 (30.40)	-	71 (0.68)	1 (0.01)	404 (3.89)	
1999	1066 (9.96)	-	-	1726 (16.1)	-	-	-	-	117 (3.31)	951 (8.89)	5 (0.05)	-	-	1555 (14.53)	4664 (43.59)	20 (0.19)	20 (0.19)	-	65 (0.61)	
2000	752 (3.39)	3 (0.00)	66 (0.30)	389 (1.75)	-	-	512 (2.31)	1154 (5.20)	735 (5.20)	1399 (6.30)	13 (0.06)	60 (0.27)	3 (0.01)	2891 (13.03)	7966 (35.90)	-	296 (1.33)	5950 (26.8)	-	
2001	1456 (2.21)	10 (0.01)	30 (0.05)	2424 (3.69)	-	-	5 (0.01)	1443 (2.20)	183 (5.59)	1099 (1.67)	21 (0.03)	485 (0.74)	0	6732 (10.24)	8014 (12.19)	-	38069 (57.9)	2 (0.00)	2095 (3.19)	
2002	213 (3.41)	41 (0.02)	126 (0.20)	5697 (9.12)	-	5 (0.01)	16 (0.03)	3158 (5.05)	158 (0.93)	2275 (3.64)	179 (0.29)	1727 (2.76)	14158 (22.66)	9026 (14.44)	20389 (32.63)	19 (0.03)	225 (0.36)	0	2581 (4.13)	
2003	1026 (1.16)	1 (0.07)	95 (0.11)	7886 (8.90)	36 (0.04)	-	73 (0.08)	409 (0.46)	916 (0.65)	999 (1.13)	75 (0.08)	322 (0.36)	20098 (22.69)	10279 (11.61)	38756 (43.76)	8 (0.01)	386 (4.37)	1540 (1.74)	1610 (1.82)	
2004	1333 (1.10)	0 (0.00)	15 (0.01)	4084 (3.37)	1130 (0.93)	-	34 (0.03)	706 (0.58)	812 (0.20)	3115 (2.57)	13 (0.01)	2481 (2.05)	42954 (35.46)	15426 (12.73)	23877 (19.71)	0 (0.00)	16291 (13.45)	7910 (6.53)	730 (0.60)	
2005	2101 (1.24)	-	-	10542 (6.23)	485 (29)	4 (0.00)	170 (0.10)	2208 (0.23)	1754 (80)	1362 (0.01)	16 (0.01)	4443 (63)	21404 (12.65)	20870 (2.33)	41105 (24.29)	82 (0.00)	3808 (2.25)	58456 (34.5)	-	
2006	2031 (1.12)	3 (0.00)	-	9687 (5.35)	98 (0.05)	6 (0.00)	853 (1.21)	2190 (0.07)	313 (0.42)	758 (0.07)	134 (0.14)	250 (0.14)	9960 (5.50)	39780 (21.98)	94504 (52.21)	12 (0.01)	13965 (7.72)	4508 (2.49)	1813 (1.00)	
2007	10292 (2.62)	-	-	16362 (4.16)	-	37 (0.01)	37 (0.01)	1480 (0.34)	666 (0.71)	2782 (0.07)	292 (0.53)	2081 (0.53)	14431 (3.67)	46976 (11.94)	235654 (59.89)	161 (0.04)	51110 (13)	4146 (1.05)	5629 (1.43)	
2008	8440 (2.23)	424 (0.11)	27 (0.01)	11296 (2.99)	604 (0.16)	76 (0.02)	486 (0.13)	3717 (0.16)	1219 (0.23)	853 (0.06)	241 (1.23)	4650 (1.23)	20375 (5.39)	37975 (10.05)	182112 (48.20)	1784 (0.47)	81889 (21.7)	12346 (3.27)	8720 (2.31)	
2009	64069 (14.8)	37 (0.01)	176 (0.04)	18022 (4.16)	450 (0.10)	-	2897 (0.67)	1242 (0.04)	2531 (0.21)	889 (1.57)	6804 (0.91)	3944 (0.91)	5434 (1.26)	14322 (3.31)	195693 (45.23)	4458 (1.03)	82538 (19.0)	18008 (4.16)	11026 (2.55)	
2010	33405 (8.33)	219 (0.05)	11 (0.00)	47685 (11.9)	10 (0.0)	4 (0.00)	8668 (2.16)	799 (0.12)	2302 (0.07)	286 (2.14)	8585 (1.78)	7153 (1.78)	10938 (2.73)	28641 (7.14)	173119 (43.17)	897 (0.22)	40189 (10.0)	31436 (7.84)	6205 (1.55)	
2011	21363 (3.97)	131 (0.02)	606 (0.11)	47125 (8.75)	7 (0.0)	-	9426 (1.75)	7233 (0.10)	6177 (0.42)	2264 (0.46)	2494 (1.69)	9091 (1.69)	5302 (0.98)	50368 (9.36)	296387 (55.06)	242 (0.04)	21722 (4.03)	51876 (9.64)	5940 (1.10)	
2012	8789 (1.65)	299 (0.06)	376 (0.07)	32647 (6.14)	4036 (0.76)	0 (0.00)	14787 (0.67)	3560 (0.77)	25599 (0.18)	962 (0.40)	2137 (0.99)	5276 (0.99)	1167 (0.22)	52805 (9.94)	276202 (51.99)	374 (0.07)	4363 (0.82)	58456 (11.0)	35357 (6.65)	
CGR	13.08	16.60	11.16	13.34	11.41	8.43	18.42	12.96	13.01	10.73	11.33	14.60	13.61	12.65	14.82	15.49	15.93	19.06	0.71	13.53
Share	4.84	0.02	0.16	8.76	0.20	0.11	0.39	1.31	1.81	3.42	2.46	1.36	6.61	19.00	33.40	0.11	7.35	5.12	0.00	2.89

Source: Calculated from World integrated Trade Solution (WITS), 2012.

