Trends and Patterns of India's High Technology Exports with Special Reference to Pharmaceutical Products

A Dissertation Submitted to the Central University of Punjab

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In

Development Economics

By
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Supervisor

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DECLARATION

I declare that the dissertation entitled "**Trends and Patterns of India's High Technology Exports with Special Reference to Pharmaceutical Products**" has been prepared by me under the guidance of Dr. Sandeep Kaur Bhatia, Assistant Professor, Centre for Economics Studies, School of Social Sciences, Central University of Punjab. No part of this dissertation has formed the basis for the award of any degree or fellowship previously.

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CERTIFICATE

This is to certify that the thesis entitled, "**Trends and Patterns of India's High Technology Exports with Special Reference to Pharmaceutical Products**" which is being submitted by Manisha for the award of the degree of Master of Philosophy in Development Economics to the Central University of Punjab, Bathinda, is a bonafied record of research work done under my guidance and supervision.

The dissertation has reached the standard fulfilling the requirements of the regulations relating to the degree. The results obtained in the dissertation have not been submitted partially or wholly to any other university or institution for the award of any degree or diploma.

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ABSTRACT

"Trends and Patterns of India's High Technology Exports with Special Reference to Pharmaceutical Products"

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Diversification of a country's exports plays an important role in the economic growth of the developing countries. These countries are trying to increase its exports by exporting high technology products and improve their ranking in the world trade. India is no exception to this. The present study is an attempt to examine the competitiveness of pharmaceutical exports in India's high technology exports, which is the largest sector amongst high technology commodities, with the US and Russian Federation by calculating different indices like Revealed Comparative Advantage (RCA), Revealed Symmetric Comparative Advantage (RSCA) and Intra Industry Trade (IIT) during 1991-2012. An attempt is also made to study some of the important issues of TRIPS related to India's pharmaceutical exports. An extensive research effort has been made to comprehend the composition and direction of India's Pharmaceutical exports with its top two export partners i.e. US and Russia using these indices. The empirical result of the study revealed that India has revealed comparative advantage in maximum pharmaceutical products with these two countries. The policy of the country regarding the international trade has under gone

various changes since liberalization, as a result of the emergence of Trade Related Intellectual Property Rights (TRIPS). Further, the result of the study also explained that TRIPS has a positive impact on India's pharmaceutical exports. The study also revealed that domestic companies are more R&D oriented than foreign companies. The positive correlation of R&D expenditure and exports has been found in Indian Pharmaceutical companies. For India to become a top player in the global pharmaceutical business, the government of India needs to support foreign investments in pharmaceuticals sector in order to overcome the stiff competition in the global pharmaceutical market.

Manisha Dr. Sandeep Kaur Bhatia

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Manisha

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List of Codes

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3.	54133	Tetracycline's and derivatives
4.	54139	Other antibiotics(bulk)
5.	54151	Insulin and its salts
6.	54152	Pituitary/hormones etc.
7.	54153	Cortisone derivatives
8.	54159	Other hormones/devices etc.
9.	54161	Glycosides and derivatives
10.	54162	Glands etc and extracts
11.	54163	Antisera/Blood fracture/Vaccine
12.	54164	Blood/Toxin/Cultures
13.	54211	Penicillin non retail
14.	54212	Antibiotic n.e.s non retail
15.	54213	Penicillin/Strept retail
16.	54219	Antibiotic n.e.s retail
17.	54221	Insulin formulated, bulk
18.	54222	Other hormones non retail
19.	54223	Insulin retail pack
20.	54224	Hormone ach retail pack
21.	54229	Hormone n.e.s retail pack

List of Abbreviations

Sr.No	Full Form	Abbreviation
1.	Centre for Monitoring Indian Economy	CMIE
2.	Compound Growth Rate	CGR
3.	Comprehensive Economic Partnership Agreements	CEPA
4.	Exclusive Market Rights	EMR
5.	Globel Lloyd Index	G-L
6.	Gross Domestic Product	GDP
7.	High Technology	HT
8.	Intra Industry Trade	IIT
9.	Non Essential Substances	n.e.s
10.	Organization for Economic Cooperation and Development	OECD
11.	Research and Development	R&D
12.	Revealed Comparative Advantage	RCA
13.	Revealed Symmetric Comparative Advantage	RSCA
14.	Standardize International Trade Classification	SITC
15.	Trade Related Intellectual Property Rights	TRIPS
16.	United Kingdom	UK
17.	United Nations Commodity Trade Database	UNCOMTRADE
18.	United States Of America	USA
19.	World Integrated Trade Solution	WITS
20.	World Trade Organization	WTO

Chapter 1
Introduction

Export promotion has been playing an important role in the economic growth of many countries since the 1960s. Now, diversification of a country's exports has become essential for easing the pressure on balance of payment situation and also for the growth of more viable and efficient agricultural and industrial sectors for balanced development. According to Dennis (2007), export diversification plays a significant role in the economic growth of the developing countries because terms of trade are always unfavorable for these countries as they are exporters of primary goods. According to Samen (2010), the pattern of economic development is allied with structural changes in exports and expansion of export diversification worldwide. With the phases of development, many developing countries started to shift from natural resources based and low technology exports to medium and high technology exports as these countries realized that dependency on exports of primary products would hinder their development process.

According to Alexander and Warwick (2011), countries should create and export those goods which are demanded by the other countries. In spite of whether countries produce primary goods or manufactured goods, it is the compatibility with world demand that will determine the extent to which a country's growth. The pattern of trade has been changed from finished products to intermediate and processing products. Different countries that specialized in different tasks have added value to the processing of products such as parts and components, imported for processing and assembly into semi-finished or finished products and re-exported to the global supply chain before they reach the final consumers (Ismail, 2013) .

According to Srholec (2010), over the past two decades, the global map of exports has changed dramatically due to the arrival on the market of high technology products from developing countries. The striking transformation in the export pattern has led economists to question whether the success of high technology exports from developing countries is real or just a 'statistical illusion'. Although some optimists consider it a positive signal that emerging economies are climbing up the ladder in

the global value chain and competing head-to-head with developed countries in high technology, some skeptics have pointed out that the expansion of the high technology exports from developing countries is largely due to their active participation in the labor-intensive processing stages within high-tech industries resulting from the international fragmentation of production (Dahai, 2010).

The analysis of exports growth and its overall economic effects has also been a significant topic in the economic literature over the last decades. However, more recently, the focus has turned to high-technology trade, as researchers attempt to understand the associations among innovation, high-tech international trade and overall economic performance (Eaton and Kortum, 2001; Spulber, 2008; Zhang, 2007; Falk, 2009). This growing interest is mostly due to the fact that international trade of high-technology goods provides information about the overall competitiveness and position of an economy within the technology global market. It also contributes to the understanding of how innovation affects comparative advantages on a dynamic economic environment and of the relative importance of high-technology on the international marketplace (Tebaldi, 2011).

For instance, Falk (2009) shows that the share of high-tech exports significantly impacts GDP growth. The share of developing countries in high technology exports is very large, but the majority of developed countries take no part in the export of high technology products because there is much variation in the technological capability of even the high technology exporting countries. At the one end of the spectrum are Korea and Singapore, which have the local capability to design, manufacture and export high technology items. Malaysia is somewhere in the middle, while Thailand and Philippines appear to be at the other end with low capability. However, the developing countries as a whole are fast catching up with the developed countries (Sunnil Mani, 2004).

Specialization in high technology products is frequently used to capture technology intensity of exports. These products play an important role in exporting of any country where as it may not be an important factor for underdeveloped country but it is more important for high developed countries as well as new emerging countries, because they are highly developed in technology development. Under

developed countries are importing these high developed technologies at higher cost from developing and emerging country, which shows the path of development of underdeveloped countries. High technology industries have a great dependence on science and technology innovation that leads to new or improved products and services. They generally have a substantial economic impact, fueled both by large research and development spending, and a higher than industry average sales growth. In addition, innovation demands a trained and talented workforce. The demand can serve the entire business community by drawing talent to the high technology companies, as well as by calling upon the resources of other companies and entrepreneurs in the region and beyond. Now- a –days companies grow up around the high technology enterprises and supplies such as raw materials, components, specialized technological expertise in design, marketing, and knowledge management, skilled sub-contractors, specialty in packaging, distribution, and transportation.

Developing countries are increasingly becoming exporters of high technology products, and some may even be among the most deeply specialized countries in the field of high technology exports. Specialization in high technology exports typically does not appear in tandem with indigenous technological capabilities in developing countries. Bulk of high technology exports can actually be attributed to the effect of increasingly international fragmentation of production systems in electronics on trade statistics. It is confirmed in an econometric framework that while domestic technological capabilities have some influence on export performance in electronics, it is the propensity to import electronics components that accounts for by far the largest proportion of cross-country differences in specialization in electronics export. Specialization in high-tech products is frequently used to capture technological intensity of exports (Srholec, 2007).

High technology products have advanced and fast-changing technologies, with high research and development investments and prime emphasis on product design (Lall S. , 2000). 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) basically involves highly skilled workers, advanced

technology, and high cost (Ismail, 2013). Products are divided into nine categories, namely Aerospace, Computers/Office Machine, Electronic-telecommunications, Pharmacy, Scientific Instruments, Electrical Machinery, Chemistry, Non-Electrical Machinery, and Armament. However, some products like electronics have labour-intensive final assembly, and their high value-to-weight ratios make it economical to place this stage in low wage areas. These products lead in new international integrated production systems where different processes are separated and located by Multinational Corporations (MNCs) according to fine differences in production costs. Separate Harmonized trade 1, electronic and electrical products from Harmonized trade 2, other high-technology products. Apart from electronics, other high-technology products (generating equipment, aircraft, precision instruments and pharmaceuticals) remain rooted in economies with high levels of skills, technology and supplier networks (Lall S. , 2000).

European Union's definition of high technology products (2012), the commodities namely Aerospace items, Computers-office machines, Electronics-telecommunications items, Pharmacy products, scientific instruments, Electrical machineries, on electrical machineries and Chemicals armaments comprise the same (Pohit, 2012). Organization for Economic Cooperation and Development (OECD, 2005) has developed a four way classification-high technology, medium technology, medium low technology and low technology .The classification is based on the importance of expenditure on research and development relative to the gross output and value added of different types of industries that produce goods for exports. India's Technological Classification of Indian Manufacturing Industry is presented in Table 1.1

Table 1.1: Technological Classification of Indian Manufacturing Industry

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

Source: Revision of the high-technology sector and product classification 1997.

Like other countries, India's export growth is also associated with economic growth. In an effort to put its economy on a path of rapid and sustained growth, India embarked on a process of economic reform and progressive integration with the global economy in 1991. India has undertaken a series of economic reforms towards opening up of the economy in the decade of the nineties. Notable among these has been the extensive effort to liberalize its international trade. It is therefore expected that trade liberalization in India would have led to changes in the composition of exports so as to reflect her comparative advantage in the global economy. Reduction of trade barriers creates competitive pressures and the potential for technology transfer so as to lead to productivity gains and restructuring of an economy toward its comparative advantage (Batra and Khan, 2005).

Export performance enhanced during the post-1991 years and the global map of exports has changed significantly due to the arrival on the market of high-technology products from developing countries (Srholec, 2007). High technology

goods trade provides information about the overall competitiveness and position of an economy within the technological global market (Tebaldi, 2011).

One of the objectives of launching of the economic reforms was that it would facilitate access to new technology. It is also believed that Indian economy would become more innovative with economic reforms. Modern growth theory acknowledges that a country's economic prosperity large part depends on its capacity for technological innovation (Basu, 2012). Although, India is progressive on the path of development, yet its export shares in the global market are still very small, with a modest increase in export of medium- and high- technology products (Nayak, 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 per cent in the case of Brazil, 25.81 per cent in the case of China, 31.44 per cent in the case of Israel & Japan and 43.39 and 45.16 per cent in the case of Malaysia and Singapore. Some of the areas where India is making impact are computer software, automobiles and auto components and pharmaceuticals.

The total market size of pharmaceuticals for entire regions in the world has been US $ 874.6 billion (audited and un-audited) in the year 2010 and it is expected to grow by 25% in 2014 with an expected value of US$ 1093.72 billion and for year 2015, the expected pharmaceutical market size is US$ 1159.34 billion considering at a maximum growth rate of 6% from 2014 (Dr.Appaji, 2012). The Indian pharmaceutical sector has come a long way, from being almost non-existent before 1970 to an outstanding supplier of healthcare products at present (Kodgule, 2012). 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. The Pharmaceutical industry has grown from mere US$ 0.3 billion turnover in 1980 to about US$ 21.73 billion in 2009-10. The country now ranks 3rd in terms of volume of production (10 per cent of global share) and 14th largest by value (Greene, 2007). The core strength of Indian pharmaceutical industry today is its huge export potential. The industry is making adequate returns from the domestic sales but bulk of its profits come from the export of generics and active pharmaceutical ingredients to the developed markets. The industry has been exporting more than half of its total

production, which is estimated to be more than 20 billion dollars currently. In 2010, India exported $10.3 billion worth of pharmaceutical products, registering 17.5% growth over 2009. By March 2012, pharmaceutical exports from the country have touched a growth of 20%. The largest export destination continues to be the USA, followed by the UK, Germany, South Africa, and Russia (Kodgule, 2012).

Significance of the study

Today is the world highly competitive, each country is trying to increase its exports by exporting high technology products and improve its ranking in the world trade. As India is no exception to this. There is a need to analyze the trends and patterns of India's high technology exports. Among other high technology sectors, India has greater advantage in pharmaceutical sector .Therefore; the study has tried to examine the composition and direction of pharmacy products of India with her top two partners from 1991-2012. An attempt is also made to study the issues of TRIPS with respect to India's pharmaceutical sector. Even though a number of studies have been done in the way of export performance of high technology goods sector in India, but only a few studies have examined the competitiveness of pharmaceutical components in India's exports which is the largest sector amongst high technology commodities. Therefore, keeping in view the above literature gap, the present study attempts to carry out the following objectives to contribute to the literature and provide further knowledge about the subject.

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 its top two export partners over the period of 1991 to 2012.
3. To analyze the Indian competitiveness and intra-industry trade of pharmaceutical products with its top two partners.
4. To study the issues of TRIPS with respect to India's pharmaceutical exports.

Plan of the Present Study: The present study is planned into six chapters including present one. Second Chapter reviews various studies related to theme of the study. Third Chapter deals with data and methodology used for analyzing the theme of study. In other words, it demonstrates sources of data and different indices used to know the trade potential of India with selected countries. Chapter 4 analyses the growth and performance of India's high technology exports by focusing pharmaceutical exports since liberalization period. The results obtained from various trade indices are discussed in this chapter. Chapter 5th describes the important issues of TRIPS on Indian pharmaceutical exports. To end with, Chapter 6 is an attempt to summarize the findings of the study. It also includes some possible suggestions for policy building to get better India-USA and Russian Federation trade ties in pharmaceutical products.

Chapter 2
Review of Literature

The purpose of literature review is to offer an overview of significant literature published on the theme of study. Several studies have examined the export performance of India's high-tech products, particularly of pharmaceutical components as they are contributing most part of export value of high-tech products of India. In this context, an attempt has been made to review the related studies in chronological order by dividing them in two sections. Section one highlights the post liberalized studies pertained to overall high technology product exports of India with rest of the world. Section two is meant for reviewing the studies which have been sequentially carried out in view of the export of pharmaceutical components of India.

I

Kumar (2003) analyzed the trends and patterns of export competitiveness in Indian manufacturing in the 1990s. In the global context it is found that high technology exports are highly concentrated in the industrialized courtiers. 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 the study suggests that the technology profile of Indian manufacturing has not changed significant still it is contributed by low and medium low technology industries. Secondly, outward investment is a strategic tool to achieve export competitiveness in general and in particular in high technology industries.

