High Technology Products Exports by India and China: A Constant Market Share Analysis

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Abstract

With more and more globalization, international trade has expanded to a large extent. This is also observable for trades in high technology products. India and China have emerged as two major exporters of high technology products in the world today. This paper makes an attempt to understand the various dimensions of high technology products exports from these two countries through constant market share (CMS) analysis and also the policy implications by looking at the various components of export growth from the CMS analysis.

1. Introduction

In the era of increased globalization, the world has also witnessed a surge in the growth of mechanization in industrial as well as domestic activities which has resulted in the flourishing of various high technology products. Thus there has been an increase in the usage of high

technology products all over the world leading to an obvious increase in the demand for these products. In a globalized world, with increased scope for international exchange, some countries can and indeed are specializing in producing and exporting high technology products. It has been observed that over the years, high technology product exports are being majorly taken over by developing countries. There are many supportive evidences confirming this phenomenon in the economics literature.

Mani (2000) observes that the international trade is growingly becoming trade in hi-tech products. Through an analysis of consistent time series data on hi-tech products, Mani (2000) shows that having been exporters of primary products earlier, the developing countries are now transforming into exporters of manufactured products. He also shows that the share of exports of developing countries have recorded phenomenal increases from 8 per cent in 1998 to 23 per cent in 1997. However, Mani (2000) subsequently, by looking at net export figures rather than gross export, infers that this increase in hi-tech product exports by developing countries is not "*really real*". He argues that the developing countries merely assemble components of high technology products from their developed counterparts by using labour-intensive techniques and thus produces the finished hi-tech products that they eventually export.

According to Shrolec (2005), the empirical literature confirms hi-tech products to be the fastest growing segment of international trade with developing countries growingly becoming the major exporters of such products. Shrolec (2005) makes an attempt to assess the relationship between growth of exports and level of development of indigenous technological capabilities of the developing countries. He analyses intra-product imports and then infers that the bulk of hi-tech exports are actually attributable to "*effect of increasingly international fragmentation of the production systems in electronic on trade statistics*". Econometric analysis reveals that the

propensity to import electronics components accounts for the largest proportion of cross-country differences in specialization in electronics exports rather than domestic technological capabilities.

Sara, Jackson and Upchurch (2012) analyse the relationship between the technological innovation and high-tech exports of a nation. They discuss the role of exports in growth of some fast developing countries in recent years and their expansion of high-tech products. They observe that export has served as the engine of growth in many fast growing countries, e.g. Malaysia, Taiwan, South Korea etc. In this current era of global competition, countries maintain as well as expand their share of export markets by developing the capability for competing successfully in new, high productivity segments of industries. As a consequence, fast growing countries have enhanced their share of hi-tech products in total exports. Their paper establishes that innovative capability of a country is a significant determinant of the share of hi-tech products in total exports of a country. Therefore, they suggest that countries should concentrate on improving innovative capabilities if they want to make use of exports as their engine of growth, since hi-tech products will constitute an increasing proportion of manufactured exports.

It is agreed upon by many economists that among the developing countries, the two countries leading in terms of their potential to emerge as future world powers are India and China[1].In this paper we concentrate on the trends in exports of hi-tech products of these two countries. There are a number of papers which deal with the issue of hi-tech products exports of these two countries. We look at a few of them here for our purpose.

[1]Harris (2005) observes that Brazil, India and China have become world economic powers. Also, Bhat, Guha and Paul (2006) observe that India and China are expected to be the engines of global economic growth in the present century.

According to an IIFT study (2011) India's exports have over time reflected a shift towards medium and high technology products over low technology products. This study uses the technological classification of trade in terms of high, medium and low based on the Standard International Trade Classification (SITC), Revision 3, as adopted by the United Nations Industrial Development Organization (UNIDO). This study suggests that the share of low technology exports have come down from 33 per cent in 2004 to 28 per cent in 2008, while the shares of medium and high technology exports have increased from 14 to 17 per cent and from 5 per cent to 7 per cent respectively. In terms of composition of hi-tech exports, pharmaceutical products constituted a large proportion. Other high and medium technology items that have shown maximum dynamism include power generating machines, telecom and sound equipment and scientific instruments in the first category and chemicals, machinery and equipment and transport equipment in the second category. The study also suggests that India's technology intensive exports reflect increased investment in R&D.