Table 4: India's Pharmaceutical Imports from USA (US\$ Thousands)

Year\ commodity codes →	54131	54132	54133	54139	54151	54152	54153	54159	54161	54162	54163	54164	54211	54212	54213	54219	54221	54222	54223	54224	54229
1991	3056 (18.25)	-	55 (0.33)	7174 (42.85)	92 (0.55)	1 (0.01)	359 (2.14)	1326 (7.92)	2 (0.01)	115 (0.69)	378 (2.26)	289 (1.73)	2 (0.01)	169 (1.01)	8 (0.05)	201 (1.20)	364 (2.17)	3031 (18.10)	0 (0.00)	119 (0.71)	2 (0.01)
1992	676 (3.31)	58 (0.28)	146 (0.71)	10894 (53.34)	-	44 (0.22)	2587 (12.67)	2204 (10.79)	3 (0.01)	121 (0.59)	2822 (13.82)	394 (1.93)	49 (0.24)	46 (0.23)	-	40 (0.20)	7 (0.03)	38 (0.19)	3 (0.01)	193 (0.94)	100 (0.49)
1993	3185 (17.23)	-	-	7661 (41.45)	279 (1.51)	-	2485 (13.44)	3251 (17.59)	16 (0.09)	13 (0.07)	928 (5.02)	322 (1.74)	17 (0.09)	113 (0.61)	22 (0.12)	2 (0.01)	-	87 (0.47)	-	95 (0.51)	7 (0.04)
1994	2518 (11.44)	-	3 (0.01)	13258 (60.23)	204 (0.93)	-	1307 (5.94)	2689 (12.22)	33 (0.15)	36 (0.16)	891 (4.05)	242 (1.10)	115 (0.52)	93 (0.42)	432 (1.96)	16 (0.07)	-	25 (0.11)	-	42 (0.19)	107 (0.49)
1995	3238 (8.45)	126 (0.33)	46 (0.12)	11607 (30.30)	340 (0.89)	-	1554 (4.06)	2155 (5.62)	100 (0.26)	25 (0.07)	1675 (4.37)	16563 (43.23)	-	35 (0.09)	146 (0.38)	541 (1.41)	-	60 (0.16)	61 (0.16)	-	41 (0.11)
1996	3460 (19.37)	204 (1.14)	7 (0.04)	8475 (47.46)	1253 (7.02)	-	360 (2.02)	1669 (9.35)	5 (0.03)	6 (0.03)	1392 (7.79)	539 (3.02)	-	1 (0.01)	63 (0.35)	417 (2.33)	1 (0.01)	-	-	-	7 (0.04)
1997	3693 (11.11)	5 (0.02)	29 (0.09)	15279 (45.96)	1479 (4.45)	-	780 (2.35)	4607 (13.86)	55 (0.17)	36 (0.11)	3902 (11.74)	1983 (5.92)	11 (0.03)	15 (0.05)	34 (0.10)	1042 (3.13)	-	12 (0.04)	127 (0.38)	-	157 (0.47)
1998	2223 (7.48)	-	-	20076 (67.58)	-	-	262 (0.88)	2817 (9.48)	38 (0.13)	43 (0.14)	2835 (9.54)	616 (2.07)	-	-	15 (0.05)	215 (0.72)	-	450 (1.51)	59 (0.20)	-	60 (0.20)
1999	1079 (5.01)	15 (0.07)	43 (0.20)	13585 (63.06)	433 (2.01)	1 (0.00)	625 (2.90)	2965 (13.76)	198 (0.92)	77 (0.36)	1145 (5.31)	971 (4.51)	5 (0.02)	-	353 (1.64)	26 (0.12)	2 (0.01)	10 (0.05)	-	-	10 (0.05)
2000	1065 (5.76)	0	34 (0.18)	10425 (56.38)	102 (0.55)	0	93 (0.50)	2152 (11.46)	65 (0.35)	41 (0.22)	1575 (8.52)	1342 (7.26)	-	-	653 (3.53)	873 (4.72)	1 (0.01)	9 (0.05)	2 (0.01)	-	58 (0.31)
2001	240 (1.30)	4 (0.02)	0	9965 (53.87)	1266 (6.84)	-	135 (0.73)	1980 (10.70)	33 (0.18)	71 (0.38)	1860 (10.06)	1856 (10.23)	12 (0.06)	-	477 (2.58)	230 (1.24)	-	4 (0.02)	-	-	365 (1.97)
2002	1631 (5.35)	-	18 (0.06)	14072 (46.16)	123 (0.40)	-	-	3730 (12.24)	81 (0.27)	183 (0.60)	6947 (22.79)	1753 (5.75)	5 (0.02)	-	1677 (5.50)	103 (0.34)	-	34 (0.11)	9 (0.03)	-	117 (0.38)
2003	1127 (2.79)	0	0	22611 (56.00)	3715 (9.20)	-	904 (2.24)	3602 (8.92)	157 (0.39)	1 (0.00)	3977 (9.85)	867 (2.15)	2 (0.00)	-	1504 (3.72)	74 (0.18)	3 (0.01)	254 (0.63)	-	215 (0.53)	1367 (3.39)
2004	261 (0.60)	3 (0.01)	0	23781 (55.01)	4811 (11.13)	1 (0.00)	1119 (2.59)	1747 (4.04)	586 (1.36)	81 (0.19)	5444 (12.59)	2591 (5.99)	11 (0.03)	1 (0.14)	1779 (4.12)	347 (0.80)	4 (0.01)	266 (0.62)	0	-	394 (0.91)
2005	795 (1.51)	1 (0.00)	0	25750 (48.90)	3387 (6.43)	3 (0.01)	1477 (2.80)	1530 (2.91)	1040 (1.98)	30 (0.06)	8531 (16.20)	4935 (9.37)	9 (0.02)	75 (0.22)	1995 (3.79)	904 (1.72)	-	566 (1.07)	-	106 (0.20)	1523 (2.89)
2006	13 (0.02)	3 (0.00)	0	17912 (28.60)	5691 (9.09)	5 (0.01)	570 (0.91)	994 (1.59)	386 (0.62)	6 (0.01)	25836 (41.25)	3798 (6.06)	27 (0.04)	136 (0.01)	4307 (6.88)	1591 (2.54)	-	203 (0.32)	69 (0.11)	304 (0.49)	787 (1.26)
2007	8 (0.01)	2 (0.00)	1 (0.00)	41393 (43.60)	9969 (10.50)	-	476 (0.50)	1000 (1.05)	277 (0.29)	272 (0.29)	29585 (31.16)	2788 (2.94)	169 (0.18)	5 (4.25)	5123 (5.40)	1995 (2.10)	-	299 (0.31)	70 (0.07)	85 (0.09)	1430 (1.51)
2008	472 (0.38)	9 (0.01)	64 (0.05)	48671 (39.36)	4352 (3.51)	2 (0.00)	1166 (0.94)	708 (0.57)	376 (0.30)	666 (0.54)	40196 (32.51)	5081 (4.11)	537 (0.43)	5250 (0.01)	6074 (4.91)	4418 (3.57)	-	958 (0.77)	554 (0.45)	-	4104 (3.32)