Chadha (2007) investigated the product cycle and neo-technology theories of trade in the context of Indian generic pharmaceuticals. The study analyzed the export performance of 131 Indian pharmaceutical firms for the period 1989-2004. The results of the study revealed that a technology proxy by foreign patent rights has a positive impact on exports. This suggests that developing countries with innovation skill for process innovations are capable of penetrating international markets in the later stages of the product cycle by using patent, which were barriers to trade in the early stages of the product cycle. This study has also found that the export market is

substantially dynamic and that the results have significant implications for government policy. Innovations do not merely reflect the extent of technological opportunity, but are a strategic tool for gaining market share in world markets. In high-technology sector like pharmaceuticals, large profit making and innovating firms are found to have greater potential to enter export market .Thus, it is an opportune time for developing countries like India to diversify their exports.

Lakshmann (2007) attempted to analyze the India's exports from 1995-96 to 2006-07. In his study, the author has found that India's manufacturing sector is becoming increasingly integrated with the global economy and the world GDP is positively affecting India's manufacturing exports. It is found that India is one of the leading producers and exporters in respect of various commodities as also the country enjoys significant advantages in terms of lower labor costs as compared to other emerging economies. However, the study has brought out that India's performance in manufacturing sector is not as impressive as that of other comparable emerging economies. This could have largely been attributed to lesser export orientation coupled with low technology exports of Indian manufacturing sector. The author has recommended for further diversifying India's export basket towards high value goods such as office and telecom equipments, high technology goods, etc. to improve India's competitiveness.

Pranav (2009) investigated the structure of India's technology intensive exports and found that India plays a dominant role on drugs and pharmaceutical and electronic goods in high tech sector. Exports of high tech services like Information technology enabled services are found to have emerged as a noteworthy sector. Between the years 2002-03 and 2007-08, the proportion of low-tech export was found to have declined from 66 to 56 percent. Against this, the share of medium and high-tech is found to have risen to 30 from 22 percent and from 7 to 14 percent. Moreover, it has been concluded that the drugs and pharmaceutical and electronics goods dominate in high-tech export sector in India. The study further concludes that technological capabilities into higher level of high technology exports required high level of coordination and policy interventions. It is suggested that, India might require greater level of coordination and policy interventions to translate the technological

capabilities into higher level of high-tech exports by taking advantage of expanding markets in this sector.

Lall (2009) examined the performance of developing countries manufactured exports, and provided a comprehensive mapping of the technological structure and performance of manufactured exports. The study has explained that many developing countries between 1985 and 1998 became exporters of high-technology products. The study has concluded that the outstanding performance in high-technology exports observed in developing countries might be 'something of a statistical illusion' resulting from their specialization in the labor-intensive processes within high-technology intensive industries. East Asia is found to dominate the scene with 70% of developing world manufactured exports.

Fu *et. al.,* (2010) examined the effect of innovation on export decision in Chinese high-tech firms during the period of 2005-2007. Using a parametric instrumental variable approach and a non-parametric matching method, the study found that the firm-level innovation efforts, measured by research and development spending and new product output play only a minor role for domestic exporters. It was also found that the foreign-invested firms dominate the high-tech exports but do not rely on indigenous innovation activities. In their study it was concluded that the innovation showed irregular trend across the industries. Moreover, the authors have concluded that the different types of innovation measures showed different impacts on the likelihood of exporting. The impact of innovation on exporting was observed to vary widely across industries and Chinese regions.

Basu (2012) examined the India's pattern of high technology merchandise exports over the last 10 years. The study has found that India's performance on the high technology manufacturing export front is not too impressive. The author has concluded that India is a small player in most of the product categories excluding the pharmacy sector. It was found that in last 10 years' period, India has not been able to increase her presence significantly in most of the segments. The study suggested raising the pharmacy sector which is the most advantageous in terms of foreign exports from India. Further, the study has also recommended strengthening the

innovation support mechanism which has been weakened through government's initiation.

Nayak *et. al.,* (2013) analyzed the high technology exports of India by classifying OECDs of manufacturing industries based on technology intensity and RCA trade indicator has been used to analyze the revealed comparative advantage of the technology intensive exports. The study has analyzed that although there has been slow shift from low technology intensive exports to medium-low technology intensive exports in India, but the dominance of low technology intensive exports still persist. The study has highlighted incentivizing the high technology intensive exports as a concern for the policy makers. It has been recommended that the government should take initiative of providing support for in-house R&D efforts that would help manufacturing industries to reach global market.

II

Prasad and Bhat (1993) examined and concluded that India's pharmaceutical sector was quite competitive and the prices might be affected mainly due to decontrol of prices rather than introducing product patents. The authors have concluded that there has been no need to fear granting product patents by India in the pharmaceutical sector, considering imports as tantamount to working patent's could be accepted; duration of patents could be left for mutual bargaining and pipeline protection could be used as a bait for cancelling or reducing pipeline protection of developed countries in sectors like textiles. The study has suggested that the administration of the patents has to be streamlined and Patents Act has to be modified. Moreover, greater importance to R&D and substituting non patented drugs for patented drugs were called for in the pharmaceutical sector. In conclusion, the authors have said that the patents regime has to be strengthened on the lines suggested by their study to promote greater transfer of technology and join the process of international harmonization without forsaking India's interests. It is also suggested that the sector-specific studies for other sectors are the need of the hour.

Joseph (2009) estimated and showed that there has been a decline in the growth rate of exports of intermediates bulk drugs and formulations, which

accounted for 90.8 per cent of the export of drugs and Pharmaceuticals from India in 2006-07, in the post 1999- 2000 period, during which the monopoly rights of the inventor got protected in India. On the other hand, Bulk drugs, other drugs and pharmaceutical products have shown an increase in the growth of exports under the new patent regime; but they are found to constitute only one-tenth of total drugs and Pharmaceuticals exported from India. The trends in the growth of imports were found to more disturbing. The growth rates of import of almost the entire drugs and Pharmaceuticals (inter- mediates and bulk drugs, bulk drugs and formulations accounting for 97.3 per cent of imports) are found to have increased in the post-1999-2000 period. The author has concluded that the rates of growth show a declining trend in the exports front and an increasing trend in the imports front have long-term adverse implications for the balance of trade in drugs and pharmaceuticals which was already running into deficits. The findings of the study have confirmed the apprehension that changes in the patent regime would adversely affect India's trade in drugs and pharmaceuticals - exports may decline and imports will increase.

Dhar and Gopakumar (2006) tried to provide a detailed template of a possible developing country patent regime. In other words, they have concluded that the countries must be prepared to make course corrections while they are implementing their TRIPS-consistent laws. It is found that for countries like India having matured pharmaceutical industries, the challenges are even more formidable. Besides engaging in a constant process of reviewing the newly amended Patents Act, India would have to take complementary measures to ensure that the firms are not able to secure benefits that run contrary to the realization of the fundamental objective of access to medicines at affordable prices. A legal regime for preventing misuse of patent monopoly would be an essential component of such measures. In this regard, the authors have suggested that India needs to go a fair distance given that the Competition Law of the country, which was enacted in 2002, contains explicit provisions to exclude intellectual property laws. But above all, it is believed that the developing countries would need to ensure that their TRIPS-consistent patent laws provide a balance of rights and obligations. While several of the obligations would be

country-specific, in authors view, inclusion of obligations for ensuring the realization of the objective of access to medicines at affordable prices would remain the touchstone of their patent laws.

Rau and Appaji (2011) examined the export performance of Indian pharmaceutical companies, and it was observed that Indian pharmaceutical companies were best utilizing and framing strong forecast strategies for export business. The authors have concluded that a few companies were well established with intellectual property, regulatory and market forecast strategies when compared to total number of companies established in India as manufactures. It has been assumed that the contribution of India pharmaceutical industry for exports may increase by involving new exports to new countries. Moreover, the major implication of the study is to understand that the common inspection, filing procedures accepted among regions, countries may help the industry a faster growth.

Kodgule (2012) in a study entitled “Growth of Indian Pharmaceutical Industry: Impact of Indian, US and European Patent Laws and Regulatory Requirements”, has examined that after nearly 30 years of focusing inward, India’s pharmaceutical industry has emerged as a global player. The study has stated that the Indian pharmaceutical industry’s emergence on the global platform as a strong generic player was due, in no small measure, to the development and enforcement of different Patent regimes from time to time as per the need of that era. It has also been mentioned that although India shifted to the product patent regime in 2005, the capabilities developed during the past two decades became a competitive advantage for the Indian Pharma industry in the 1990s, when the rising healthcare costs in many developed countries forced them to seek the cheaper generic drug option. Thus, the Indian Pharmaceutical industry was able to capitalize the enormous generic opportunity that was spawned. Moreover, it has been mentioned that the increase in exports resulted due to the changing regulatory and patent scenario worldwide in favor of generics.

Thus from above studies, India’s high technology exports are increasing, though its performance is not too impressive. Drugs and pharmaceutical goods begin to dominate in high-tech export sector in India. Even though a number of studies

have done in this field of export performance of high technology goods sector in India, but a few studies have examined the competitiveness of pharmaceutical components in India's exports which is the largest industry of high technology sector. The present study has tried to fill this gap by analyzing the Indian competitiveness in this sector.

Chapter 3
Data and Methodology

This chapter 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 has been taken from the following different sources:

1. Data for India high technology exports 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 data base 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). It is also more critically reviewed by Lapadre (2001). The index has been calculated at the sector and commodity level using SITC-5 (revision-3) digit level classification. This classification is based on OECD definition, contains technical products of which the manufacturing involved a high intensity of R&D.

Table 3.1: Classification of Pharmaceutical Products

Sr.no.	SITC CODE	Commodity Name
1.	54131	Pencillines and derivatives
2.	54132	Streptomycin's and derivatives
3.	54133	Tetracycline's and derivatives
4.	54139	Other antibiotics(bulk)
5.	54151	Insulin and its salts
6.	54152	Pituitary/hormones etc.
7.	54153	Cortisone derivatives
8.	54159	Other hormones/devices etc.
9.	54161	Glycosides and derivatives
10.	54162	Glands etc and extracts
11.	54163	Antisera/Blood fracture/Vaccine
12.	54164	Blood/Toxin/Cultures
13.	54211	Penicillin non retail
14.	54212	Antibiotic n.e.s non retail
15.	54213	Penicillin/Strept retail
16.	54219	Antibiotic n.e.s retail
17.	54221	Insulin formulated, bulk
18.	54222	Other hormones non retail
19.	54223	Insulin retail pack
20.	54224	Hormone ach retail pack
21.	54229	Hormone n.e.s retail pack

The RCA indicates whether a country is in the process of extending the products in which it has export potential, as opposed to situation in which the number of products that can be trade prospects with new partners. Countries with similar RCA profiles are unlikely to have high bilateral 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 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 world total 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 specialization in that commodity (Balassa, 1977).

In present study, RCA has been calculated for Indian pharmaceutical exports to USA and Russia.

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

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 country is specialized in that particular sector (Burange, 2008). Dalum et al. (1998) suggested 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)

This measure varies between -1 and +1 commodity is said to have comparative advantage in its exports if the corresponding RSCA value is positive and vice versa. In the present study, the RSCA is also used.

Intra – Industry Trade (IIT):

Intra Industry trade arises if a country, in same period of time, 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.

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

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) points out, this measurement of IIT will be affected by the size of the overall trade imbalance of the country. The greater the imbalance the greater will be the share of net trade and smaller share of IIT (Bruhart, 1995; Stone, 1995). IIT is driven by economies of scale and commodity gains. By being engaged in IIT, a country can reduce the number of similar commodities 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 (Parvakar, 2009).

It is based on the Grubel-Lloyd (G-L) formula; G-L index for bilateral trade is used to find out the intra- industry trade between India and USA and Russian Federation. It is a modified form used by Sahoo (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.

$$Y = AB^t$$

Where *A* and *B* are parameters, *Y* is dependent variable and *t* is time variable.

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 data base. There are nearly 5000 manufacturing firms in Bombay Stock Exchange (BSE) which are filtered on the basis of two steps as first exclude those firms which have zero or less than zero sales during any year of study period, secondly, there is exclusion of all those firms which have nil foreign equity in any year of study period. These companies are mentioned in Table 3.2.

Table 3.2: Selection of Indian Pharmaceutical Companies

Sr. No.	Name of the Company
1.	Hester Biosciences Ltd.
2.	Gujarat Themis Biosyn Ltd.
3.	Ranbaxy Laboratories Ltd.
4.	Cipla Ltd.
5.	Pfizer Ltd.
6.	Sanofi India Ltd.
7.	GlaxoSmithKline Pharmaceuticals Ltd.
8.	Merck Ltd.
9.	Wyeth Ltd.
10.	AstraZeneca Pharma India Ltd.
11.	Abbott India Ltd.
12.	Zenotech Laboratories Ltd.
13.	Resonance Specialties Ltd.
14.	Novartis India Ltd.
15.	Vista Pharmaceuticals Ltd.
16.	Kerala Ayurveda Ltd.
17.	Wanbury Ltd.
18.	Fermenta Biotech Ltd.
19.	Themis Medicare Ltd.
20.	Capsugel Healthcare Ltd.

Chapter 4

Growth and Performance of India's High Technology Exports: An Analysis of Pharmaceutical Products

Countries are now shifting from natural resources based and low technology exports to medium and high technology as countries those completely depends on exports of primary products face constraints in the long run development process (Nayak, 2013). India is no exception of this. Therefore, this chapter is an attempt to study the growth of India's high technology exports with the world since 1991. India has the highest share of pharmaceutical products among the high technology exports; therefore this chapter has focused towards pharmaceutical products with top two markets i.e. USA and Russia federation. The first part of the chapter presents an overview of high technology exports with the world. The second section discusses the trends of India's pharmaceutical exports and their competitiveness with its top two markets.

Table 4.1 depicts the growth and share of different components of India's high technology exports to the World for the period of 1991 to 2012. India's exports of computer office machines to World have increased from US$ 146554.18 thousand in 1991 to US$ 4994401.995 thousand in 2012 while its share has been declined from 10.8 percent to 4.99 percent during the same period. The export of scientific instruments has increased from US$ 26506.96 thousand in 1991 to US$ 1018081 in 2012 and its share has also increased from 4.77 percent to 10.28 percent for the same period. Indian aerospace exports to world have also increased from US$ 18274.01 thousand in 1991 to US$ 25103.65 thousand in 2012. Similarly, electronic telecommunication export values have increased from US$ 1939925 thousand to US$ 332199.4 thousand for the same period. The percentage share of aerospace exports has increased from 3.29 percent in 1991 to 19.59 percent in 2012, but the export share of electronic telecommunication has decreased from 4.52 percent to 3.36 percent during the same period. Even though the Indian exports of chemistry and non electronic machinery has increased from US$ 223272 thousand and US$

27977.082 thousand in 1991 to US$ 1886630 and US$ 233228.452 thousand respectively in 2012 but their export shares have tremendously decreased from 40.22 percent and 5.04 percent in 1991 to 19.06 percent and 2.36 percent in 2012 respectively. India's exports of armaments, electrical machinery and pharmacy to world have increased from US$ 180.572 thousand, US$ 42248.5 thousand and US$ 131142.43 thousand in 1991 to US$ 35234.872 thousand, US$ 233157.536 thousand and US$ 3727534 thousand respectively in 2012, but the share of electrical machinery has decreased from 7.61 percent in 1991 to 2.36 percent in 2012. On the other hand, the share of armaments and pharmacy products has increased from 0.03 percent and 23.62 percent in 1991 to 0.36 percent and 37.65 percent respectively in 2012, implying the highest share of pharmaceutical Indian exports among all categories of high technology exports.