Desai (2011) also observes that India's technology intensive exports have experienced a rapid growth over the last two decades. He makes an attempt to focus on India's changing pattern of technology intensive exports "*in a systemic perspective and on increasing significance of the linkages between National and International Systems of Innovation*". The paper tries to analyse the structure of India's technology intensive exports along with its innovation processes. It also investigates whether structure of technology intensive exports bears any relationship with economic development and whether low, medium and hi-tech products are affected differently by technological learning. The paper argues that export performance can improve through enhancement of technological capabilities which in turn develop by technological learning which is determined by codified knowledge in R&D output e.g. publications, patents and designs and

also through interactive learning processes of international S&T collaboration along with inward and outward foreign direct investments.

Regarding China's hi-tech product exports, however, there are different opinions. The trade statistics reflect a rise in China's hi-tech product exports. For example, a European Commission report suggests that, China has recorded a higher amount of hi-tech exports than the U.S.A. or the EU[2] and thus emerged as the largest exporter of hit-tech products in the world. Also, according to the U.S. Census Bureau data, the U.S.A. has consistently run a trade deficit with China in advanced products since 2002 which reached a record high in 2010[3].According to Frangos (2013)[4] China has been increasing exports in industries as varied as computers, car parts, high technology lamps and optical-surgical equipments. Frangos (2013) also quotes Royal Bank of Scotland Economist Louis Kujis who states that Chinese employment in higher value industries e.g. electrical and communications equipment production has leaped since 2008 now exceeding employment in textiles, garments and leather making. Thus China's shifting towards production of hi-tech products which are fueling its export growth.

The observation of a surge in China's hi-tech exports is criticized by Xing (2012). According to Xing (2012) PRC (People's Republic of China) Customs classifies trade into two major categories e.g. processing trade and ordinary trade. Import of parts and components as intermediate inputs, processing and assemblage of these intermediate inputs into finished products and re-export of these finished products into global markets, constitute the processing trade. Both imported as well as domestically produced parts and components are used in

[2]Xing (2012)

[3]ibid

[4]Frangos, Alex (2013), "Behind China's Switch to High-end Exports", *Wall Street Journal*, March 24

processed exports. The domestic value added to exports is determined by the share of domestically produced contents. Xing (2012) suggests that due to lack of technological advantage, since 1990s, the processing trade has become the major form of hi-tech product export from China. Assemblage of parts and components into finished products only requires low-skilled labour and thus is no different from manufacturing or any other labour intensive commodities. Therefore, Xing (2012) argues that the contribution of the Chinese workers is not in advanced technology, but labour. Hence hi-tech products produced from majorly imported components should be excluded from the hi-tech product category and be rather termed, as Xing (2012) calls it, "*assembled hi-tech*" product category.

With this backdrop, this paper makes an attempt to examine whether India and China are indeed experiencing a rise in their exports of hi-tech products and if so then what factors are contributing to such a phenomenon. For this we resort to the constant market shares (CMS) analysis. CMS analysis "*is a technique for analysing trading patterns and trends for the purpose of policy formulation.*"[5] It "*compares the actual export growth performance of a country with the performance that would have been achieved if the country had maintained its exports relative to some standard*"[6].Thus this method intends to throw some light on the "*reasons underlying a country's comparative export performances*"[7]. For comparison, this method requires to have a standard. This standard may be "*the world or the set of similar or closely competitive countries*"[8]. Total exports are categorized in terms of product type and country of destination.

[5] Ahmadi-Esfahani (2006)

[6]Ahmadi-Esfahani and Anderson (2006)

[7]ibid.

[8]ibid.