2009	208 (0.14)	8708 (5.76)	47276 (31.29)	47276 (31.29)	8708 (5.76)	-	1596 (1.06)	570 (0.38)	506 (0.33)	547 (0.36)	68095 (45.07)	5010 (3.32)	-	13 (0.00)	7074 (4.68)	4568 (3.02)	-	651 (0.42)	3 (0.00)	0 (0.00)	6272 (4.15)
2010	532 (0.31)	6049 (3.51)	59053 (34.30)	59053 (34.30)	6049 (3.51)	-	1126 (0.65)	1316 (0.76)	679 (0.39)	631 (0.54)	74747 (43.07)	5811 (3.38)	-	-	5279 (3.07)	6888 (4.00)	-	1094 (0.64)	2 (0.00)	1 (0.00)	8878 (5.16)
2011	4789 (2.13)	10398 (4.63)	55569 (24.74)	55569 (24.74)	10398 (4.63)	-	1804 (0.80)	3573 (1.59)	635 (0.28)	1206 (0.10)	87823 (39.10)	6644 (2.96)	-	50 (0.02)	29963 (13.34)	-	-	167 (0.07)	6130 (2.73)	20 (0.01)	7843 (3.49)
2012	3116 (1.66)	3722 (1.98)	31467 (16.78)	31467 (16.78)	3722 (1.98)	-	841 (0.45)	3511 (1.87)	1154 (0.62)	185 (0.27)	117831 (62.83)	12134 (6.47)	-	-	-	12.94	-	476 (0.25)	7641 (4.07)	0 (0.00)	5014 (2.67)
CGR	9.01	9.71	10.95	10.95	12.29	9.49	10.12	9.73	12.90	11.30	12.80	11.54	10.80	10.08	14.26	1.66	7.88	11.12	11.91	9.12	14.13
Share	5.62	0.11	0.09	44.87	4.13	0.01	2.75	7.22	0.41	0.27	19.97	6.14	0.08	0.32	3.01	33.40	0.10	1.18	0.23	0.17	1.51

Source: Calculated from World integrated Trade Solution (WITS), 2012.

Table 5: India's Pharmaceutical Exports to Russian Federation (US\$ Thousands)

Year\ commodity codes →	54131	54132	54133	54139	54151	54152	54153	54159	54161	54162	54163	54164	54211	54212	54213	54219	54221	54222	54223	54224	54229
1992	3945 (2.54)	1 (0.0)	-	13270 (8.56)	13 (0.01)	-	-	879 (0.57)	219 (0.14)	561 (0.36)	2004 (1.29)	1547 (1.00)	438 (0.28)	1184 (0.76)	15048 (9.70)	43508 (28.05)	4 (0.0)	1843 (1.19)	41315 (26.64)	9774 (6.30)	19549 (12.60)
1993	1402 (1.11)	-	-	3160 (2.51)	-	5 (0.02)	212 (0.17)	123 (0.10)	1162 (0.92)	760 (0.60)	1781 (1.42)	1835 (1.46)	1171 (0.93)	2983 (2.37)	5320 (4.23)	49530 (39.87)	339 (0.27)	703 (0.56)	17386 (13.81)	16902 (13.43)	21112 (16.77)
1994	7096 (3.71)	10 (0.01)	38 (0.02)	9033 (4.73)	1629 (0.85)	50 (0.16)	764 (0.40)	376 (0.20)	74 (0.04)	88 (0.05)	6489 (3.40)	2410 (1.26)	2100 (1.10)	1546 (0.81)	12884 (6.74)	66616 (34.87)	92 (0.05)	8896 (4.66)	21068 (11.03)	17740 (9.29)	32050 (16.78)
1995	6436 (3.78)	17 (0.01)	71 (0.04)	2670 (1.57)	6787 (3.99)	9 (0.05)	542 (0.32)	424 (0.25)	348 (0.20)	1168 (0.69)	8805 (5.18)	1798 (1.06)	2120 (1.25)	1997 (1.17)	13292 (7.81)	58209 (34.22)	-	5160 (3.03)	25689 (15.10)	15619 (9.18)	18940 (11.13)
1996	13442 (5.92)	58 (0.03)	517 (0.23)	4522 (1.99)	4295 (1.89)	77 (0.21)	260 (0.11)	389 (0.17)	304 (0.13)	1290 (0.57)	17978 (7.92)	5152 (2.27)	784 (0.35)	485 (0.21)	12377 (5.45)	63169 (27.82)	28 (0.01)	1723 (0.76)	48877 (21.53)	14905 (6.57)	36395 (16.03)
1997	11922 (4.40)	213 (0.08)	496 (0.18)	6146 (2.27)	410 (0.15)	624 (1.10)	507 (0.19)	530 (0.20)	568 (0.21)	3410 (1.26)	19773 (7.31)	11860 (4.38)	983 (0.36)	866 (0.32)	10454 (3.86)	73125 (32.36)	117 (0.04)	3366 (1.24)	44562 (16.47)	23757 (8.78)	56952 (21.04)
1998	7925 (3.61)	887 (0.40)	369 (0.17)	7587 (3.46)	970 (0.44)	93 (0.22)	80 (0.04)	441 (0.20)	510 (0.23)	1222 (0.56)	23511 (10.72)	5704 (2.60)	355 (0.16)	3155 (1.44)	8886 (4.05)	70964 (28.97)	2 (0.00)	1703 (0.78)	32441 (14.79)	10924 (4.98)	41598 (18.97)
1999	6578 (3.32)	0 (0.0)	507 (0.26)	11178 (5.64)	30 (0.02)	35 (0.11)	834 (0.42)	400 (0.20)	583 (0.29)	1851 (0.93)	18004 (9.08)	6091 (3.07)	136 (0.07)	1994 (1.01)	7779 (3.92)	57463 (28.19)	6466 (3.26)	1532 (0.77)	30876 (15.57)	15174 (7.65)	30844 (15.55)
2000	8037 (2.72)	109 (0.02)	475 (0.16)	11328 (3.84)	515 (0.17)	0 (0.0)	1228 (0.42)	698 (0.24)	2093 (0.71)	2307 (0.78)	31543 (10.69)	8118 (2.75)	839 (0.28)	704 (0.24)	9433 (3.20)	83155 (21.31)	31 (0.01)	2906 (0.99)	55911 (18.95)	24203 (8.20)	51398 (17.42)
2001	8558 (1.95)	100 (0.01)	541 (0.12)	10400 (2.37)	747 (0.17)	-	425 (0.10)	250 (0.06)	621 (0.14)	2577 (0.59)	62221 (14.15)	10669 (2.43)	753 (0.17)	1156 (0.26)	18124 (4.12)	93698 (28.19)	-	6290 (1.45)	114536 (26.05)	38028 (8.65)	69960 (15.91)
2002	5320 (1.52)	23 (0.02)	333 (0.10)	10910 (3.12)	18 (0.01)	65 (0.12)	553 (0.16)	443 (0.13)	1094 (0.31)	872 (0.25)	63772 (18.21)	18971 (5.42)	1077 (0.31)	912 (0.26)	15416 (4.40)	88969 (22.82)	-	8058 (2.30)	42361 (12.10)	34578 (9.88)	56379 (16.10)