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 found to be maximum 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 4.1, pharmaceutical products seem to be most important in terms of value as well as extent.

Table 4.1: India's High Technology Exports with World

(US$ Thousands)

Year	Computer office Machines	Scientific Instruments	Aerospace	Electronics Tele-com's	Chemistry	Non Electrical Machinery	Armaments	Electrical Machinery	Pharmacy	Total
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)	555149.3
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)	605956.1
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)	698559.4
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)	861404.5
1995	217242.911 (18.18)	30743.33 (2.57)	10057.6 (0.84)	229700.06 (19.22)	340698.9 (28.51)	28363.113 (2.37)	324.507 (0.03)	13865.273 (0.65)	323828.56 (27.10)	1194824
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)	1209451
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)	1325869
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)	1007571
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)	1213898
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)	1506264
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)	1816634
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)	1903265
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)	2253285

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Year	Computer office Machines	Scientific Instruments	Aerospace	Electronics Tele-com's	Chemistry	Non Electrical Machinery	Armaments	Electrical Machinery	Pharmacy	Total
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)	2549383
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)	3326358
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)	3819724
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)	5112407
2008	354813.511 (4.63)	471756.8 (6.15)	1726497 (22.52)	333957.5 (4.36)	1573699 (20.53)	383090.719 (5.00)	43528.586 (0.57)	109302.257 (1.68)	2669985 (34.83)	7666630
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)	6305123
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)	7918883
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)	8640323
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)	9900393
Compound Growth Rate	**10.91**	**12.02**	**12.66**	**11.16**	**11.07**	**11.54**	**12.59**	**11.66**	**11.78**	-
Average share	**12.10**	**5.57**	**6.31**	**4.36**	**30.51**	**4.15**	**0.22**	**1.87**	**34.92**	-

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

Note: Values in parentheses shows the percentage share of different sections.

Table 4.2 depicts the direction and volume of India's pharmaceutical exports with its top ten exporting countries. It can be seen that, India's pharmaceutical exports with the US has been increased from US$ 27116 thousand in 1991 to US$ 3137276 thousand in 2012 and its share has also been increased from 21.86 percent to 55.79 percent during the same period. India's exports to Russian federation started in 1992 after the solution of Soviet Union. Russian Federation entered into the importing partners of India's pharmacy products in 1992 with US$ 49761 thousand imports and has increased to US$ 490932 thousand in 2012, while the percentage share declined from 23.80 percent to 8.73 percent for the same study period. In case of United Kingdom, it is found that India's pharmaceutical exports has increased from US$ 12624 thousand in 1991 to US$ 395117 thousand in 2012 while its percent share has declined from 46.70 percent to 4.78 percent during the same period. Similarly, Nigeria imports from India have increased from US$ 17653 thousand to US$ 287755 thousand for the same period. Its percent share has decreased from 14.23 percent in 1991 to 5.12 percent in 2012. Even though Indian pharmaceutical exports to Germany, South Africa, Brazil, Vietnam has increased from US$ 57926 thousand, US$1 thousand, US$ 512 thousand and US$ 985 thousand in 1991 to US$ 269.31 thousand, US$ 315593 thousand, US$ 203849 thousand and US$ 17495 thousand respectively in 2012. Their percentage shares have increased from 46.7 percent, 0 percent, 0.41 percent and 0.79 percent in 1991 to 4.78 percent, 5.61 percent, 3.63 percent and 3.11 percent in 2012 respectively.

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. India's exports of pharmaceuticals to Ukraine have increased from US$ 5620 thousand in 1993 to US$ 165652 thousand in 2012 and its share has also been marginally increased from 2.25 percent to 2.74 percent during the same period. India's exports of pharmaceutical products to Netherland have also been increased from US$ 7219 thousand in 1991 to US$ 181365 thousand in 2012 while its percent share has declined from 5.82 percent to 3.26 percent during the same period.

From Table 4.2, 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 destination 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. Germany is the third major importing country of India's pharma products with an average share of 12.78 percent, followed by Nigeria (10.08 percent) United Kingdom (4.76 percent), Netherlands (4.60 percent), Vietnam (4.55 percent), Ukraine (7.48 percent), Brazil (4.39 percent) and South Africa (4.22 percent) in total pharmaceutical exports of India during 1991 to 2012. The compound growth rate of South Africa indicates to be maximum i.e.14.26 percent followed by Brazil (13.09 percent), US (12.59 percent), Ukraine (12.16 percent), Vietnam (12.03), UK (11.99 percent), Nigeria (11.31 percent), Netherlands (11.19), Russian federation (11.10 percent) and Germany (10.67 percent) during the study period.

Table 4.2: 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	Total Trade
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)	124035.7
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)	209091.3
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)	249344.9
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)	292133
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)	339327.5
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)	378572.5
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)	417259.7
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)	345045.6
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)	430526
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)	449222.1
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)	578519.9

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Year	United States	Russian Federation	United Kingdom	Nigeria	Germany	South Africa	Brazil	Vietnam	Ukraine	Netherlands	Total Trade
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)	687796.6
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)	862762.9
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)	997573.4
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)	1168750
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)	1520642
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)	2164115
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)	2626325
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)	2813683
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)	3581478
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)	4886199
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)	5622938
Compound Growth Rate	**12.59**	**11.1**	**11.99**	**11.31**	**10.67**	**14.24**	**13.09**	**12.03**	**12.16**	**11.19**	
Average Share	**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:** Values in parentheses shows the percentage share of different countries in India's High Technology Product exports and (–) indicates no trade.

Table 4.3 shows the India's exports of pharmaceutical products to USA for the period of 1991 to 2012. The exports of 'Pencillines and their derivatives' (54131) was US$ 60 thousand in 1992 has increased to U$ 8789 thousand in 2012 while its percent share declined from 5.42 percent to 1.65 percent during the same period. Throughout the study period its value shows irregular fluctuations, sometime as high as US$ 64069 thousand in 2009 and sometime as low as US$ 60 thousand in 1991. Export of 'Streptomycin's and derivatives' (54132) have also been increased from US$ 3 thousand to US$ 299 thousand but its percent share increased marginally i.e. 0.00 percent to 0.06 percent for the same study period. Similarly, most of the pharmaceutical products have been increased with an irregular manner such as exports of 'Tetracycline's and derivatives' (54133) has been increased US$ 66 thousand in 1991 to US$ 376 thousand in 2012 and its percentage share has also increased from 0.93 percent to 1.65 percent for the same period. Exports of 'Other antibiotics (bulk)' (54139) has been registered of an account of US$ 190 thousand in 1991 (17.61 percent share) which increased to US$ 32647 thousand in 2012 (6.14 percent share). Thus, its percentage share declined sharply during the study period. India's 'Insulin and its salts' (54151) exports to USA found of an amount of US$ 35 thousand in 1993, increased to US$ 32647 thousand in 2012 and its percent share also increased from 1.66 percent to 6.14 percent. Exports of 'Pituitary/hormones etc.' (54152) have also been increased from US$ 253 thousand in 1998 to US$ 4076 thousand in 2012 but its percentage share value has declined from 2.44 percent to 0.76 percent during the same period. For 'Cortisone derivatives' etc. (54153), there has been no exports to US till 1997 India started export of this pharmaceutical product in 1998 with US$ 21 thousand. Its exports to US remained negligible in various years of study period. The other pharmaceutical products like 'Other hormones/devices etc.' (54159), 'Glands etc and extracts' (54162), 'Antisera/blood fracture/vaccine' (54163) and 'Blood/Toxin/Cultures' (54164) has recorded exports of an amount of US$ 171 thousand, US$ 6 thousand, US$ 66 thousand and US$ 92 thousand respectively in 1991 and has increased to US$ 7233 thousand, US$ 6177 thousand, US$ 2264 thousand and US$ 2494 thousand respectively in 2012 (with the percent share of 1.58 percent, 0.52 percent, 6.12 percent and 8.53 percent in 1991 to

0.10 percent, 0.42 percent, 0.46 percent and 1.69 percent in 2012 respectively). 'Glycosides and derivatives' (54161), 'Insulin formulated bulk' (54221), 'Hormone ach retail pack' (54224) and 'Hormone n.e.s retail pack' (54229) exports of these pharmaceutical products started in the different years, such as 'Glycosides and derivatives' (54161) exports started on 1999 as it was US$ 1.25 thousand in 1999 and has increased to US$ 4113 thousand during the same period of study while its average percent share has also been increased from 1.17 percent to 4.82 percent for the same period. 'Antisera/blood fracture/vaccine' (54163) has recorded exports amounted to US$ 20 thousand in 1996, which increased to US$ 242 thousand in 2012. Its percentage share has 0.20 percent to 4.03 percent for the same period. 'Hormone ach retail pack' (54224) exports have been started in 2011 as it was US$ 28 thousand in 2011 and has increased to US$ 2 thousand in 2012. 'Hormone ach retail pack' (54229) export value was US$ 97 thousand in 1992 and has increased to US$ 35357 thousand in 2012 while its percentage share has declined from 8.82 percent to 6.65 percent during the period.

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', 'Antibiotic n.e.s retail', 'Penicillin/Strept retail' and 'Antibiotic 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 'Antibiotic 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), 'Antibiotic n.e.s non retail' (6.61). These are important commodities in India's exports to USA throughout the period.

Table 4.3: India's Pharmaceutical Exports to USA

(US$ Thousands)

Year	54131	54132	54133	54139	54151	54152	54153	54159	54161	54162	54163	54164	54211	54212	54213	54219	54221	54222	54223	54224	54229	Total
1991	NT	NT	NT	190 (17.61)	NT	NT	NT	171 (1.58)	NT	6 (0.56)	66 (6.12)	92 (8.53)	5 (0.46)	39 (3.61)	626 (58.02)	17 (1.58)	NT	10 (0.93)	11 (1.02)	NT	NT	1079
1992	60 (5.45)	NT	NT	28 (2.55)	NT	NT	NT	NT	NT	NT	NT	94 (8.55)	6 (0.55)	NT	449 (40.82)	346 (31.45)	NT	NT	20 (1.82)	NT	97 (8.82)	1100
1993	219 (10.3)	NT	NT	426 (20.20)	35 (1.66)	NT	NT	NT	NT	NT	NT	237 (11.24)	6 (0.28)	NT	464 (22.00)	461 (21.86)	NT	NT	NT	NT	261 (12.3)	2109
1994	109 (2.34)	NT	NT	426 (9.14)	18 (0.39)	NT	NT	NT	NT	24 (0.51)	205 (4.4)	261 (5.60)	24 (0.51)	718 (15.40)	1485 (31.86)	1019 (21.86)	NT	104 (2.23)	NT	NT	268 (5.75)	4661
1995	653 (9.22)	NT	NT	813 (11.47)	NT	NT	NT	28 (0.40)	NT	209 (2.95)	566 (7.99)	289 (4.08)	27 (0.28)	378 (5.33)	2504 (35.34)	1489 (21.01)	NT	81 (1.14)	49 (0.69)	NT	NT	7086
1996	1175 (12.0)	NT	NT	1474 (15.05)	NT	NT	21 (0.21)	70 (0.71)	NT	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)	NT	NT	369 (3.77)	9795
1997	239 (3.37)	NT	66 (0.93)	701 (9.87)	NT	NT	NT	450 (6.34)	NT	717 (10.1)	1033 (14.55)	408 (5.75)	692 (9.75)	12 (0.17)	1187 (16.72)	1433 (20.18)	NT	11 (0.15)	NT	NT	152 (2.14)	7101
1998	673 (6.48)	NT	11 (0.11)	1466 (14.11)	NT	253 (2.44)	NT	92 (0.89)	NT	936 (9.01)	716 (6.89)	252 (2.43)	142 (1.37)	NT	2213 (21.30)	3158 (30.40)	NT	71 (0.68)	1 (0.01)	NT	404 (3.89)	10388
1999	1066 (9.96)	NT	176 (1.64)	1726 (16.13)	NT	NT	8 (0.07)	202 (1.89)	125 (1.17)	117 (3.31)	951 (8.89)	5 (0.05)	NT	NT	1555 (14.53)	4664 (43.59)	20 (0.19)	20 (0.19)	NT	NT	65 (0.61)	10700
2000	752 (3.39)	3 (0.00)	66 (0.3)	389 (1.75)	NT	NT	NT	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)	NT	296 (1.33)	5950 (26.8)	NT	NT	22189
2001	1456 (2.21)	10 (0.01)	30 (0.05)	2424 (3.69)	NT	NT	5 (0.01)	1443 (2.20)	3672 (5.59)	183 (5.59)	1099 (1.67)	21 (0.03)	485 (0.74)	0	6732 (10.24)	8014 (12.19)	NT	38069 (57.9)	2 (0.00)	NT	2095 (3.19)	65740
2002	213 (3.41)	41 (0.02)	126 (0.2)	5697 (9.12)	NT	5 (0.01)	16 (0.03)	3158 (5.05)	583 (0.93)	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	NT	2581 (4.13)	62493
2003	1026 (1.16)	1 (0.07)	95 (0.11)	7886 (8.90)	36 (0.04)	NT	73 (0.08)	409 (0.46)	572 (0.65)	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)	NT	1610 (1.82)	88569
2004	1333 (1.10)	0 (0.00)	15 (0.01)	4084 (3.37)	1130 (0.93)	NT	34 (0.03)	706 (0.58)	238 (0.20)	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)	NT	730 (0.60)	121149

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Year	54131	54132	54133	54139	54151	54152	54153	54159	54161	54162	54163	54164	54211	54212	54213	54219	54221	54222	54223	54224	54229	Total
2005	2101 (1.24)	NT	NT	10542 (6.23)	485 (0.29)	4 (0.00)	170 (0.10)	2208 (0.23)	388 (1.04)	1754 (0.80)	1362 (0.01)	16 (2.63)	4443 (2.63)	21404 (12.65)	20870 (12.33)	41105 (24.29)	82 (0.05)	3808 (2.25)	58456 (34.5)	NT	NT	169198
2006	2031 (1.12)	3 (0.00)	NT	9687 (5.35)	98 (0.05)	6 (0.00)	853 (1.21)	2190 (0.07)	135 (0.17)	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)	NT	1813 (1.00)	181000
2007	10292 (2.62)	NT	NT	16362 (4.16)	NT	37 (0.01)	37 (0.01)	1480 (0.34)	1353 (0.17)	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)	NT	5629 (1.43)	393489
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)	592 (0.32)	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)	NT	8720 (2.31)	377826
2009	64069 (14.8)	37 (0.01)	176 (0.04)	18022 (4.16)	450 (0.10)	NT	2897 (0.67)	1242 (0.04)	165 (0.58)	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)	NT	11026 (2.55)	432705
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)	466 (0.57)	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)	NT	6205 (1.55)	401018
2011	21363 (3.97)	131 (0.02)	606 (0.11)	47125 (8.75)	7 (0.0)	NT	9426 (1.75)	7233 (0.10)	558 (1.15)	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)	28 (0.0)	5940 (1.10)	538340
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)	4113 (4.82)	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)	2 (0.0)	35357 (6.65)	531307
CGR	**13.08**	**16.60**	**11.16**	**13.34**	**11.41**	**8.43**	**18.42**	**12.96**	**10.32**	**13.01**	**10.73**	**11.33**	**14.60**	**13.61**	**12.65**	**14.82**	**15.49**	**15.93**	**19.06**	**0.71**	**13.53**	
Average Share	**4.84**	**0.02**	**0.16**	**8.76**	**0.20**	**0.11**	**0.39**	**1.31**	**0.71**	**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.