This method is mostly used to understand whether a country's export performance vis-à-vis other countries is attributable to changing market shares or changes in the global trends in demand. A country's export share might grow in line with its major competitors or the country's comparative performance is might be attributable to its location in high growth regions or its specialization in high growth products. The first effect is termed as the scale effect, while the second and third are termed as the regional and product effects respectively. The CMS method aims at answering whether a country's comparative export performances is due to scale effects, regional effects, product effects or competitive gains in individual markets.

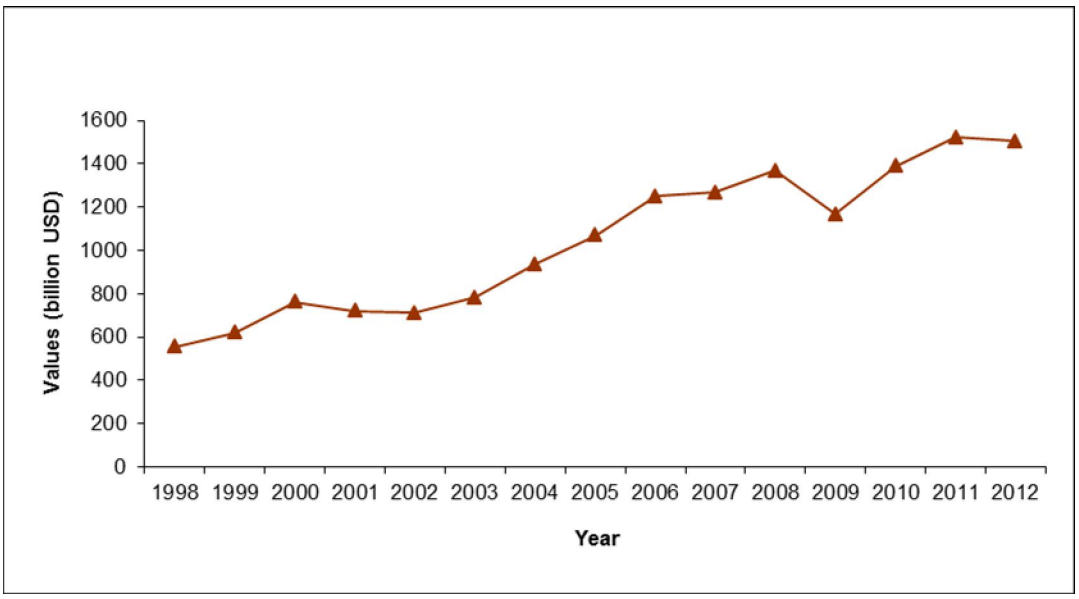
The paper is organized as follows: section 2, 3 and 4 discuss the overall trade dynamics of the world, India and China respectively in the high technology products sector, section 5 makes a comparison between the overall trade dynamics of India and China for the high technology products, section 6 briefly describes the Constant Market Share (CMS) analysis to understand the dynamics of exports changes, section 7 elaborates the CMS analysis for the high technology products exports for India and China, section 8 makes a comparison of the findings through application of the CMS analysis on India and China and finally, section 9 concludes the paper summarizing the findings briefly and discussing policy implications.

2. Overall Trade Dynamics

The following Figure 1 shows the total world export of high technology products during 1998-2012. As is evident, the total world export of high technology products has reflected a rising trend over this period although it had declined in 2009 (possibly as an outcome of the financial meltdown). The compound annual growth rate (CAGR) of world export of high tech products during this period is 7.38. However, as reflected in Figure 2 that depicts the movement in share of high technology products over the same years, we observe a slightly declining trend. We must