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2003	7181 (1.61)	111 (0.07)	282 (0.06)	11426 (2.56)	9 (0.00)	-	571 (0.13)	198 (0.04)	1321 (0.30)	750 (0.17)	87550 (19.65)	18788 (4.22)	810 (0.18)	1064 (0.21)	23671 (5.31)	101670 (24.07)	-	24272 (5.45)	52293 (11.74)	41245 (9.26)	72387 (16.24)
2004	6365 (1.11)	414 (0.01)	456 (0.08)	10417 (1.82)	3 (0.00)	15 (0.02)	527 (0.09)	230 (0.04)	1603 (0.28)	1774 (0.31)	106565 (18.66)	35030 (6.13)	644 (0.11)	574 (0.10)	29376 (5.14)	137429 (24.92)	-	14675 (2.57)	73652 (12.90)	55380 (9.70)	95874 (16.79)
2005	4813 (0.59)	93 (0.01)	410 (0.05)	14862 (1.81)	8 (0.00)	-	606 (0.07)	232 (0.03)	1390 (0.17)	3336 (0.41)	194791 (23.71)	43624 (5.13)	3374 (0.41)	445 (0.05)	38365 (4.67)	204732 (22.1)	67 (0.01)	2056 (0.25)	104050 (12.6)	82850 (10.0)	121296 (14.77)
2006	5938 (0.45)	130 (0.01)	313 (0.02)	17362 (1.33)	417 (0.03)	-	663 (0.05)	83 (0.01)	3293 (0.25)	989 (0.08)	437687 (33.43)	71071 (5.43)	5874 (0.45)	10695 (0.82)	64792 (4.95)	289383 (22.0)	-	8605 (0.66)	89601 (6.84)	101750 (7.77)	200599 (15.32)
2007	4764 (0.33)	143 (0.01)	798 (0.06)	27044 (1.88)	2264 (0.16)	-	1170 (0.08)	598 (0.04)	3847 (0.27)	1930 (0.13)	501050 (34.85)	104607 (7.27)	685 (0.05)	6371 (0.44)	66842 (4.65)	316756 (19.97)	6 (0.0)	19200 (1.34)	124427 (8.65)	104544 (7.27)	150891 (10.49)
2008	2739 (0.13)	18 (0.00)	121 (0.01)	27363 (1.33)	1670 (0.08)	-	1064 (0.05)	1868 (0.09)	2365 (0.11)	26161 (1.27)	768343 (37.30)	162388 (7.88)	3863 (0.19)	12572 (0.61)	124351 (6.04)	411371 (19.97)	1	13925 (0.68)	131410 (6.38)	159701 (7.75)	208858 (10.14)
2009	3706 (0.19)	201 (0.01)	391 (0.02)	41202 (2.16)	2849 (0.15)	-	614 (0.03)	871 (0.05)	2631 (0.14)	19700 (1.03)	708273 (37.12)	115157 (6.04)	129 (0.01)	9348 (0.49)	88021 (4.61)	362323 (18.99)	-	3241 (0.17)	120433 (6.31)	176177 (9.23)	252783 (13.25)
2010	9931 (0.41)	321 (0.01)	153 (0.01)	48208 (1.99)	4707 (0.19)	2 (0.0)	12090 (0.50)	1418 (0.06)	4791 (0.20)	30359 (1.25)	868054 (35.75)	156596 (6.45)	72 (0.0)	3961 (0.16)	81843 (3.37)	541450 (22.30)	4	6523 (0.27)	197671 (8.14)	200786 (8.27)	259488 (10.69)
2011	6874 (0.22)	1106 (0.03)	1443 (0.05)	66184 (2.08)	5449 (0.17)	-	2593 (0.08)	1165 (0.04)	7609 (0.24)	35183 (1.11)	1157377 (36.42)	259244 (8.16)	140 (0.0)	11564 (0.36)	212386 (6.68)	620402 (19.52)	251 (0.01)	6562 (0.21)	218735 (6.88)	262462 (8.26)	301409 (9.48)
2012	5235 (0.16)	576 (0.02)	1924 (0.06)	54992 (1.70)	9381 (0.29)	3 (0.0)	1742 (0.05)	1470 (0.05)	9551 (0.30)	36546 (1.13)	1183404 (36.64)	296487 (9.18)	381 (0.01)	14360 (0.44)	155896 (4.48)	699453 (21.65)	8	2446 (0.08)	204467 (6.33)	275397 (8.53)	276285 (8.55)
CGR	9.99	12.04	10.81	11.33	11.09	8.10	11.16	10.54	11.91	12.26	13.88	13.15	9.51	11.17	11.73	11.52	8.88	10.68	11.18	11.87	11.57
Share	1.90	0.04	0.08	2.80	0.42	0.02	0.16	0.13	0.27	0.64	19.18	4.46	0.32	0.60	5.13	26.00	0.17	1.40	13.28	8.52	14.48