Note: Values in parentheses shows the percentage share of different countries in India's High Technology Exports and 'NT' indicates no trade.

Table 4.4 portrays the India's import values of pharmaceutical products from USA for the period of 1991 to 2012. It can be seen that among all other pharmaceutical products, the India's imports from USA of 'Pencillines and derivatives' (54131) has increased from US$ 3056 thousand in 1991 to US$ 3116 thousand in 2012 while its percentage share has been declined sharply i.e.18.25 percent to 1.66 percent during the same period. In case of other products 'Streptomycin's and derivatives' (54132), India's imports from USA started in 1992 with US$ 58 thousand in 1992 and has increased to US$ 197 thousand in 2012 and its share declined marginally i.e. from 0.28 percent to 0.11 percent for the same period. For the 'Cortisone derivatives' (54133), imports from USA has increased from US$ 55 thousand in 1991 to US$ 246 thousand in 2012 its percentage share also marginally declined from 0.33 percent to 0.13 percent for the same period. For 'Other antibiotics' (54139), imports from USA have increased from US$ 7174 thousand in 1991 to US$ 31467 thousand in 2012 and its percentage share has declined sharply from 42.85 percent to 16.78 percent during the same period.

Similarly, imports of 'Insulin and its salts' (54151) shows increasing trend with an irregular manner for the same period that is US$ 92 thousand in 1991 increased to US$ 246 thousand in 2012 at the same and its percentage share has been 0.55 percent in 1991 to 1.98 percent respectively. The imports of 'Pituitary/hormone etc.' (54152) remain negligible throughout the study period. For 'Cortisone derivatives' (54153) imports has been US$ 212 thousand in 1993 which increased to US$ 1742 thousand in 2012 with percentage share of 0.05 percent in 2012. Similarly, for the 'Other hormones/devices etc.' (54159) product, imports have increased from US$ 58 thousand to US$ 197 thousand in 2012 but its percent share has also been declined 7.92 percent to 1.87 percent for the same period. The imports of 'Glycosides and derivatives' (54161) has been US$ 2 thousand in 1991 to US$ 1154 thousand in 2012 while its percentage share has increased marginally from 0.01 percent to 0.62 percent during the same period. For 'Glands etc and extracts', import value has been US$ 115 thousand in 1991 which increased to US$ 185 thousand in 2012 as its percentage share has been 0.69 percent to 0.27 percent for the study period.

Imports of ‘Antisera/blood fracture/vaccine’ (54163) has been recorded of US$ 378 thousand in 1992 which increased to US$ 117831 thousand in 2012 its percentage share has increased sharply from 2.26 percent to 62.83 percent. Imports of ‘Blood/Toxin/Cultures’ have been found of US$ 289 thousand in 1991 to US$ 12134 thousand in 2012 and its percent share has increased from 1.73 percent to 6.47 percent during the study period. For ‘Insulin formulated, bulk’ (54211) product import value has increased from US$ 2 thousand in 1991 to US$ 537 thousand in 2008. Imports of ‘Insulin formulated, bulk’ (54212) has declined from US$ 169 thousand in 1991 to US$ 50 thousand in 2012 and so its percent share has also been declined from 1.01 percent to 0.02 percent for the same period. Similarly, ‘Penicillin/strept retail’ (54213) and antibiotic n.e.s retail (54219) product reached at a level of US$ 54213 thousand and US$ 201 thousand in 1991 respectively increased to US$ 29963 thousand and US$ 6895 respectively thousand in 2012 and their percent share has also been increased 0.05 percent and 1.20 percent in 1991 to 13.34 percent and 3.07 percent respectively.

Same is the case of other pharmaceutical products, imports of ‘Other hormones non retail’ (54222) and ‘Hormone ach retail pack’ (54224) fluctuated at a higher level. In case of ‘Insulin formulated, bulk’ (54221) product imports value has been found of US$ 364 thousand increased to US$ 4 thousand in 2004 and after that India does not import from USA. Similarly for ‘Hormone ach retail pack’ (54229) products import value is of US$ 2 thousand in 1991 increased sharply to US$ 5014 thousand in 2012. Its percent share increased sharply from 0.01 percent to 2.67 percent during the period. Among all pharmaceutical commodities imported by India from USA, ‘Other antibiotics (bulk)’ has the highest average share (44.87 percent) followed by ‘Antibiotics n.e.s non retail’ (33.40), ‘Antisera/blood fracture/vaccine’ (19.97 percent) ‘Other hormone/devices etc.’ (7.22 percent), ‘Blood/Toxin/Cultures’ (6.14 percent), ‘Penicillin and their derivatives’ (5.62), ‘Insulin and its salts’ (4.13 percent) and ‘Penicillin/strept retail’ (3.01 percent).

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), ‘Antibiotic 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 import pattern of India pharmaceutical products from USA.

Table 4.4: India's Pharmaceutical Imports from US

(US$ Thousands)

SITC CODE	54131	54132	54133	54139	54151	54152	54153	54159	54161	54162	54163	54164	54211	54212	54213	54219	54221	54222	54223	54224	54229	Total Trade
1991	3056 (18.25)	NT	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)	16743
1992	676 (3.31)	58 (0.28)	146 (0.71)	10894 (53.34)	NT	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)	NT	40 (0.20)	7 (0.03)	38 (0.19)	3 (0.01)	193 (0.94)	100 (0.49)	20425
1993	3185 (17.23)	NT	NT	7661 (41.45)	279 (1.51)	NT	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)	NT	87 (0.47)	NT	95 (0.51)	7 (0.04)	18483
1994	2518 (11.44)	NT	3 (0.01)	13258 (60.23)	204 (0.93)	NT	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)	NT	25 (0.11)	NT	42 (0.19)	107 (0.49)	22011
1995	3238 (8.45)	126 (0.33)	46 (0.12)	11607 (30.30)	340 (0.89)	NT	1554 (4.06)	2155 (5.62)	100 (0.26)	25 (0.07)	1675 (4.37)	16563 (43.23)	NT	35 (0.09)	146 (0.38)	541 (1.41)	NT	60 (0.16)	61 (0.16)	NT	41 (0.11)	38313
1996	3460 (19.37)	204 (1.14)	7 (0.04)	8475 (47.46)	1253 (7.02)	NT	360 (2.02)	1669 (9.35)	5 (0.03)	6 (0.03)	1392 (7.79)	539 (3.02)	NT	1 (0.01)	63 (0.35)	417 (2.33)	1 (0.01)	NT	NT	NT	7 (0.04)	17859
1997	3693 (11.11)	5 (0.02)	29 (0.09)	15279 (45.96)	1479 (4.45)	NT	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)	NT	12 (0.04)	127 (0.38)	NT	157 (0.47)	33246
1998	2223 (7.48)	NT	NT	20076 (67.58)	NT	NT	262 (0.88)	2817 (9.48)	38 (0.13)	43 (0.14)	2835 (9.54)	616 (2.07)	NT	NT	15 (0.05)	215 (0.72)	NT	450 (1.51)	59 (0.20)	NT	60 (0.20)	29709
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)	NT	353 (1.64)	26 (0.12)	2 (0.01)	10 (0.05)	NT	NT	10 (0.05)	21543
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)	NT	NT	653 (3.53)	873 (4.72)	1 (0.01)	9 (0.05)	2 (0.01)	NT	58 (0.31)	18490
2001	240 (1.30)	4 (0.02)	0	9965 (53.87)	1266 (6.84)	NT	135 (0.73)	1980 (10.70)	33 (0.18)	71 (0.38)	1860 (10.06)	1856 (10.23)	12 (0.06)	NT	477 (2.58)	230 (1.24)	NT	4 (0.02)	NT	NT	365 (1.97)	18498
2002	1631 (5.35)	NT	18 (0.06)	14072 (46.16)	123 (0.40)	NT	NT	3730 (12.24)	81 (0.27)	183 (0.60)	6947 (22.79)	1753 (5.75)	5 (0.02)	NT	1677 (5.50)	103 (0.34)	NT	34 (0.11)	9 (0.03)	NT	117 (0.38)	30483
2003	1127 (2.79)	0	0	22611 (56.00)	3715 (9.20)	NT	904 (2.24)	3602 (8.92)	157 (0.39)	1 (0.00)	3977 (9.85)	867 (2.15)	2 (0.00)	NT	1504 (3.72)	74 (0.18)	3 (0.01)	254 (0.63)	NT	215 (0.53)	1367 (3.39)	40380
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	NT	394 (0.91)	43227

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YEAR	54131	54132	54133	54139	54151	54152	54153	54159	54161	54162	54163	54164	54211	54212	54213	54219	54221	54222	54223	54224	54229	Total Trade
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)	NT	566 (1.07)	NT	106 (0.20)	1523 (2.89)	52657
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)	NT	203 (0.32)	69 (0.11)	304 (0.49)	787 (1.26)	62638
2007	8 (0.01)	2 (0.00)	1 (0.00)	41393 (43.60)	9969 (10.50)	NT	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)	NT	299 (0.31)	70 (0.07)	85 (0.09)	1430 (1.51)	94947
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)	NT	958 (0.77)	554 (0.45)	NT	4104 (3.32)	123658
2009	208 (0.14)	9 (0.01)	6 (0.00)	47276 (31.29)	8708 (5.76)	NT	1596 (1.06)	570 (0.38)	506 (0.33)	547 (0.36)	68095 (45.07)	5010 (3.32)	NT	13 (0.00)	7074 (4.68)	4568 (3.02)	NT	631 (0.42)	3 (0.00)	0 (0.00)	6272 (4.15)	151092
2010	532 (0.31)	7 (0.00)	66 (0.04)	59053 (34.30)	6049 (3.51)	NT	1126 (0.65)	1316 (0.76)	679 (0.39)	631 (0.54)	74747 (43.07)	5811 (3.38)	NT	NT	5279 (3.07)	6888 (4.00)	NT	1094 (0.64)	2 (0.00)	1 (0.00)	8878 (5.16)	172159
2011	4789 (2.13)	847 (0.38)	237 (0.11)	55569 (24.74)	10398 (4.63)	NT	1804 (0.80)	3573 (1.59)	635 (0.28)	1206 (0.10)	87823 (39.10)	6644 (2.96)	NT	50 (0.02)	29963 (13.34)	NT	NT	167 (0.07)	6130 (2.73)	20 (0.01)	7843 (3.49)	224593
2012	3116 (1.66)	197 (0.11)	246 (0.13)	31467 (16.78)	3722 (1.98)	NT	841 (0.45)	3511 (1.87)	1154 (0.62)	185 (0.27)	117831 (62.83)	12134 (6.47)	NT	NT	NT	12.94	NT	476 (0.25)	7641 (4.07)	0 (0.00)	5014 (2.67)	187535
CGR	**9.01**	**9.71**	**10.30**	**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**	
Average 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.

Note: Values in parentheses shows the percentage share of different countries in India's High Technology Product imports and 'NT' indicates that there is no trade.

Table 4.5 shows the India's exports of pharmaceutical products to Russian Federation (US$ thousand) from 1992 to 2012. It is clear from the table that India's total exports increased from US$ 3945 thousand in 1992 to US$ 5235 in 2012 for 'Penicillin and derivatives' (54131) product but its percent share declined 2.54 percent to 0.16 percent during the study period. Their exports to Russian Federation have continuously increased during the period. In case of 'Streptomycin's and their derivatives' (54132), exports have been found of US$1 thousand in 1991 increased to US$ 576 thousand in 2012. Exports of 'Tetracycline's and their derivatives' (54133) found of US$ 38 thousand in 1994, which increased to US$ 1924 thousand in 2012 while its percent increased from share 0.02 percent to 0.06 percent for the same period. Exports of 'Other antibiotics, bulk' (54139) had the value of US$ 13270 thousand in 1991 which increased to US$ 54992 thousand in 2012. Although its percent share declined sharply from 8.76 percent to 1.70 percent during the study period. Exports of 'Insulin and its salts' (54151) amounted US$ 13 thousand in 1991, which increased to US$ 9381 thousand in 2012 and its percent share increased from 0.01 percent to 0.29 percent for the same period. Exports of 'Pituitary glands' (54152) product have value of US$ 5 thousand in 1993, increased to US$ 3 thousand in 2012. Exports of 'Cortisone derivative' (54153) product have increased from US$ 212 thousand in 1993 to US$ 1742 thousand in 2012 with share of 0.17 percent to 0.05 percent for the same period. Exports of 'Other hormones/devices etc.' (54159) have found of US$ 213 thousand in 1993 which increased to US$ 1470 thousand in 2012 as its percent share declined from 0.57 percent to 0.05 percent for the same period. 'Glycosides and derivative' (54161) have US$ 219 thousand in 1991, which increased to US$ 9551 thousand in 2012 and also its percent share has been increased from 0.14 percent to 0.30 percent. For 'Glands etc. and extracts' (54162) value of export had US$ 56 thousand in 1992 which increased to US$ 36546 thousand in 2012 and its percent share increased from 0.36 percent to 1.13 percent during the period. Exports of 'Antisera/blood fracture/vaccine' (54163) recorded of US$ 2004 thousand in 1991 and increased to US$ 1183404 thousand in 2012 and its percent share has also been increased sharply from 1.29 percent to 36.64 percent for the same period. Exports of 'Blood/Toxin/Cultures' (54164) product by India to

Russia of an amount registered US$ 1547 thousand and US$ 296487 thousand in 2012 and its percent share increased from 1.00 percent to 9.18 percent during same period. Exports of 'Penicillin/strept retail' (54213) has been of US$ 15048 thousand in 1992 and US$ 155896 thousand in 2012 for the same period. Exports of 'Antibiotic n.e.s retail' (54219) has increased from US$ 43508 thousand in 1992 to US$ 620402 thousand in 2012 while its percent share has declined from 28.05 percent to 19.52 percent for the same study period. Exports of 'Insulin formulated, bulk' (54221) has accounted of US$ 4 thousand in 1992 and reached at a level of US$ 251 thousand in 2012 but its percent share increased marginally from 0.00 percent to 0.01 percent. 'Other hormones non retail' (54222) has exports value of US$ 1843 thousand in 1992, increased to US$ 6562 thousand in 2012 while its percent share has been declined from 1.19 percent to 0.21 percent for the same study period. 'Insulin retail packs' (54223) recorded US$ 41315 thousand exports in 1992 which further increased to US$ 218735 thousand in 2012 with percent share of 26.64 percent to 6.88 percent during the same period. Exports of 'Hormones ach retail pack' (54224) product increased from US$ 9774 thousand in 1992 to US$ 262462 thousand in 2012 while its percent share increased 6.30 percent to 8.53 percent and 'Hormones n.e.s retail pack' (54229) has been of US$ 19549 thousand in 1992 increased to US$ 276285 thousand but its percent share declined from 12.60 percent to 8.55 percent for the same period.