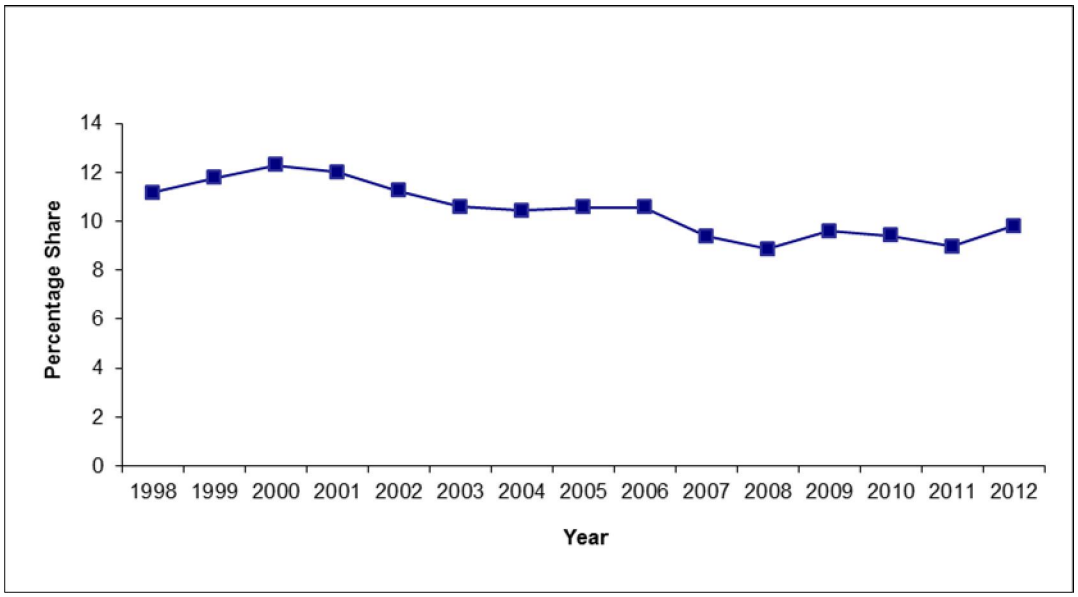
note here that the trend in the share of high technology products exports in total exports depends on both the levels of high technology products exports as well as total exports. As can be observed from Figure 2, the share of high technology products export in total exports has increased during 1998-2000 reaching a maximum in 2000. It is interesting to note that in 2009 the share of high technology products export in total exports has increased slightly; which is indicating that the financial meltdown was unable to hit the export of high technology products as badly as it hit the exports of other commodities.

Figure 1: Trend in World's Export of High Technology Products



Source: Calculated from data obtained from WITS database

Figure 2: Trend in the Share of World's Export of High Technology Products in Total Export



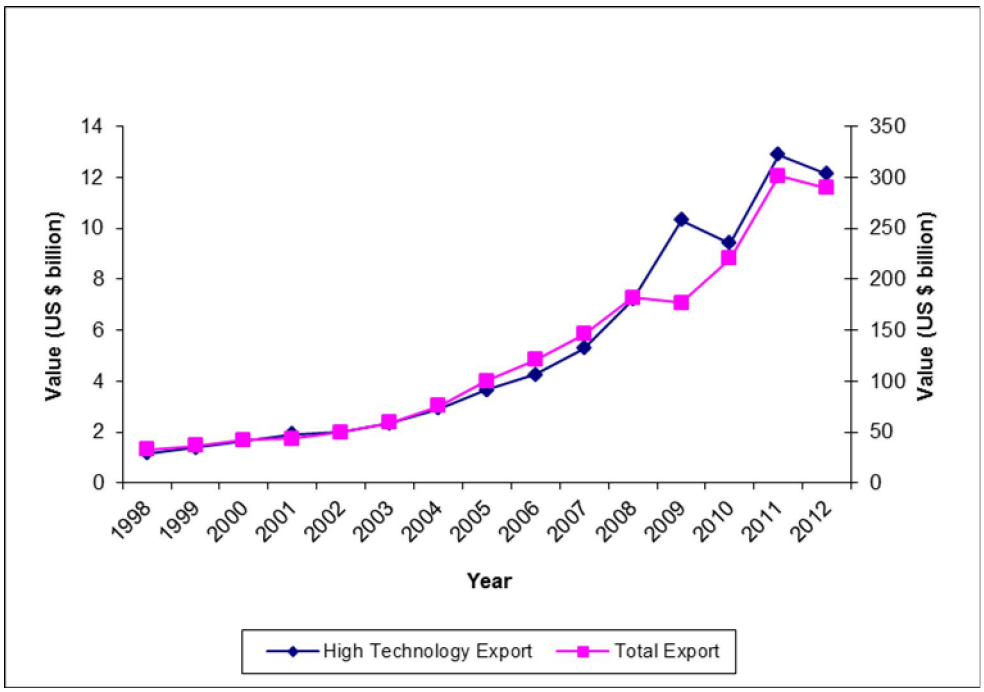
Source: Calculated from data obtained from WITS database