Source: Calculated from World integrated Trade Solution (WITS), 2012

Table 6: India's Pharmaceutical Imports from Russian Federation (US\$ Thousands)

Year\ commodity codes	54131	54139	54152	54153	54159	54162	54164	54219	54221	54222	54223	54229
1992	370 (87.14)	34 (8.02)	-	-	-	21 (4.84)	-	-	-	-	-	-
1993	1023 (58.14)	720 (40.95)	-	-	-	-	-	-	16 (0.91)	-	-	-
1994	1133 (95.29)	36 (3.06)	-	-	-	-	20 (1.65)	-	-	-	-	-
1995	1729 (77.63)	498 (22.37)	-	-	-	-	-	-	-	-	-	-
1996	4070 (78.46)	980 (18.89)	-	83 (1.61)	46 (0.89)	8 (0.15)	-	-	-	-	-	-

1997	2141 (37.55)	3245 (56.90)	190 (3.33)	-	-	-	39 (0.68)	-	-	88 (1.54)	-	-
1998	467 (8.71)	4686 (87.38)	-	-	-	210 (3.92)	-	-	-	-	-	-
1999	2633 (53.67)	1874 (38.21)	-	-	-	398 (8.11)	-	-	-	-	-	-
2000	4264 (68.21)	1431 (22.89)	-	-	-	557 (8.90)	-	-	-	-	-	-
2001	1485 (25.43)	2677 (45.85)	-	-	-	1676 (28.71)	-	-	-	-	-	-
2002	840 (23.67)	1874 (52.82)	-	-	72 (2.02)	763 (21.49)	-	-	-	-	-	-
2003	-	736 (33.91)	-	-	-	1342 (61.82)	93 (1.28)	-	-	-	-	-
2004	-	2588 (89.53)	-	-	-	300 (10.37)	2 (0.06)	1 (0.04)	-	-	-	-
2005	-	2743 (75.70)	-	-	-	827 (22.83)	1 (0.04)	20 (0.54)	-	-	32 (0.88)	-
2006	-	5290 (82.36)	-	-	-	1107 (17.24)	3 (0.05)	22 (0.35)	-	-	-	-
2007	-	5384 (87.03)	-	-	-	802 (12.97)	-	-	-	-	-	-
2008	-	8507 (92.40)	-	-	-	695 (7.55)	5 (0.05)	-	-	-	-	-
2009	-	1760 (62.98)	-	-	-	1034 (37.02)	-	-	-	-	-	-
2010	-	17 (4.24)	-	-	-	394 (95.76)	-	-	-	-	-	-
2011	26 (0.82)	1346 (42.01)	-	-	-	1772 (55.31)	13 (0.40)	-	-	-	-	47 (1.46)
2012	-	772 (76.09)	-	-	-	236 (23.21)	7 (0.70)	-	-	-	-	-
CGR	9.09	10.77				26.93	11.98	8.51				
Average share	29.27	49.69	0.16	0.08	0.14	20.04	0.34	0.04	0.04	0.07	0.04	0.07

Source: Compiled from World Integrated Trade Solution (WITS), 2012,

Note: Values in parentheses shows the percentage share of world in India's high technology product.

Table 7: Revealed Comparative Advantage and Revealed Symmetric Comparative Advantage of Pharmaceutical Products of India with USA

Year	Name of the Product*	RCA	RSCA	Year	Product Name**	RCA	RSCA
1991-1995	Insulin and its salt	12.73	0.85	1991-1995	Insulin formulated, bulk	28.01	0.93
1996-2000	Insulin formulated, bulk	46.15	0.96	1996-2000	Insulin formulated, bulk	2821.06	1.00
2001-2005	Other hormone non retail	57.71	0.97	2001-2005	Insulin formulated, bulk	178.93	0.99
2006-2010	Insulin formulated, bulk	50.19	0.96	2006-2010	Other hormones non retail	189.58	0.99
2006-2012	Insulin formulated, bulk	51.42	0.96	2006-2012	Other hormones non retail	170.31	0.99

Source: Calculated from World Integrated Trade Solution (WITS), 2012. *USA, **Russian Federation

Table 8: India-USA* and Russian Federation Bilateral Grubel-Lloyd Index**

Year	Product Name*	GL	Year	Product name**	GL
1991-1995	Hormones n.e.s retail pack	0.88	1991-1995	Pituitary/hormones etc.	1.00
1996-2000	Antisera/blood fracture/vaccine	0.68	1996-2000	Pencillines and derivatives	0.71
2001-2005	Other hormones/devices etc.	0.67	2001-2005	Glands etc. and extracts	0.59
2006-2010	Hormone n.e.s retail pack	0.64	2006-2010	Other antibiotics, bulk	0.49
2006-2012	Other hormones/devices etc.	0.68	2006-2012	Other antibiotics, bulk	0.37

Source: Calculated from World Integrated Trade Solution (WITS), 2012. *USA, **Russian Federation

Table 9: Growth of R & D Expenditure in Indian Pharmaceutical Companies

Year	R & D Expenditure					R & D expenditure as % of sales				
	Domestic Company (Rs.Crores)	Growth %	Foreign Company (Rs.Crores)	Growth %	Domestic Company %	Growth %	Foreign Company %	Growth %	Domestic Company %	Growth %
2005	1527.24	40.86	510.50	47.25	4.98	30.71	1.63	48.18		
2006	1850.97	21.20	816.02	59.85	5.35	7.43	2.39	46.63		
2007	2371.79	28.14	695.62	-14.75	5.01	-6.36	2.67	11.72		
2008	2772.63	16.90	700.18	0.66	4.78	-4.59	2.86	7.12		
2009	2316.14	19.60	846.05	20.83	4.89	2.30	3.84	34.27		
2010	3342.32	0.79	934.40	10.44	4.50	-7.98	4.01	4.43		

Source: Ministry of Chemicals and Fertilizers, Department of Pharmaceuticals Annual Report 2011-12.