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 'Antibiotic 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 4.5: India's Pharmaceutical Exports to Russian Federation

(US$ Thousands)

Year	54131	54132	54133	54139	54151	54152	54153	54159	54161	54162	54163	54164	54211	54212	54213	54219	54221	54222	54223	54224	54229	Total Trade
1992	3945 (2.54)	1 (0.0)	NT	13270 (8.56)	13 (0.01)	NT	NT	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 (0.00)	1843 (1.19)	41315 (26.64)	9774 (6.30)	19549 (12.60)	155102.3
1993	1402 (1.11)	NT	NT	3160 (2.51)	NT	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)	125885.3
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)	191049.8
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)	NT	5160 (3.03)	25689 (15.10)	15619 (9.18)	18940 (11.13)	170102.2
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)	227026
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)	270640.3
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)	219326.1
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)	198354.3
2000	8037 (2.72)	109 (0.02)	475 (0.16)	11328 (3.84)	515 (0.17)	0 (0.00)	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)	295030.4
2001	8558 (1.95)	100 (0.01)	541 (0.12)	10400 (2.37)	747 (0.17)	NT	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)	NT	6290 (1.43)	114536 (26.05)	38028 (8.65)	69960 (15.91)	439654
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)	NT	8058 (2.30)	42361 (12.10)	34578 (9.88)	56379 (16.10)	350123.2
2003	7181 (1.61)	111 (0.07)	282 (0.06)	11426 (2.56)	9 (0.00)	NT	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)	NT	24272 (5.45)	52293 (11.74)	41245 (9.26)	72387 (16.24)	445598.6
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)	NT	14675 (2.57)	73652 (12.90)	55380 (9.70)	95874 (16.79)	571001.1

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Year	54131	54132	54133	54139	54151	54152	54153	54159	54161	54162	54163	54164	54211	54212	54213	54219	54221	54222	54223	54224	54229	Total Trade
2005	4813 (0.59)	93 (0.01)	410 (0.05)	14862 (1.81)	8 (0.00)	NT	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)	821399.9
2006	5938 (0.45)	130 (0.01)	313 (0.02)	17362 (1.33)	417 (0.03)	NT	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)	NT	8605 (0.66)	89601 (6.84)	101750 (7.77)	200599 (15.32)	1309244
2007	4764 (0.33)	143 (0.01)	798 (0.06)	27044 (1.88)	2264 (0.16)	NT	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)	1437938
2008	2739 (0.13)	18 (0.00)	121 (0.01)	27363 (1.33)	1670 (0.08)	NT	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 (0.0)	13925 (0.68)	131410 (6.38)	159701 (7.75)	208858 (10.14)	2060151
2009	3706 (0.19)	201 (0.01)	391 (0.02)	41202 (2.16)	2849 (0.15)	NT	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)	NT	3241 (0.17)	120433 (6.31)	176177 (9.23)	252783 (13.25)	1908051
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 (0.0)	6523 (0.27)	197671 (8.14)	200786 (8.27)	259488 (10.69)	2428426
2011	6874 (0.22)	1106 (0.03)	1443 (0.05)	66184 (2.08)	5449 (0.17)	NT	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)	3178138
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 (0.00)	2446 (0.08)	204467 (6.33)	275397 (8.53)	276285 (8.55)	3230004
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**	
Average 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.

Note: Values in parentheses shows the percentage share of different countries in India's High Technology Product exports and 'NT' indicates no trade.

Table 4.6 depicts India's imports of pharmaceutical products from Russia Federation during 1992 to 2012. India's imports of pharmaceutical product of 'Penicillin and their derivatives' shows the fluctuating trend sometime as high US$ 4264 thousand in 2000 and US$ 4070 in 1996 and sometime as low as US$ 26 thousand in 2011. It is clear that overall imports of 'Penicillin and their derivatives' have decreased throughout the study period, as it is evident from the import Table 4.6 that its value decreased from US$ 470 thousand in 1992 to US$ 26 thousand in 2011. After 2002, India got specialization in this product and do not import this product from Russian federation. However in 2011, India again imports of US$ 26 thousand while its percent share was 87.42 percent declined to 0.82 percent of this product from Russian federation and currently India has no imports from Russian federation.

However, imports of India of 'Other antibiotics (bulk)' product increased from US$ 34 thousand in 1991 to US$ 772 thousand in 2012 as its percent share increased sharply from 8.02 percent to 76.09 percent for the same study period. Imports of product 'Pituitary/hormones etc.' were only of US$ 190 in 1997 after that India got specialization in this product. Similarly import value of products 'Cortisone derivatives' and other 'Hormones/devices etc.' in 1996 has been US$ 830 thousand and US$ 46 thousand having average share of 0.08 per cent and 0.14 per cent respectively. After that, commodities were not imported. 'Glands etc. and extract' imports value has been of US$ 21 thousand in 1991 to US$ 236 thousand while its percent share is of 4.84 percent which sharply increased and reached a level of 23.41 percent respectively. In case of 'Blood/Toxin/Cultures' product, imports were of US$ 2 thousand in 1991, increased to US$ 7 thousand in 2012 and its percent share declined 1.65 percent to 0.70 percent for the same study period. Imports of 'Antibiotic n.e.s non retail' product are of US$ 1 thousand in 2004 and reached a level of to US$ 25 thousand in 2006 as its percent share has been accounted of 0.35 percent in 2006.

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 per cent) followed by ‘Pencillines and derivatives’ (29.27 percent) and ‘Glands etc and extracts’ (20.04 percent). And others have very less average share in imports. ‘Blood/Toxin/Cultures’, ‘Antibiotic 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.

Table 4.6: India's Pharmaceutical Imports from Russian Federation

(US$ Thousands)

Year	54131	54139	54152	54153	54159	54162	54164	54219	54221	54222	54223	54229	Total Trade
1992	370 (87.14)	34 (8.02)	NT	NT	NT	21 (4.84)	NT	NT	NT	NT	NT	NT	424.63
1993	1023 (58.14)	720 (40.95)	NT	NT	NT	NT	NT	NT	16 (0.91)	NT	NT	NT	1758.85
1994	1133 (95.29)	36 (3.06)	NT	NT	NT	NT	20 (1.65)	NT	NT	NT	NT	NT	1188.83
1995	1729 (77.63)	498 (22.37)	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	2227.37
1996	4070 (78.46)	980 (18.89)	NT	83 (1.61)	46 (0.89)	8 (0.15)	NT	NT	NT	NT	NT	NT	5187.77
1997	2141 (37.55)	3245 (56.90)	190 (3.33)	NT	NT	39 (0.68)	NT	NT	NT	88 (1.54)	NT	NT	5702.36
1998	467 (8.71)	4686 (87.38)	NT	NT	NT	210 (3.92)	NT	NT	NT	NT	NT	NT	5362.65
1999	2633 (53.67)	1874 (38.21)	NT	NT	NT	398 (8.11)	NT	NT	NT	NT	NT	NT	4904.88
2000	4264 (68.21)	1431 (22.89)	NT	NT	NT	557 (8.90)	NT	NT	NT	NT	NT	NT	6252.23
2001	1485 (25.43)	2677 (45.85)	NT	NT	NT	1676 (28.71)	NT	NT	NT	NT	NT	NT	5837.32
2002	840 (23.67)	1874 (52.82)	NT	NT	72 (2.02)	763 (21.49)	NT	NT	NT	NT	NT	NT	3548.72

Contd…

Year	54131	54139	54152	54153	54159	54162	54164	54219	54221	54222	54223	54229	Total Trade
2003	NT	736 (33.91)	NT	NT	NT	1342 (61.82)	93 (1.28)	NT	NT	NT	NT	NT	2170.14
2004	NT	2588 (89.53)	NT	NT	NT	300 (10.37)	2 (0.06)	1 (0.04)	NT	NT	NT	NT	2890.72
2005	NT	2743 (75.70)	NT	NT	NT	827 (22.83)	1 (0.04)	20 (0.54)	NT	NT	32 (0.88)	NT	3623.40
2006	NT	5290 (82.36)	NT	NT	NT	1107 (17.24)	3 (0.05)	22 (0.35)	NT	NT	NT	NT	6422.99
2007	NT	5384 (87.03)	NT	NT	NT	802 (12.97)	NT	NT	NT	NT	NT	NT	6186.48
2008	NT	8507 (92.40)	NT	NT	NT	695 (7.55)	5 (0.05)	NT	NT	NT	NT	NT	9206.79
2009	NT	1760 (62.98)	NT	NT	NT	1034 (37.02)	NT	NT	NT	NT	NT	NT	2793.93
2010	NT	17 (4.24)	NT	NT	NT	394 (95.76)	NT	NT	NT	NT	NT	NT	410.97
2011	26 (0.82)	1346 (42.01)	NT	NT	NT	1772 (55.31)	13 (0.40)	NT	NT	NT	NT	47 (1.46)	3204.13
2012	NT	772 (76.09)	NT	NT	NT	236 (23.21)	7 (0.70)	NT	NT	NT	NT	NT	1015.10
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.
NT: indicate that there is no trade in that year.

Trade Competitiveness of India with the US and Russian Federation

Trade specialization of 21 pharmaceutical products of India with US and Russia Federation is examined through various indices i.e. Revealed Comparative Advantage (RCA), Revealed Symmetric Comparative Advantage (RSCA) and Grubel-Lloyd index (G-L). These indices enable to find out the goods where India's competitiveness lies.

Revealed Comparative Advantage (RCA)

Revealed comparative advantage is one of the most applied tools to measure the export competitiveness. "*It is defined as the share of particular products in a country's total exports to the share of the exports products in world's total exports*" (Balassa b. , 1965). Table 4.7 shows India's Revealed Comparative Advantage in Pharmaceutical products with United States of America for the period of 1991 to 2012. During 1991-1995, among 21 pharmaceutical products, India has the greatest RCA with US in 'Insulin and Its Salts' (12.73) followed by 'Antibiotics n.e.s non retail' (5.22) and 'Penicillin/strept retail' (3.70) while during 1996-2000, the highest RCA of India with US is found for Insulin formulated, bulk (46.15). Similarly, during 2001-2005 'Other hormones non retail' has the highest revealed comparative advantage (57.71) followed by 'Antibiotic n.e.s non retail' with RCA value of 38.71 and 'Penicillin non retail' (25.66). During 2006-10, India has registered great extent of competitive advantage for 'Insulin formulated bulk' i.e. 50.10 which is increased by 1.01 percent in 2006-12. 'Pencillines and derivatives' also show an increasing trend as its RCA value increased from 0.30 in 1991-95 to 16.54 in 2006-12.The RCA value of many pharmaceutical products shows decreasing trend except 'Pencillines and derivatives', 'Streptomycin's and derivatives', 'Other antibiotics (bulk)', 'Pituitary/hormones etc.', 'Cortisone derivatives', 'Blood/Toxin/Cultures', 'Penicillin non-retail', 'Penicillin/strept retail', 'Antibiotic n.e.s retail' and 'Hormone ach retail pack' in 2006-12 as compared to 2006-2010. It may be due to global financial crisis and implementation of TRIPS agreement in India (Ghosh, 2009) . It is clear that India has greater advantage for 'Insulin formulated bulk' followed by 'Penicillin non retail' and 'Other hormones non retail' throughout 2000-2012. The commodity 'Streptomycin's and derivatives', 'Tetracycline's and derivatives', 'Pituitary/hormones etc.', 'Cortisone derivatives',

'Glycosides and derivatives' and 'Insulin formulated, bulk' maintained more advantage as compared to 'Hormone ach retail pack' could not achieve advantage during study period.

Table 4.7: Revealed Comparative Advantage of Pharmaceutical Products of India with US

SITC code	Name of the Product	1991-1995	1996-2000	2001-2005	2006-2010	2006-2012
54131	Pencillines and derivatives	0.30	0.84	1.54	17.37	16.54
54132	Streptomycin's and derivatives	-	0.26	1.44	3.53	3.43
54133	Tetracycline's and derivatives	-	0.18	0.07	0.06	0.14
54139	Other antibiotics(bulk)	0.11	0.27	0.85	2.94	2.74
54151	Insulin and its salts	12.73	-	4.52	1.38	6.99
54152	Pituitary/hormones etc.	-	6.91	0.00	0.08	0.07
54153	Cortisone derivatives	-	0.04	0.02	0.43	0.59
54159	Other hormones/devices etc.	0.25	0.26	1.29	0.59	0.90
54161	Glycosides and derivatives	-	1.66	2.40	0.52	0.63
54162	Glands etc and extracts	0.11	0.44	0.38	0.32	0.79
54163	Antisera/Blood fracture/Vaccine	0.09	0.15	0.07	0.01	0.01
54164	Blood/Toxin/Cultures	0.71	0.46	0.04	0.25	0.23
54211	Penicillin non retail	0.10	0.97	25.66	30.38	33.16
54212	Antibiotic n.e.s non retail	5.22	0.99	38.71	18.97	14.29
54213	Penicillin/strept retail	3.70	7.08	6.57	8.79	8.33
54219	Antibiotic n.e.s retail	0.34	1.00	5.19	14.68	13.45
54221	Insulin formulated, bulk	-	46.15	2.57	50.19	51.42
54222	Other hormones non retail	1.95	2.08	57.71	42.63	30.61
54223	Insulin retail pack	0.06	6.10	2.14	0.76	0.89
54224	Hormone ach retail pack	-	-	-	-	0.00
54229	Hormone n.e.s retail pack	0.20	0.05	0.13	0.31	0.39

Source: Calculated from World Integrated Trade Solution (**WITS**), 2012. **Note**: '-' Indicates that the either the data was not available or there has no export in the corresponding period.

Revealed Symmetric Comparative Advantage (RSCA): After analyzing the top pharma products of India with US and Russian federation, there is a need to analyze the problem of asymmetry because RCA is basically not comparable on both sides of unity. "*It ranges from one to infinity for commodities in which a country reveals comparative advantage, but only from zero to one for products which reveal comparative disadvantage. This asymmetry creates problems in the study of specialization patterns of trade*" (Lapadre, 2001).

Table 4.8 depicts RSCA with USA for pharmaceutical products during 1991-1995, 1996-2000, 2001-2005, 2006-2010 and 2006-2012. In 1991-1995, India has great extent of symmetric competitive advantage index with 'insulin and salts' (0.85) in 1991-95 followed by 'Antibiotic n.e.s non retail' (0.68), Penicillin/Strept Retail (0.57) and 'Other hormones non-retail' (0.32). Remaining pharmaceutical products namely 'Pencillines and derivatives' (-0.54), 'Other antibiotics (bulk)' (-0.80), 'Other hormones/devices etc.' (-0.60), 'Glands etc. and extracts' (-0.81), 'Antisera/Blood fracture/Vaccine' (-0.83), 'Blood/Toxin/Cultures' (-0.17), 'Penicillin non retail' (-0.82), 'Antibiotic n.e.s retail' (-0.49), 'Insulin retail pack' (-0.88) and 'Hormone n.e.s retail pack'(-0.67) have revealed symmetric comparative disadvantage for the same study period. Perfect symmetric disadvantage has also been found in 'Streptomycin's and derivatives', 'Tetracycline's and derivatives', 'Pituitary/hormones etc.', 'Cortisone derivatives', 'Glycosides and derivatives', 'Insulin formulated, bulk' and 'hormone n.e.s retail pack' for the same period. Highest symmetric competitive advantage index is found in 'Insulin formulated, bulk' (0.96) followed by 'Penicillin non retail' (0.94), 'Penicillin and derivatives' (0.89), 'Antibiotic n.e.s non retail' (0.87), 'Penicillin/Strept Retail' (0.79) and 'Insulin and its salts' (0.75). Pharmaceutical products namely 'Streptomycin's and derivatives', 'Other antibiotics (bulk)', 'Penicillin non retail', 'Antibiotic n.e.s non retail', 'Antibiotic n.e.s retail' and 'Insulin formulated, bulk' gained as they came to status from disadvantage to advantage throughout the study period. Some pharmaceutical products namely 'Tetracycline's and derivatives', 'Pituitary/hormones etc.' 'Cortisone derivatives', 'Other hormones/devices etc.' 'Glycosides and derivatives', 'Glands etc. and extracts', 'Antisera/blood

fracture/vaccine', 'Blood/toxin/cultures', 'Hormone ach retail pack' and 'Hormone n.e.s retail pack' could not achieve symmetric advantage status.

Table 4.8: Revealed Symmetric Comparative Advantage of Pharmaceutical Products of India with US

SITC code	Name of the Product	1991-1995	1996-2000	2001-2005	2006-2010	2006-2012
54131	Pencillines and derivatives	-0.54	-0.09	0.21	0.89	0.89
54132	Streptomycin's and derivatives	-1.00	-0.58	0.18	0.56	0.55
54133	Tetracycline's and derivatives	-1.00	-0.70	-0.87	-0.89	-0.75
54139	Other antibiotics(bulk)	-0.80	-0.57	-0.08	0.49	0.46
54151	Insulin and its salts	0.85	-1.00	0.64	0.16	0.75
54152	Pituitary/hormones etc.	-1.00	0.75	-0.99	-0.85	-0.88
54153	Cortisone derivatives	-1.00	-0.92	-0.96	-0.40	-0.25
54159	Other hormones/devices etc.	-0.60	-0.59	0.13	-0.26	-0.05
54161	Glycosides and derivatives	-1.00	0.25	0.41	-0.32	-0.23
54162	Glands etc and extracts	-0.81	-0.39	-0.45	-0.51	-0.12
54163	Antisera/Blood fracture/Vaccine	-0.83	-0.74	-0.86	-0.97	-0.98
54164	Blood/Toxin/Cultures	-0.17	-0.37	-0.93	-0.60	-0.63
54211	Penicillin non retail	-0.82	-0.02	0.92	0.94	0.94
54212	Antibiotic n.e.s non retail	0.68	-0.01	0.95	0.90	0.87
54213	Penicillin/strept retail	0.57	0.75	0.74	0.80	0.79
54219	Antibiotic n.e.s retail	-0.49	0.00	0.68	0.87	0.86
54221	Insulin formulated, bulk	-1.00	0.96	0.44	0.96	0.96
54222	Other hormones non retail	0.32	0.35	0.97	0.95	0.94
54223	Insulin retail pack	-0.88	0.72	0.36	-0.13	-0.06
54224	Hormone ach retail pack	-1.00	-1.00	-1.00	-1.00	-1.00
54229	Hormone n.e.s retail pack	-0.67	-0.91	-0.76	-0.53	-0.44

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

Table 4.9 shows India's revealed Comparative Advantage in Pharmacy Sector with Russian federation from the period of 1992 to 2012. In 1992-1995, India has greater RCA with Russian federation in 'Insulin formulated, bulk' (28.01) followed by 'Other hormones non retail' (24.36), 'Penicillin non retail' (17.58), Blood/Toxin/Cultures (16.98), 'Glands etc. and extracts' (11.39), 'Antibiotic n.e.s non retail' (10.21), 'Penicillin and derivatives' (7.85), 'Cortisone derivatives' (5.40), 'Other antibiotics (bulk)' (4.17)' 'Hormones n.e.s retail pack' (3.76), 'Insulin retail pack' (1.44). Highest comparative advantage have accounted in 'Other hormones non retail' (189.58) in the 2006-2010. While in 2006-2012, India has again registered great extent of competitive advantage for 'Other hormones non retail' with 170.3. 'Antibiotic n.e.s non retail' shows tremendous increase from 10.21 in 1991-1995 to 121.96 in 2006-2012. Value of RCA has decreased from 2006-10 to 2006-2012 for all products except 'Insulin and its salts', 'Penicillin/strept retail', 'Hormone ach retail pack' and 'Hormone n.e.s retail pack'. This decrease is due to the impact of global financial crisis. During 1996-2005, the products namely 'Pencillines and derivatives', 'other antibiotics (bulk)', 'Penicillin non retail', 'Antibiotic n.e.s retail', 'Other hormones non retail' and 'Hormone n.e.s retail pack' have come into the category of higher comparative advantage. But during 2006-2012, 'Pituitary/hormones etc.' and 'Insulin formulated, bulk came in under specialization. From the above description of Table 4.9, highest comparative advantage of India with Russian federation is in the 'Insulin formulated bulk' during 1992-2005. Since 2005, other pharmaceutical products namely 'Penicillin and derivatives', 'Streptomycin's and derivatives', 'Other antibiotics (bulk)', 'Insulin and its salt', 'Penicillin non retail', 'Antibiotic n.e.s non retail', 'Penicillin/strept retail', 'Insulin formulated, bulk' and 'Other hormones non retail' gained its position.

Table 4.9: Revealed Comparative Advantage of Pharmaceutical Product of India with Russian Federation

SITC code	Name of the Product	1992-1995	1996-2000	2001-2005	2006-2010	2006-2012
54131	Pencillines and derivatives	7.85	15.95	16.05	47.62	34.69
54132	Streptomycin' and derivatives	0.00	2.32	0.00	6.62	4.73
54133	Tetracycline's and derivatives	0.00	0.17	0.00	0.65	0.47
54139	Other antibiotics(bulk)	4.17	7.84	14.51	10.95	8.98
54151	Insulin and its salts	0.00	0.00	0.00	0.00	0.56
54152	Pituitary/hormones etc.	0.00	0.85	0.00	0.00	0.00
54153	Cortisone derivatives	5.40	0.84	6.37	10.89	8.13
54159	Other hormones/devices etc.	0.53	3.10	0.55	2.22	1.58
54161	Glycosides and derivatives	0.00	0.09	0.00	0.00	0.03
54162	Glands etc and extracts	11.39	6.99	38.02	12.06	8.66
54163	Antisera/Blood fracture/Vaccine	0.66	0.30	2.15	3.76	2.70
54164	Blood/Toxin/Cultures	16.98	14.26	0.83	0.64	0.47
54211	Penicillin non retail	17.58	24.28	72.23	90.13	67.07
54212	Antibiotic n.e.s non retail	10.21	10.09	39.86	169.25	121.96
54213	Penicillin/strept retail	15.99	12.61	9.29	12.01	16.57
54219	Antibiotic n.e.s retail	1.87	4.24	11.96	17.29	15.55
54221	Insulin formulated, bulk	28.01	2821.06	178.93	0.00	0.00
54222	Other hormones non retail	24.36	50.76	116.15	189.58	170.31
54223	Insulin retail pack	1.44	3.09	1.95	2.06	2.03
54224	Hormone ach retail pack	0.00	0.00	0.00	0.18	0.28
54229	Hormone n.e.s retail pack	3.76	3.77	3.81	8.15	10.37

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

Table 4.10 shows India's RSCA with Russian federation during 1992-2012 like RCA results. The highest RSCA value during is of 'Insulin formulated, bulk' (0.93) followed by 'Other hormones non retail' (0.92), 'Blood/Toxin/Cultures' (0.89), 'Glands etc. and extracts' (0.84), 'Antibiotic n.e.s non retail' (0.82), 'Penicillin and derivatives' (0.77), 'Cortisone derivatives' (0.69), 'Other antibiotics(bulk)' (0.61)' 'Hormones n.e.s retail pack' (0.58), 'Insulin retail pack' (0.18) during 1992-1995. The highest RSCA value is of 'Other hormone non retail' (0.99) followed by 'Antibiotic n.e.s non retail' (0.98), 'Penicillin non retail' (0.97), 'Penicillin and derivatives (0.94), 'Penicillin/ strept retail' (0.89), 'Hormone n.e.s retail pack' (0.82), 'Antibiotic n.e.s retail' (0.88), 'Other antibiotics(bulk)' (0.80), 'Glands etc and extract' (0.79) and 'Cortisone derivative' (0.78) during 2006-2012.

It is clear from the above analysis that greater RSCA value with Russian federation has been in the 'Pencillines and derivatives', 'Penicillin non retail', 'Antibiotic n.e.s non retail', 'Antibiotic n.e.s retail' and 'Other hormones non retail' throughout the study period. Some products 'Insulin and salts', 'Pituitary/hormones etc.', 'Glycosides and derivatives' and 'Hormone ach retail pack' cannot maintain its status. But 'Other hormones/devices etc.' and 'Antisera/blood fracture/vaccine', are able to maintain its position from comparative disadvantage to advantage throughout the study period.

Table 4.10: Revealed Symmetric Comparative Advantage of Pharmaceutical Products of India with Russian Federation

SITC code	Name of the Product	1991-1995	1996-2000	2001-2005	2006-2010	2006-2012
54131	Pencillines and derivatives	0.77	0.88	0.88	0.96	0.94
54132	Streptomycin's & derivatives	-1.00	0.40	-1.00	0.74	0.65
54133	Tetracycline's and derivatives	-1.00	-0.71	-1.00	-0.21	-0.36
54139	Other antibiotics(bulk)	0.61	0.77	0.87	0.83	0.80
54151	Insulin and its salts	-1.00	-1.00	-1.00	-1.00	-0.28
54152	Pituitary/hormones etc.	-1.00	-0.08	-1.00	-1.00	-1.00
54153	Cortisone derivatives	0.69	-0.09	0.73	0.83	0.78
54159	Other hormones/devices etc.	-0.31	0.51	-0.29	0.38	0.23
54161	Glycosides and derivatives	-1.00	-0.84	-1.00	-1.00	-0.94
54162	Glands etc and extracts	0.84	0.75	0.95	0.85	0.79
54163	Antisera/blood fracture/vaccine	-0.20	-0.53	0.37	0.58	0.46
54164	Blood/Toxin/Cultures	0.89	0.87	-0.09	-0.22	-0.36
54211	Penicillin non retail	0.89	0.92	0.97	0.98	0.97
54212	Antibiotic n.e.s non retail	0.82	0.82	0.95	0.99	0.98
54213	Penicillin/strept retail	0.88	0.85	0.81	0.85	0.89
54219	Antibiotic n.e.s retail	0.30	0.62	0.85	0.89	0.88
54221	Insulin formulated, bulk	0.93	1.00	0.99	-1.00	-1.00
54222	Other hormones non retail	0.92	0.96	0.98	0.99	0.99
54223	Insulin retail pack	0.18	0.51	0.32	0.35	0.34
54224	Hormone ach retail pack	-1.00	-1.00	-1.00	-0.69	-0.57
54229	Hormone n.e.s retail pack	0.58	0.58	0.58	0.78	0.82

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

Intra Industry Trade Index (IIT)

Intra industry trade explains that countries of the same factor endowments would still trade due to differences in technology, as this would encourage specialization and trade (Krugman, 1981). Therefore, Intra- industry trade arises if a country, in same period of time, imports and exports similar types of goods or services taken from the same sector. IIT allows a country to take advantage of larger markets. Most commonly used index to measure the IIT is Grubel-Lloyd (G-L) index. Zero value of the G-L index means there are no exports or imports of a particular product i.e. no IIT in that particular product (Brulhart, 1994). This study calculates this most wisely preferred index given by Grubel-Lloyd (G-L) during the study period by using SITC (Revision 3) five digit levels, data at average of five period i.e. 1991-1995, 1996-2000, 2001-2005, 2006-2010 and 2006-2012.

Table 4.11 highlights values of intra-industry trade measured by GL index between India and US 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' (0.88) followed by 'Penicillin/strept retail' with the value of 0.82, 'Antibiotic n.e.s retail' (0.69), 'Blood/Toxin/Culture' (0.56), 'Insulin retail pack' (0.39), 'Penicillin /strept retail' (0.82), 'Other hormones non retail' (0.31), 'Glands etc and extracts' (0.25) , 'Antisera/blood fracture/vaccine' (0.22), 'Insulin and its salts' (0.19), 'Penicillin and derivatives' (0.18), 'Other antibiotic, bulk' (0.08), and 'Other hormone devices etc.' (0.01) during 1991-1995. 'Streptomycin's and derivatives' has no intra industry trade between India and US during 1991-1995 but it has been found at moderate level during remaining study period. In 2006-2012, it is found the highest for 'Other antibiotics (bulk)' (0.71) followed by 'Other hormones/devices etc.' (0.68), 'Glycosides and derivatives' (0.62) and 'Blood/Toxin/Cultures' (0.41). 'Hormones n.e.s retail' has maintained its position throughout study period as its intra industry trade index has been found maximum in many years. The intra industry trade has found increase in 'Other antibiotics (bulk)', 'Insulin formulated, bulk', and 'Hormone n.e.s retail pack' throughout the study period. 'Streptomycin's and their derivatives', 'Tetracycline's and their derivatives', 'Pituitary glands', 'Cortisone derivative', 'Glycosides and derivatives', 'Insulin formulated, bulk',

and 'hormones ach retail pack' has found zero intra industry trade in many selected years as in these commodities India depends on USA's imports.

Table 4.11: India-US Bilateral Grubel-Lloyd Index

SITC code	Name of the Product	1991-1995	1996-2000	2001-2005	2006-2010	2006-2012
54131	Pencillines and their derivatives	0.18	0.58	0.60	0.03	0.15
54132	Streptomycin's and their derivatives	0.00	0.05	0.30	0.28	0.35
54133	Tetracycline's and their derivatives	0.00	0.34	0.05	0.19	0.33
54139	Other antibiotics (bulk)	0.08	0.17	0.47	0.62	0.71
54151	Insulin and its salts	0.19	0.00	0.13	0.07	0.19
54152	Pituitary glands	0.00	0.00	0.31	0.23	0.19
54153	Cortisone derivative	0.00	0.03	0.10	0.49	0.41
54159	Other hormones/devices etc.	0.01	0.17	0.67	0.63	0.68
54161	Glycosides and derivative	0.00	0.18	0.36	0.59	0.62
54162	Glands etc. and extracts	0.25	0.32	0.34	0.42	0.35
54163	Antisera/blood fracture/vaccine	0.22	0.68	0.53	0.06	0.05
54164	Blood/Toxin/Cultures	0.56	0.32	0.08	0.40	0.41
54211	Penicillin/strept retail	0.37	0.01	0.02	0.11	0.08
54212	Antibiotic n.e.s non retail	0.10	0.29	0.00	0.09	0.07
54213	Penicillin/strept retail	0.82	0.17	0.22	0.33	0.34
54219	Antibiotic n.e.s retail	0.69	0.31	0.03	0.05	0.04
54221	Insulin formulated ,bulk	0.00	0.31	0.14	0.00	0.00
54222	Other hormones non retail	0.31	0.39	0.13	0.03	0.05
54223	Insulin retail pacts	0.39	0.01	0.02	0.03	0.08
54224	Hormones ach retail pack	0.00	-	0.00	0.00	0.14
54229	Hormone n.e.s retail pack	0.88	0.31	0.40	0.64	0.62

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

Note: '-' Indicates that the either the data was not available or there has no trade in the corresponding period.

Table 4.12 shows that intra industry trade between India and Russian federation during 1992-1995, 1996-2000, 2001-2005, 2006-2010 and 2006-2012. 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', 'Insulin retail pack', 'Other hormones non retail' and 'Hormone n.e.s retail pack' as for these commodities India does not depend on Russia. It is found the highest for 'Pencillines and derivatives' (0.71) followed by 'Other antibiotics (bulk)' (0.53), 'Cortisone derivative' (0.50), 'Insulin formulated, bulk' (0.05) and 'Blood/Toxin/Culture' (0.02) during same period. During 2006-2012 highest intra industry trade between India and Russian federation is found in 'Other antibiotic bulk' (0.49) followed by 'Blood/Toxin/Culture' (0.20), 'Glands etc. and extract' (0.19) and then 'Penicillin and derivatives' (0.01). The commodity 'Antibiotic n.e.s retail', 'Other hormone non retail',' 'Insulin retail pack', and 'Hormone n.e.s retail pack' have found zero intra industry trade. But in other commodities 'Cortisone derivatives' have also found zero intra industry trade here India only exports to Russia.