Table 10: Research and Development Intensity of Indian Pharmaceutical Companies

Name of the companies	Mar 2001	Mar 2002	Mar 2003	Mar 2004	Mar 2005	Mar 2006	Mar 2007	Mar 2008	Mar 2009	Mar 2010	Mar 2011	Mar 2012	Average Share
Hester Biosciences Ltd.	0	0	0	0	0	0	0	0	0	0	0.15	0.22	0.03
Gujarat Themis Biosyn Ltd.	0	0	0	0	0	0	0	0.01	0	0	0	0	0.00
Ranbaxy Laboratories Ltd.	0	0	35.03	52.21	75.35	106.55	86.56	104.95	85.43	101.26	105.86	86	69.93
Cipla Ltd.	0	0	0	0	0	27.09	33.46	50.69	45.97	55.1	57.74	60.89	27.58
Pfizer Ltd.	0	0	0	0	0	0	0	6.16	5.73	6.27	2.31	1.22	1.81
Sanofi India Ltd.	0	0	0	0	0.91	0	0	1.15	0.96	1.1	0.81	0.76	0.47
GlaxoSmithKline Pharmaceuticals Ltd.	0	0	0	0	0	0	0	1.12	0.95	1	0.98	0.73	0.40

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Merck Ltd.	0.13	0.08	0.06	0.03	0.06	0.13	0.23	0.31	0.31	0.39	0.54	0.59	0.24
Wyeth Ltd.	0	0	0	0	0	0	0	0.2	0.19	0.17	0.45	0.3	0.11
AstraZeneca Pharma India Ltd.	0	0	0	0	0	0	0.5	0.6	0.49	0.45	0.72	0.29	0.25
Abbott India Ltd.	0	0	0	0	0	0	0	0.79	0.91	0.24	0.37	0.23	0.21
Zenotech Laboratories Ltd.	0	0	0	0	0	0	0	0.85	1.07	0.52	0.27	0.17	0.24
Resonance Specialties Ltd.	0.03	0.03	0.02	0.05	0.05	0.05	0.07	0.09	0.09	0.25	0.19	0.11	0.09
Novartis India Ltd.	0	0	0	0	0	0	0	0.19	0.06	0.03	0.04	0.05	0.03
Vista Pharmaceuticals Ltd.	0	0	0	0	0	0	0	0	0	0	0	0.01	0.00
Kerala Ayurveda Ltd.	0.02	0.01	0.02	0.02	0.01	0.02	0.02	0.03	0.01	0.05	0.32	0.8	0.11
Wanbury Ltd.	0	0	0	0	0	0	0	1.19	0.37	1.27	1.28	0.95	0.42
Fermenta Biotech Ltd.	0	0	0	0	0	0	0.24	0.2	0.36	0.52	0.38	0.68	0.20
Themis Medicare Ltd.	0	0	0	0	0	0	0	0.42	0.38	0.27	0.63	0.4	0.18
Capsugel Healthcare Ltd.	0.01	0	0.01	0.01	0.01	0	0	0	0	0	0	0	0.00

Source: Centre for Monitoring Indian Economy (CMIE), Prowess
R & D Intensity: Expenditure on R&D as a proportion of firm's sales

Table 11: Export performance of Indian Pharmaceutical Companies (US \$ Million)

Name of the companies	Mar 2001	Mar 2002	Mar 2003	Mar 2004	Mar 2005	Mar 2006	Mar 2007	Mar 2008	Mar 2009	Mar 2010	Mar 2011	Mar 2012	CGR	Average Share
Hester Biosciences Ltd.	0	0	0.05	0.02	0.04	0.07	0.05	0.17	0.13	0.17	0.73	0.58	14.17	0.01
Gujarat Themis Biosyn Ltd.	2.48	0.57	0.43	0.12	0.11	0.34	0.37	0	0	0	0	0	7.49	0.10
Ranbaxy Laboratories Ltd.	161.05	218.1	395.08	536.87	546.8	493.99	587.61	641.53	555.07	600.36	761.6	1039.12	11.32	45.69
Cipla Ltd.	57.11	101.92	120.26	192.54	250.57	349.63	421.78	558.8	577.8	671.31	759.34	739.54	12.61	28.17
Sanoofi India Ltd.	9.63	21.46	26.58	32.73	45.7	48.68	49.47	42.28	42.25	48.92	46.11	42.63	11.05	3.36
GlaxoSmithKline	15.46	15.8	13.87	8.58	8.5	9.77	12.45	20.06	19.46	25.39	23.51	14.83	10.51	1.72

CONCLUSION

Analysis of the study indicates that among the exports of high technology products, the country has the highest share in pharmaceutical sector from 1991 to 2012. USA is the top most destinations of India's pharmaceutical exports followed by the Russian Federation. Commodity wise analysis of India's pharmaceutical exports to the USA indicates that India has the highest share in the exports of product 'Antibiotic n.e.s retail' followed by 'Penicillin/strept retail'. Similarly, in case of Russia, India has the highest average share in the export of 'Antibiotic n.e.s retail' followed by 'Antisera/blood fracture/vaccine'. The study revealed that India has competitive gain with the USA and Russian Federation is found for the 'Insulin formulated bulk'. Results show that value of intra-industry trade between India and USA is the highest for 'Hormones n.e.s retail' throughout the study period. It has maintained its position throughout the study period as its intra-industry trade index has been found maximum in many years. After 2005, Indian leading pharmaceutical companies recognized that they could not survive as global players without the contribution of R&D capabilities. India started to increase expenditure in R&D as a result an increase in the production and exports of pharmaceutical products. The pharmaceuticals sector, where India has emerged as the most reliable supplier of quality generic drugs to Russia, has potential for further cooperation. Under Pharma 2020 program of the Russian Government, which aims at developing the domestic production base, leading Indian Pharma companies have started engaging with Russian partners to consider possibilities of joint investments. Thus, it is clear that the introduction of the TRIPS Agreement, which mainly concerns product patents, has increased the length of the patent to twenty years and affected India's pharmaceutical sectors. Under Indian Patent Act of 1970, a product patent was not allowed for pharmaceutical products, agricultural products, food products and any chemical products. It seems from the preceding sections that grant of intellectual property rights for an invention is necessary for the domain of the pharmaceutical sector. Though it creates a short term monopoly and loss in social welfare, the long-term benefits are enormous. Secondly, the idea of making India compliant with TRIPS policy thereby is attracting more foreign direct investment or multi-national corporations in this sector need to be looked into carefully.

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Appendix :A

High Technology Products List – SITC Rev. 3 (Period 1988-95)

CODES SITC	TITLE
Aerospace	
7921	Helicopters
7922+7923+7924+792	Aero planes
Of which: 7922	Aero planes of unladen weight<2000 kg
7923	Aero planes of unladen weight<2000 kg and <15000kg
7924	Aero planes of unladen weight >15000kg
7925	Spacecraft (including satellites and launch vehicles)
79291	Propellers, rotors and parts thereof
79293	Under-carriages and parts thereof
714-71489	Aero planes motors
71441	Turbo-jets
71449	Other than turbo-jets
71491	Parts of turbo-jets or turbo-propellers
87411	Other navigational instruments
Computers-office machine	
75113	Word-processing machines
75131+75132+7513	Photo-copying apparatus
752-7529	Computers
Of which: 7521	Analogue or hybrid data processing machines
7522	Digital automatic data processing with a central processing unit
7523	Digital automatic data processing with storage, input or output units
7526	Input or output units
7527	Storage units
75997	Parts and accessories of group 752--
Electronics-telecommunications	
76381	Video apparatus
76383	Other sound reproducing apparatus
764--	Telecommunications equipment
Of which : 7641 -	Electrical apparatus for telephone or telegraphed
76411	Telephone sets
76413	Teleprinters
76415	Communication apparatus
76417	Other apparatus for carries-current line systems

76419	Other telephonic apparatus, n.e.s
7642-	Microphones, loudspeakers and amplifiers
Of which: 76421	Microphones
76422+76423	Loudspeakers
Of which: 76422	Loudspeakers, mounted in their enclosures
76423	Loudspeakers, not mounted in their enclosures
76424	Headphones, earphones and combined microphones/speaker sets
76425	Audio-frequency electric amplifiers
76426	Other sound amplifiers
7643	Transmission apparatus for radio, telephone and TV, including reception apparatus
Of which: 76431	Transmission apparatus (without reception)
76432	Transmission apparatus incorporating reception apparatus
7648-	Telecommunications equipments, n.e.s.
Of which: 76481	Reception apparatus for radiotelephony
76482	Television cameras
76483	Radar apparatus
76491	Parts and accessories of 7641-
76492	Parts and accessories of 7642-
7722-	Printed circuits
77261	Electrical boards and consoles<1000V
77318	OPTICAL FIBRE CABLES
77625	Microwave tubes
77627	Other valves and tubes
7763-	Semi-conductor devices
Of which: 77631	Non-photosensitive diodes
77632+77633	Transistors (excluding photosensitive transistors)
77635	Thyristors, diacs and triacs
77637	Photosensitive semi-conductor devices
77639	Other semi-conductor devices
7764-	Electronic integrated circuits and micro assemblies
Of which: 77641	Digital monolithic integrated units
77643	Non-digital monolithic units
77645	Hybrid integrated circuits
77649	Other electronic integrated circuits
7768-	Piezo-electric crystals
Of which: 77681	Piezo-electric crystals, mounted
77688	Parts of the devices of 7763- and of 77681

77689	Parts of the devices of 7764-
89879	Numeric recording stays
PHARMACY	
5413-	Antibiotics
54131	Penicillin's and their derivatives
54132	Streptomycin's and their derivatives
54133	Tetracycline's and their derivatives
54139	Other antibiotics
of which: 54151	Insulin and its salts
54152	Pituitary (anterior) or similar hormones
Of which: 5415-	Hormones and their derivatives
54151	Insulin and its salts
54152	Pituitary/hormones etc.
54153	Cortisone derivatives
54159	Other hormones/devices etc.
Of which: 5416-	Glycosides, glands, antisera, vaccines
54161	Glycosides and derivatives
54162	Glands etc and extracts
54163	Antisera/Blood fracture/Vaccine
54164	Blood/Toxin/Cultures
5421-	Medicaments containing antibiotics or derivatives thereof
Of which: 54211	Penicillin non retail
54212	Antibiotic n.e.s non retail
54213	Penicillin/Strept retail
54219	Antibiotic n.e.s retail
5422-	Medicaments containing hormones or other products of heading 5415-
Of which: 54221	Insulin formulated, bulk
54222	Other hormones non retail
54223	Insulin retail pack
54224	Hormone ach retail pack
54229	Hormone n.e.s retail pack
SCIENTIFIC INSTRUMENTS	
774--	Electro-diagnostic apparatus for medicine or surgery and radiological apparatus
of which: 7741-	Electro-diagnostic apparatus (excepting radiological apparatus)
of which: 77411	Electro-cardiographs
77412	Other electro-diagnostic apparatus
77413	Ultra-violet or infra-red ray apparatus