Table 4.12: India-Russian Federation Bilateral Grubel-Lloyd Index

SITC code	Name of the Product	1992-1995	1996-2000	2001-2005	2006-2010	2006-2012
54131	Pencillines and derivatives	0.71	0.71	0.35	0.00	0.01
54139	Other antibiotics (bulk)	0.53	0.52	0.51	0.37	0.49
54152	Pituitary/hormones etc.	-	0.37	-	-	-
54153	Cortisone derivatives	0.50	0.00	0.00	0.00	0.00
54159	Other hormones/devices etc.	0.00	0.00	0.12	0.00	0.00
54162	Glands etc and extracts	0.00	0.39	0.59	0.16	0.19
54164	Blood/Toxin/Cultures	0.02	0.00	0.52	0.12	0.20
54219	Antibiotic n.e.s retail	0.00	0.00	0.00	0.00	0.00
54221	Insulin formulated bulk	0.05	0.00	0.00	-	-
54222	Other hormones non retail	0.00	0.01	0.00	0.00	0.00
54223	Insulin retail pack	0.00	0.00	0.00	0.00	0.00
54229	Hormone n.e.s retail pack	0.00	0.00	0.00	0.00	0.00

Source: Calculated from World Integrated Trade Solution (**WITS**), 2012.
Note: '-' there has been no trade of that particular commodity in the corresponding period.

Chapter 5

TRIPS and Indian Pharmaceutical Exports

The share of manufactured trade particularly high technology products is increasing rapidly in developing countries. The high technology products are growing faster due to their higher income elasticity of demand, greater scope for product innovation and the formation of TRIPS. India has also revealed comparative advantage in the export of pharmaceutical products one of the categories of high technology sector. This is due to many factors, such as increase in their production, their low prices at international market, increase of their R&D expenditure etc. The credit goes to the TRIPS emerged under the Uruguay Rounds spanning from 1986 to 1994 and embracing 123 countries as 'contracting parties'. Therefore, in this chapter, an attempt is made to comprehend the emergence of TRIPS in India and also to discuss its one of the important issue related to its impact on Indian pharmaceutical exports. Indian pharmaceutical industry is about 120 years old. Production of modern medicines by indigenous units started with the setting up of Bengal Chemical and Pharmaceutical works in Calcutta (1892), which was followed by the establishment of Alembic Chemical works in Baroda (1907) and Bengal Immunity (1919). At that point of time, the Patents Act of 1911 was in practice, which facilitated patenting all the known and possible processes of manufacturing of a drug besides patenting the drug itself. Foreign multinational corporations (MNCs) were quick to take advantage of this provision. As a result, these corporations consistently imported bulk drugs from their home countries and produced/mixed formulations in India, contending that locally available bulk drugs were not of desired quality (Kiran, 2011).

India has a unique position in pharmaceutical industry in world especially in production of generic medicines, which has been able to provide medicines at lower prices. For all this, credit goes to the India Patents Act that of 1970 (Deolalikar & Evenson, 1989). The Patents Act of 1970 came to be enacted mainly based on the recommendations of the report of Justice N. Rajagopala Ayyangar committee submitted in 1959. The aim of this act was to enhance domestic development at the expense of foreign corporations through the following protectionist provisions:"(1)

Assisting the development of an independent Indian pharmaceutical industry; (2) making new pharmaceuticals cheaply available to the Indian public; (3) promoting import substitution by encouraging local process development followed by bulk pharmaceutical production; (4) reversing the negative pharmaceutical balance of payments by stimulating exports; and (5) encouraging original pharmaceutical research and development in India" (Koshy, 1995).

However, the Indian Patent Act of 1970 has not proved effectively for pharmaceuticals as there are impositions of an artificially low royalty ceiling on compulsory licenses and unavailability of product patents for pharmaceuticals. However, the Indian Patent Act 1970 recognizes only process patents in pharmaceuticals and agro-chemicals, while the WTO agreement requires both product and process patents in all fields. In order to meet the WTO obligations a bill was proposed to amend the India Patent Act before the Lok Sabha in March 1995. The bill did not get the approval of the Lok Sabha (Agarwal, 2001).

It was in April 15, 1994 that the Final Act embodying the results of the Uruguay round of Multilateral Trade Negotiations was authenticated by 117 nations including India. This Final Act came into force on January 1, 1995. India was one of the countries to implement the requirements of the treaty within a period of ten years. The Government temporarily implemented the treaty for the period January 1 to March 31, 1995 without any legislative approval. During the transition period, India was supposed to accept applications for product patent in the pharmaceutical sector and these applications were called the 'black box' application. *"Products which come under 'black box' application had Exclusive Marketing Rights (EMRs), wherein the applicant had the right to sell and distribute the product for a time period of maximum five years. EMRs can only be obtained for a particular pharmaceutical product when that product has been granted a patent and has obtained marketing approval in another signatory country. After this only the product can get marketing approval in India"* **Invalid source specified.**. Only very few patent applications qualify for EMRs as it applies to patent applications only after January 1, 1995. In January 1997, the US requested WTO to set a dispute panel against India to investigate India's failure to pass implementing legislation to enable the acceptance of 'black box' production

patents in the pharmaceutical sector during the transition period. By December 31, 2004, India started granting product patents for pharmaceutical sector products (Majhi, 2013). On a complaint by the US to WTO, India was asked to take steps to amend its patent laws to meet WTO obligations by April 1999. Being a member of WTO, India amended its Patent Law on March 22, 2005, abolishing its "process" patents law and introduced "product patents' for pharmaceuticals, food, and chemicals to meet its TRIPs obligations (Agarwal, 2001).

The pharmaceuticals industry is one of the world's most research-intensive industries, which is making enormous contributions to health care. In order to provide incentives to innovators to undertake research, many countries, especially the developed ones where major innovations take place, have a tradition of strong patent protection. The patent system has become more prevalent after the establishment of Trade-Related Intellectual Property Rights (TRIPS) Agreement in the World Trade Organization (WTO) which made it compulsory for WTO members to include drugs/medicines in their regime for product and process patents **Invalid source specified.**. India signed the TRIPS Agreement in April 1994. Before that, India allowed only process patents for food, medicine and chemical substances. The signing of TRIPS agreement has compelled India to provide product patent protection for pharmaceuticals products (Lanjouw, 1998). In March 2005, India fulfilled the amendment of the Patent Act of 1970 to meet the terms of TRIPS Agreement. It introduced product patents for drugs, foods, and chemical product (Chaudhuri, 2002). One of the immediate consequences of the TRIPS agreement will be sharp increase in the prices of drugs invented (Maria, 2005).

Now, instead of merely working around process patents, many developing countries cannot produce ingredient due to lack of technology, equipment etc. While these countries may issue compulsory licenses to import of generic version of the patent protected medicines as the TRIPS restricted this. Paragraph 6 of the Doha Declaration promised a solution problem caused by these constraints. Doha declaration explained that, countries that have not been able to get voluntary licenses must seek highly limited compulsory licenses from both the generic manufacturers and developing country government. Besides the Doha Declaration, in recent years,

many developing countries have been coming under pressure to enact or implement even tougher or more restrictive conditions in their patent laws, known as 'TRIPS plus' provisions. Inclusion of 'TRIPS-plus' provisions in Comprehensive Economic Partnership Agreements (CEPA) would restrict exports of Indian generics drugs and prevent Indian companies from obtaining the latest technology at affordable prices from abroad. Because one of the main provisions that limit the use of compulsory licenses or that restrict generic competition. As India has the highest share in the generic export of pharmaceutical commodities, due to increased production of generic drugs, therefore India disfavors 'TRIPS Plus' (Cohen, 2008).

After 2005, India's leading drug companies recognized that they could not survive as global players without significant R&D capabilities. Its pharmaceutical companies can also operate at much lower profit margins that their western counterparts. According to Greece (2012), " *India can produce bulk drugs that cost 60 percent less than in the west and can open a production plant in India 40 percent cheaper the in developed countries because of this, India has become a hub for pharmaceutical research and development for many foreign pharmaceutical companies".*

Traditionally, the vast majority of India's pharmaceutical R&D spending is concentrated on reverse engineering and the adaptation of patented foreign drugs to the Indian market. As the pharmaceutical industry is a highly R&D-oriented sector. To comply with the WTO's TRIPS agreement, India has reintroduced product patent protection in pharmaceuticals from 1 January 2005. With the reintroduction of product patents, leading Indian pharmaceutical are shifting their business strategies by placing greater focus on R&D. Many MNCs began re-entering the Indian pharmaceutical market by setting up their manufacturing and R & D facilities. This will gradually neutralize the cost advantages enjoyed Indian pharmaceutical majors**Invalid source specified.**. The TRIPS Agreement has not only increased the R&D expenditure of the Indian pharmaceutical industry but has also changed its R&D structure. Under the pro-patent regime of the TRIPS Agreement, for pharmaceutical companies, sustainable growth depends on their continuous R&D for developing new drugs and new technologies.

Trends in Patent Applications

Table 5.1 shows the trend in the number of patent applications for the period of 2004-05 to 2012-13. The number of filed applications shows an increasing trend throughout the period. Their numbers has increased from 17466 in 2004-05 to 43674 in 2012-13. The number of granted cases also increased proportionally as their numbers were 1911 in 2004-05 and had increased to 4126 in 2012-13. But its examined case has decreased during the same period. Their number had decreased from 14813 in 2004-05 to 12268 in 2012-13. Similarly, the number of the disposal cases has also decreased as number had decreased from 17136 in 2008-09 to 2297 in 2012-13.

Table 5.1: Trends in Patent Applications

Year	Filed	Granted	Examined	Disposal of request for examination
2004-05	17466	1911	14813	NA
2005-06	24505	4320	11,569	NA
2006-07	28940	7539	14119	NA
2007-08	35218	15316	11751	NA
2008-09	36812	16061	10296	17136
2009-10	34287	6168	6069	11393
2010-11	39400	7509	11208	12851
2011-12	43197	4381	11031	8428
2012-13	43674	4126	12268	2297

Source: Annual Report of the Office of the Controller General of Patents, Designs, Trade Marks and Geographical Indication 2012-13.

Table 5.2 shows the growth of R&D expenditure in the Indian pharmaceutical industry in the post-TRIPS period. R&D expenditure of domestic Indian companies increased from Rs.80.60 crores in 1995 to Rs. 3342.32 crores in 2010. Its growth has been fluctuating throughout the study period. The maximum growth has been found in 1996 i.e. (76.78). R&D expenditure of foreign companies has increased from Rs.64.13 crores to Rs.934 crores during the same period and its growth has also

been found fluctuating and even found negative in 1999 and 2007. The compound growth rate of R&D expenditure has been found greater for domestic companies (12.29). R&D intensity of domestic companies and foreign companies increased from 1.34 percent and 0.77 percent in 1995 to 4.50 percent and 4.01 percent in 2010 respectively. From the table, it is clear that R&D expenditure and R&D intensity of Indian domestic companies is the higher as compared to foreign companies. Since The TRIPS Agreement, it has increased not only of the Indian domestic companies but also of Indian foreign companies but not in great extent. The literature explained that even after 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 regarding 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 basically pretentious about their R&D activities based in India. Therefore, R&D intensity could not grow faster.

Table 5.2: 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 %
1995	80.61	-	64.13	-	1.34	-	0.77	-
1996	142.50	76.78	83.37	30.00	1.71	27.61	0.91	18.18
1997	148.17	3.94	89.41	7.24	1.55	-9.30	0.95	4.40
1998	154.15	4.07	90.65	1.39	1.43	-7.74	0.88	-7.35
1999	218.66	41.85	79.78	-11.99	1.56	9.09	0.70	-20.43
2000	256.80	17.44	90.17	13.02	1.56	0.00	0.66	-5.71
2001	435.07	9.42	109.81	21.78	2.30	47.44	0.72	9.09
2002	597.91	37.43	110.04	0.21	2.64	14.78	0.65	-9.72
2003	686.74	14.86	232.73	111.50	2.93	10.98	0.71	9.23
2004	1084.20	57.89	346.69	48.97	3.81	30.03	1.16	54.93
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
CGR	12.95	26.03*	12.29	23.09*	11.11	9.63	11.25	13.26

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

*Represents average

Among all the agreements administered by the World Trade Organization (WTO), the Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS) is undoubtedly the most controversial with respect to its development-related impacts. The agreement requires all WTO member states to establish minimum

standards of legal protection and enforcement for number of different forms of intellectual property rights.

Table 5.3 and 5.4 shows the R&D intensity and export performance of 22 firms of the pharmaceutical sector. These firms are selected on the basis of selected of equity and share in Bombay Stock Exchange (BSE), respectively. The study of the selected firms of the pharmaceutical sector revealed that increasing R&D intensity enhanced the export performance. For example, R&D intensity of Hester Biosciences Ltd has increased from 0 in March 2001 to 0.22 in March 2012 and its export performance also gone up from 0 in March 2001 to US$ 0.58 million in March 2012. Spending on R&D in manufacturing had a much larger impact on the probability of exporting, this suggests that spending on R&D was not simply to boost the probability of producing new goods and services, but it likely involved an additional impact of improving the establishment's knowledge assets, which in help to boost the productions. The results here also supported the economic theory which explained that 'spending on R&D in manufacturing had a much larger impact on the probability of exporting' as is evident from the result of the study.

The results shows that R&D intensity of Ranbaxy Laboratories Ltd increased sharply from 0 in March 2001 to 86 in March 2012 and its exports have also increased from US$ 161.05 million in Mach 2001 to US$ 1039.12 million in March 2012. Similarly, the result of all other firms revealed that with increase in intensity of R&D of the firms, exports performance of these firms has also increased such as Cipla Ltd., Merck Ltd., Mylan Laboratories Ltd. and Biocon Ltd. Their R&D intensity increased from 0, 0.13, 0 and 0 in March 2001 to 60.89, 0.73, 55.8 and 20.21 respectively. Export performance of Cipla Ltd., Merck Ltd., Mylan Laboratories Ltd. and Biocon Ltd. also gone up during the same period proportionally to the R&D intensity. Their export performance has increased from US$ 57.11 million; US$ 3.72 million; US$ 0.98 million and US$ 5.87 million in March 2001 to US$ 739.54 million; US$ 10.26 million; US$ 679.04 million and US$ 134.47 million in March 2012 respectively. Since TRIPS enforcement in India, firms started to spend more money in R and D.

This is clear from Table 5.3 that firms like Cipla Ltd. and Biocon Ltd are not investing in R&D till 2004, but since 2005, their intensity sharply increased from 27.09 and 4.16 in March 2006 to 60.89 and 20.21 respectively in March, 2012. Highest average share in R&D intensity during 2000- 2012 is found for Ranbaxy Laboratories limited (69.93 percent) followed by Cipla limited (27.53 percent) and Pfizer limited (1.81). Average share of exports is also highest for Indian Ranbaxy laboratories limited companies with average share of 45.29 followed by Cipla limited with average share of 28.25 percent and Malyon laborites limited (10. 82 percent).

Table 5.3: 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**
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.

Research and Development Intensity: Expenditure on R&D as a proportion of firm's sales.