7742- of which: 77421	Apparatus based on the use of x-rays or of alpha, beta or gamma radiations
77422	Apparatus based on the use of x-rays (for medical uses)
77423	Apparatus based on the use of alpha, beta or gamma radiations
77429	X-ray tubes
8711-	Parts and accessories of 7742-
8713-	Binoculars, astronomical instruments and optical telescopes
of which: 87131	Microscopes (other than optical microscopes)
87139	Microscopes other than optical microscopes
8714-	Parts and accessories
of which: 87141	Compound optical microscopes
87143	Stereoscopic microscopes
87145	Other microscopes (including for microphotography)
87149	Microscopes, n.e.s.
8714-	Parts and accessories
8714-	Compound optical microscopes
of which: 87141	Stereoscopic microscopes
87143	Other microscopes (including for microphotography)
87145	Microscopes, n.e.s.
87149	Parts and accessories
8719-	Liquid crystal devices, lasers and other optical instruments
of which: 87191	Telescopic sights for fitting to arms
87192	Lasers
87193	Other devices and instruments
87199	Parts and accessories of 8719-
87211	Dental drill engines
874 - 87411 - 8742	Measuring instruments and apparatus
of which: 8741 - 87411	Compasses, navigational instruments, geodesic instruments
of which: 87412	Parts and accessories
87413	Geodesic instruments
87414	Parts and accessories
8743-	Instruments for measuring or checking the flow, level, pressure or other variables of liquids or gases
of which: 87431	Instruments for measuring the flow or level of liquids
87435	Instruments for checking pressure
87437	Other instruments and apparatus
87439	Parts and accessories of 8743-
8744-	Instruments for physical or chemical analysis
of which: 87441	Gas or smoke analysis apparatus

87442	Chromatographs
87443	Spectrometers, spectrographs using optical radiations
87444	Exposure meters
87445	Other apparatus using optical radiations
87446	Apparatus for physical or chemical analysis, n.e.s.
87449	Parts and accessories of 8744-
8745-	Measuring, controlling and scientific instruments, n.e.s.
of which: 87451	Sensitive balances
87452	Instruments designed for demonstrational purposes
87453	Appliances for testing the hardness
87454	Parts and accessories of 87453
87455	Density meters
87456	Parts and accessories of 87455
8746-	Automatic regulating or controlling instruments
of which: 87461	Thermostats
87463	Pressure regulators
87465	Other regulating or controlling apparatus
87469	Parts and accessories of 8746-
8747-	Oscilloscopes, spectrum analyzers
of which: 87471	Instruments for detecting ionizing radiations
87473	Cathode-ray oscilloscopes and cathode-ray oscillographes
87475	Other instruments for checking voltage, current and resistance
87477	Instruments designed for telecommunications
87478	Other instruments for measuring electrical quantities
87479	Parts and accessories of 8747-
8749-	Parts and accessories, n.e.s.
88111	Photographic cameras
88121	Cinematographic cameras
88411	Contact lenses
88419	Optical fibers other than those of heading 7731-
89961	Hearing aids
89963	Orthopedic appliances
89966	Ocular prosthesis
89967	Pacemakers for stimulating heart muscles
ELECTRICAL MACHINERY	
77862+77863+77864+77865	Electrical fixed capacitors
of which: 77862	Tantalum fixed capacitors

77863	Aluminum electrolytic fixed capacitors
77864	Ceramic dielectric fixed capacitors, single layer
77865	Ceramic dielectric fixed capacitors, multilayer
7787-	Electrical machines, having individual functions
of which: 77871	Particle accelerators
77878	Other machines, having individual functions
77879	Parts and accessories of 7787-
77884	Electric sound or visual signaling apparatus
	CHEMISTRY
52222+52223+52229+52269	Inorganic chemical elements
of which: 52222	Selenium, tellurium, phosphorus, arsenic and boron
52223	Silicon
52229	Calcium, strontium and barium
52269	Other inorganic bases
525--	Radio-active materials
of which: 5251-	Radio-active isotopes
of which: 52511	Natural uranium and its compounds
52513	Uranium enriched in U235, plutonium and its compounds
52515	Uranium depleted in U235
52517	Spent fuel elements of nuclear reactors
52519	Radio-active isotopes, n.e.s.
5259-	Stable isotopes and their compounds
of which: 52591	Isotopes other than those of heading 5251-
52595	Compounds, inorganic or organic, of rare-earth met
531--	Organic coloring matter and colour lakes
of which: 5311-	Organic coloring matter
5312-	Synthetic organic products of a kind used as fluorescent brightening agents or luminophores
57433	Polyethylene terephthalate
of which: 5911-	Insecticides
5912-	Fungicides
5913-	Herbicides, anti-sprouting products
5914-	Disinfectants
	NON-ELECTRICAL MACHINERY
71489	Other gas turbines
71499	Parts of gas turbines
71871	Nuclear reactors
71877	Fuel elements non-irradiated

71878	Parts of nuclear reactors
72847	Machinery and apparatus for isotopic separation
7311-	Machine-tools working by laser or other light or photon beam, ultrasonic, electro-discharge or electro-chemical processes
of which: 73111	Operated by laser or other light or photon beam processes
73112	Operated by ultra-sonic processes
73113	Operated by electro-discharge processes
73114	Operated by electro-chemical, electron beam, ionic-beam or plasma jet processes
73131+73135+73142+73144+	Machine-tools, numerically controlled
73151+73153+73161+73163+	
73165+73312+73314+73316+	
7359+73733+73735	
of which: 73131	Horizontal lathes, numerically controlled
73135	Other lathes, numerically controlled
73142	Other drilling machines, numerically controlled
73144	Other boring-milling machines, numerically controlled
73151	Milling machines, knee-type, numerically controlled
73153	Other milling machines, numerically controlled
73161	Flat-surface grinding machines, numerically controlled
73163	Other grinding machines, numerically controlled
73165	Sharpening machines, numerically controlled
73312	Bending, folding, straightening or flattening machines, numerically controlled
73314	Shearing machines, numerically controlled
73316	Punching machines, numerically controlled
7359-	Parts and accessories of 731-- and 733--
of which: 73591	Parts and accessories of 731--
73595	Parts and accessories of 733--
73733	Machines and apparatus for resistance welding of metal, fully or partly automatic
73735	Machines and apparatus for arc, including plasma arc welding of metal, fully or partly automatic
	891—ARMAMENT
8911-	Armored fighting vehicles
8912-	Bombs, torpedoes, mines, missiles, etc...
8913-	Non-military arms
8919-	Parts and accessories of 89112, 89114 and 8913-

Source: Hatzichronoglou, T. (1997).