Table 5.4: 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**
Sanofi 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 Pharmaceuticals Ltd.	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**
Merck Ltd.	3.72	2.7	2.71	4.09	3.27	3.54	3.93	5.02	6.17	11.22	10.41	10.26	**11.37**	**0.49**
AstraZeneca Pharma Ltd.	0.04	0	0.3	0.48	0.82	0.82	1.4	2.24	4.7	6.15	10.52	9.75	**16.32**	**0.16**
Pfizer Ltd.	3.05	4.1	4.63	5.95	5.33	5.9	6.36	5.6	4.69	5.5	8.47	4.39	**10.38**	**0.54**
Resonance Specialties Ltd.	0.84	0.36	0.35	0.16	0.03	0.01	0.36	0.08	0.06	0.07	1.37	2.81	**10.56**	**0.06**
Novartis India Ltd.	2.95	1.14	1.14	1.74	2.13	0.85	0.86	1.04	1.32	1.22	1.17	1.18	**9.56**	**0.20**
Abbott India Ltd.	0.7	0.35	0.33	0.45	0.61	0.73	0.72	0.88	0.89	0.94	1.65	1.12	**11.14**	**0.07**
Vista Pharmaceuticals Ltd.	0.33	0.22	0.29	0.25	0.23	0.23	0.25	0.25	0.36	0.18	1.26	0.72	**10.84**	**0.04**
Wyeth Ltd.	6.03	7.43	5.26	5.25	0.02	0.05	0.29	1.75	0.16	0.13	0.62	0.15	**7.27**	**0.47**
Zenotech Laboratories Ltd.	0	0	0	0.1	0	0.27	0.22	0.04	0.08	0.02	0.02	0	**6.74**	**0.01**
Kerala Ayurveda Ltd.	0.22	0.26	0	0.18	0.29	0.24	0.19	0.8	0.19	0.15	0.2	0.13	**9.65**	**0.03**
Mylan Laboratories Ltd.	0.98	1.97	59.11	66.11	77.04	87.74	113.44	151.75	238.96	337.87	520.65	679.04	**16.49**	**10.82**
Biocon Ltd.	5.87	9.73	22.74	66.74	86.11	80.66	108.16	129.46	92.09	109.12	153.41	134.47	**12.92**	**5.81**
Wanbury Ltd.	0.15	1.77	3.24	5.18	6.25	13.23	17.42	40.91	17.08	30.64	26.69	30.34	**14.71**	**1.01**
Fermenta Biotech Ltd.	1.25	1.51	0.89	0.67	1.62	3.9	4.26	5.38	4.39	7.5	9.86	15.54	**12.89**	**0.32**
Themis Medicare Ltd.	2.16	2.11	1.99	5.3	9.44	8.29	16.85	21.85	14.39	16.09	17.96	13.2	**12.42**	**0.79**
Capsugel Healthcare Ltd.	0.71	1.18	1.59	1.91	2.66	2.24	1.96	1.18	1.51	0.88	0.35	1.24	**9.57**	**0.16**

Source: Centre for Monitoring Indian Economy (CMIE), Prowess.

Impact on medicine prices

With the emergence of new patent act the producers intensified development of innovative new drugs, which has increased the profitability for MNCs. This increase profitability of MNCs forces Indian Pharmaceutical players to focus on R&D. It is observed that the increase in "appropriation rates" from R&D can lead to a greater supply of innovations. This lowered prices of innovations. As a consequence producers of consumption goods can offer goods at lower prices. However, the new patent act of 2005 brings the patent acts with TRIPs agreement. This acts is impacted the prices of the medicines much more negatively comparatively the pervious act especially due to the following reasons.

(a) "*At any given points of time, globally only 5-10 percent of the drugs would be under patent protection.*

(b) *The price competition among different drugs in the same therapeutic group should keep the prices under control.*

(c) *Since majority of the patients in India pay from their pocket, the limited purchasing power will act as a check on very high price.*

(d) *Govt. continues to have powers to regulate the prices of medicines.*

(e) *Safe-guards like compulsory licensing, parallel imports etc. exists.*

(f) *The drugs covered in the list of Essential Medicines are not likely to be covered by patent these would continue to be abundantly available at reasonable prices*" (Department of Pharmaceuticals Annual Report 2011-12).

The study already claimed that India has higher revealed comparative advantage in pharmaceutical exports with USA and Russia. The 2005 Indian Amendment Act of Patent brings its pharmaceutical sector into the WTO-TRIPs agreement. After this Act of 2005 Indian drugs markers can no longer manufacture and market reverse-engineered of drugs patented by foreign drug producers. To replace sales lost to TRIPs action, many Indian leading pharmaceutical producers have increased their exports of generic drugs to the United States, Russia and Western European and entered into research and development agreements with foreign pharmaceutical firms. After 2005, Indian leading drug companies recognized

that they could not survive as global players without significant R&D capabilities. They started to increase expenditure in R&D resulting increase in the production as well as 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 programme of the Russian Government which aims at developing domestic production base, leading Indian Pharma companies have started engaging with Russian partners to consider possibilities of joint investments.

Thus it is clear that introduction of TRIPS Agreement, which mainly concerns product patents, has increased the length of patent to twenty years and affected India's pharmaceutical sectors. Under Indian Patent Act of 1970, product patents were not allowed for pharmaceutical products, agricultural products, food products and any kind of chemical products. It seems from the preceding sections that grant of intellectual property rights for an invention is absolutely necessary in the domain of pharmaceutical sector. Though it creates a short term monopoly and loss in social welfare, but the long term benefits are enormous. Secondly, the idea of making India compliant with TRIPS policy thereby attracting more foreign direct investment or multi-national corporations in this sector, needs to be looked into carefully. According to Das, India is a net exporter of pharmaceutical products, mainly generic versions with an export growth rate of around 4.5 to 5 percent and import growth rate of around 0.7 percent during 2010-2011. So this sector needs proper regulation so that it can improve India's balance of payment situation. Lastly, Indian pharmaceutical sector needs to be a highly regulated sector not only in terms of price and quantity, but also in the way it functions.

Chapter 6
Conclusions

Diversification of a country's exports plays an important role in the economic growth of the developing countries. These countries are trying to increase its exports by exporting high technology products and improve their ranking in the world trade. India is no exception to this. The present study is an attempt to examine the competitiveness of pharmaceutical exports in India's high technology exports, which is the largest sector amongst high technology commodities, with the US and Russian Federation by calculating different indices like Revealed Comparative Advantage (RCA), Revealed Symmetric Comparative Advantage (RSCA) and Intra Industry Trade (IIT) during 1991-2012. An attempt is also made to study the some important issues of TRIPS related to India's pharmaceutical exports.

Findings: 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. The average percentage share of pharmacy i.e. 34.92 percent 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 found to be maximum 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.

The study shows that USA is the top most destinations of India's pharmaceutical exports followed by Russian Federation with an average share of 30.30 percent and 17.5 percent respectively. Germany is the third major importing country of India's pharma products with an average share of 12.78 percent, followed by Nigeria (10.08 percent), United Kingdom (4.76 percent), Netherlands (4.60 percent), Vietnam (4.55 percent), Ukraine (7.48 percent), Brazil (4.39 percent) and

South Africa (4.22 percent) in total pharmaceutical exports of India during 1991 to 2012. The compound growth rate of South Africa indicates to be maximum i.e.14.26 percent followed by Brazil (13.09 percent), US (12.59 percent), Ukraine (12.16 percent), Vietnam (12.03), UK (11.99 percent), Nigeria (11.31 percent), Netherlands (11.19), Russian federation (11.10 percent) and Germany (10.67 percent) during the study period.

Commodity wise analysis of India's pharmaceutical exports with USA indicates that India has the highest share in the exports of product 'Antibiotic 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), 'Antibiotic n.e.s non retail' (6.61). These are important commodities in India's exports to USA throughout the period. Among all pharmaceutical commodities imported by India from USA, 'Other antibiotics (bulk)' has the highest average share (44.87 percent) followed by 'Antibiotics n.e.s non retail' (33.40), 'Antisera/blood fracture/vaccine' (19.97 percent) 'Other hormone/devices etc.' (7.22 percent), 'Blood/Toxin/Cultures' (6.14 percent), 'Penicillin and their derivatives' (5.62), 'Insulin and its salts' (4.13 percent) and 'Penicillin/strept retail' (3.01 percent).

Similarly, in case of Russia, India has the highest average share in the export of 'Antibiotic 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). Similarly in the import from Russia, the country has the highest share in 'Other antibiotics, (bulk)' (49.69 per cent) followed by 'Pencillines and derivatives' (29.27 percent) and 'Glands etc and extracts' (20.04 percent). And others have very less average share in imports. 'Blood/Toxin/Cultures', 'Antibiotic 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. This reflects that incorporation of technological (factor proportion) differences across countries to

account for possibility of product quality differences within industries, and of income differences within countries that creates demand for different qualities.

The results of comparative advantage of India with USA and Russia federation has been calculated for 1991-1995, 1996-2000, 2001-2005, 2006-2010 and 2006-2012. Regarding the results of comparative advantage of India with USA, the study revealed that India has competitive gain with the US in 'Insulin formulated bulk' followed by 'Penicillin non retail' and 'Other hormones non retail' during 2000-2012. The commodity 'Streptomycin's and derivatives', 'Tetracycline's and derivatives', 'Pituitary/hormones etc.', 'Cortisone derivatives', 'Glycosides and derivatives' and 'Insulin formulated, bulk' maintained more advantage as compared to 'Hormone ach retail pack' could not achieve advantage throughout the period. The empirical results of RSCA indicates that the highest symmetric competitive advantage index is found in 'Insulin formulated, bulk' (0.96) followed by 'Penicillin non retail' (0.94), 'Penicillin and derivatives' (0.89), 'Antibiotic n.e.s non retail' (0.87), 'Penicillin/Strept Retail' (0.79) and 'Insulin and its salts' (0.75). Pharmaceutical products namely 'Streptomycin's and derivatives', 'Other antibiotics (bulk)', 'Penicillin non retail', 'Antibiotic n.e.s non retail', 'Antibiotic n.e.s retail' and 'Insulin formulated, bulk' gained as they came to status from disadvantage to advantage from 1991-2012. But, some pharmaceutical products 'Tetracycline's and derivatives', 'Pituitary/hormones etc.' 'Cortisone derivatives', 'Other hormones/devices etc.' 'Glycosides and derivatives', 'Glands etc. and extracts', 'Antisera/Blood fracture/Vaccine', 'Blood/Toxin/Cultures', 'Hormone ach retail pack' and 'Hormone n.e.s retail pack' could not achieve symmetric advantage status during throughout the period.

Similarly, the highest comparative advantage of India with Russian federation is found for the 'Insulin formulated bulk' during 1992-2005. Since 2005, other pharmaceutical products namely 'Penicillin and derivatives', 'Streptomycin's and derivatives', 'Other antibiotics (bulk)', 'Insulin and its salt', 'Penicillin non retail', 'Antibiotic n.e.s non retail', 'Penicillin/strept retail', 'Insulin formulated, bulk' and 'Other hormones non retail' gained its position**.** The empirical results of the study also indicate that the highest symmetric competitive advantage index of India with Russian federation is found in 'Insulin formulated, bulk' (0.96) followed by 'Penicillin

non retail' (0.94), 'Penicillin and derivatives' (0.89), 'Antibiotic n.e.s non retail' (0.87), 'Penicillin/Strept Retail' (0.79) and 'Insulin and its salts' (0.75). Pharmaceutical products namely 'Streptomycin's and derivatives', 'Other antibiotics (bulk)', 'Penicillin non retail', 'Antibiotic n.e.s non retail', 'Antibiotic n.e.s retail' and 'Insulin formulated, bulk' gained as they came to status from disadvantage to advantage during the study period. Some pharmaceutical products 'Tetracycline's and derivatives', 'Pituitary/hormones etc.' 'Cortisone derivatives', 'Other hormones/devices etc.' 'Glycosides and derivatives', 'Glands etc. and extracts', 'Antisera/blood fracture/vaccine', 'Blood/toxin/cultures', 'Hormone ach retail pack' and 'Hormone n.e.s retail pack' could not achieve symmetric advantage status.

The results of intra industry trade between India and USA and also between India and Russia federation has been calculated for 1991-1995, 1996-2000, 2001-2005, 2006-2010 and 2006-2012. Results show that value of intra-industry trade between India and US is the highest for 'Hormones n.e.s retail' throughout the study period. It has maintained its position throughout study period as its intra industry trade index has been found maximum in many years. The value of intra industry trade has been found to be an increasing trend for 'Other antibiotics (bulk)', 'Insulin formulated, bulk', and 'Hormone n.e.s retail pack' throughout the study period. 'Streptomycin's and their derivatives', 'Tetracycline's and their derivatives', 'Pituitary glands', 'Cortisone derivative', 'Glycosides and derivatives', 'Insulin formulated, bulk', and 'hormones ach retail pack' has zero intra industry trade in many selected years as in these commodities India depends on USA 's imports. During 2006-2012, the highest intra industry trade between India and Russian federation is found in 'Other antibiotic bulk' (0.49) followed by 'Blood/Toxin/Culture' (0.20), 'Glands etc. and extract' (0.19) and 'Penicillin and derivatives' (0.01) in 2006-2012. The commodities namely 'Antibiotic n.e.s retail', 'Other hormone non retail',' 'Insulin retail pack', and 'Hormone n.e.s retail pack' has zero intra industry trade. But in other commodities 'Cortisone derivatives' had no intra industry trade during 1992-2012 in these commodities as India did not depend on Russian federation's imports.

The study claimed that India has higher revealed comparative advantage in pharmaceutical exports with USA and Russia. The 2005 Indian Amendment Act of

Patent brings its pharmaceutical sector into the WTO-TRIPs agreement. After this Act of 2005, Indian drugs markers can no longer manufacture and market reverse-engineered drugs patented by foreign drug producers. To replace sales lost to TRIPs action, many Indian leading pharmaceutical producers have increased their exports of generic drugs to the United States, Russia and entered into research and development agreements with foreign pharmaceutical firms. After 2005, Indian leading drug companies recognized that they could not survive as global players without significant R&D capabilities. They started to increase expenditure in R&D resulting increase in the production as well as 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. The empirical results of the study also indicate that with the emergence of new patent act, the producers have intensified development of innovative new drugs, which has increased the profitability for MNCs. It is observed that the increase in "appropriation rates" from R&D can lead to a greater supply of innovations resulting lower innovations prices.

The study revealed that domestic Indian pharmaceutical companies R&D are more as compared to foreign companies. The compound growth rate of R&D expenditure has been found greater for domestic companies (12.25) as compared to foreign companies (12.29) during 1995-2010. Since the implementation of TRIPS in India, foreign pharmaceutical companies are putting less investment in Indian Pharmaceutical Industry because they are not sure about their returns and profits. During 2000-2012, highest average share in R&D intensity is found in Ranbaxy Laboratories limited (69.93 percent) followed by Cipla limited (27.53 percent) and Pfizer limited (1.81). Average share of exports is also found the highest for Indian Ranbaxy Laboratories limited companies with average share of 45.29 followed by Cipla limited with average share of 28.25 percent and Malyon Laboratories limited (10. 82 percent).

Policy Implications

The study revealed that the country has revealed comparative advantage in case of majority of pharmaceutical products. On the basis of the results, following few policy implications have been made:

During post TRIPS period, Indian pharmaceutical sector has been growing. More investments on R&D and distribution in Indian Pharmaceutical industries can increase the quality of pharmaceutical products. High R&D intensified pharmaceutical companies will export more. This is also clear from the results of Indian pharmaceutical companies that Intellectual property rights will promote R&D.

For India to become a top player in the global pharmaceutical business, the government of India needs to support foreign investments in pharmaceuticals sector in order to overcome the stiff competition in the global pharmaceutical market because they are getting no incentives for development of Indian R&D and train Indian people with the high tech knowledge (Tebaldi, 2011). The focus needs to be changed from export oriented activity to a global marketing. This involves establishing strategic marketing alliances in developed markets that will provide access to distribution networks and enable Indian pharmaceutical companies to operate as profit sharing partners. This also involves adopting vertical integration in a planned manner into the distribution and using chain, starting from developing markets and moving up to developed markets (Chandran, 2005).

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