3. India's Trade Dynamics

In this section we look at India's trade dynamics for the period 1998-2012. The following Figure 3 shows the trends in both total export as well as high technology products export for the concerned period. It is observed that during 1998-2008, both the total and the high technology exports reflect a rising trend. In 2009, although there is a slight decline in total exports, however, the high technology products exports have sharply increased; this explains the sudden jump in the year 2009 in the share of high technology products exports of India in Figure 4. Also in contrast to the world economy, the export of high technology products from India has increased in the time of financial crisis. But for high technology products exports, India experienced the effect of the crisis after a year. Overall the high technology products export share of India shows slightly upward trend during this period. During 2010, there is a decline in high technology products exports while the total exports have increased. After that both reflect similar trends. The compound annual growth rate (CAGR) of total export for the period 1998-2012 is 16.73 and that

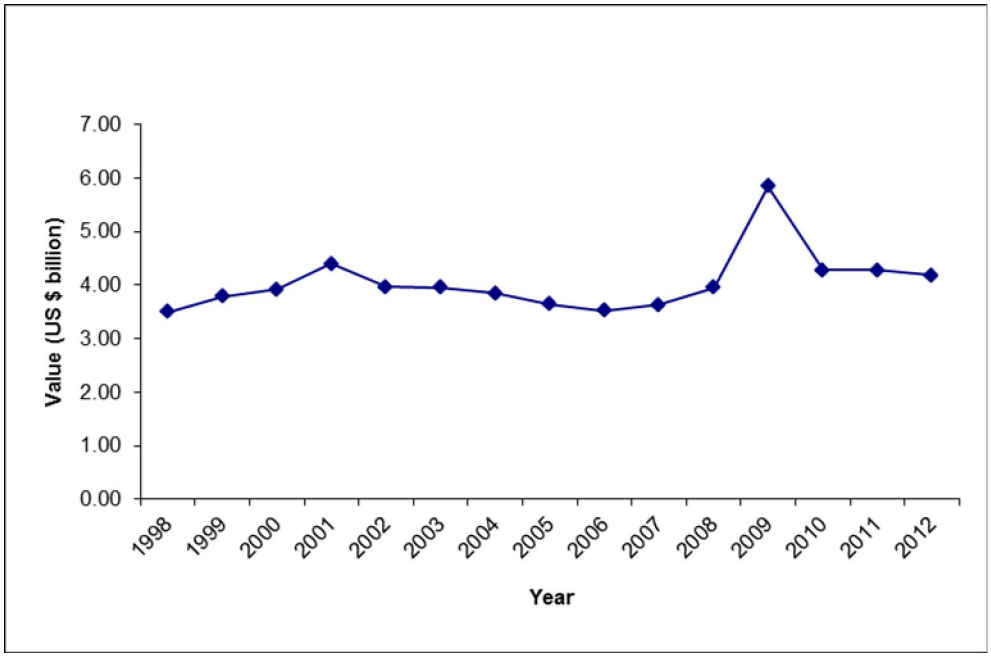
for the export of high technology products for the same period is 18.24. Thus India reflects a higher CAGR for exports of high technology products as compared to the CAGR for total exports, and also, we observe that during 2009, the year of global financial meltdown, there has been an increased demand for India's high technology products exports. Both these factors suggest that India should create incentives in order to boost its production and exports of high technology products further in order to exploit its prospect in the high technology products sector in a better manner.

Figure 3: Trend in India's Total and High Technology Export



Source: Calculated from data obtained from WITS database

Figure 4: Trend in Share of High Technology Products in India's Total Export



Source: Calculated from data obtained from WITS database

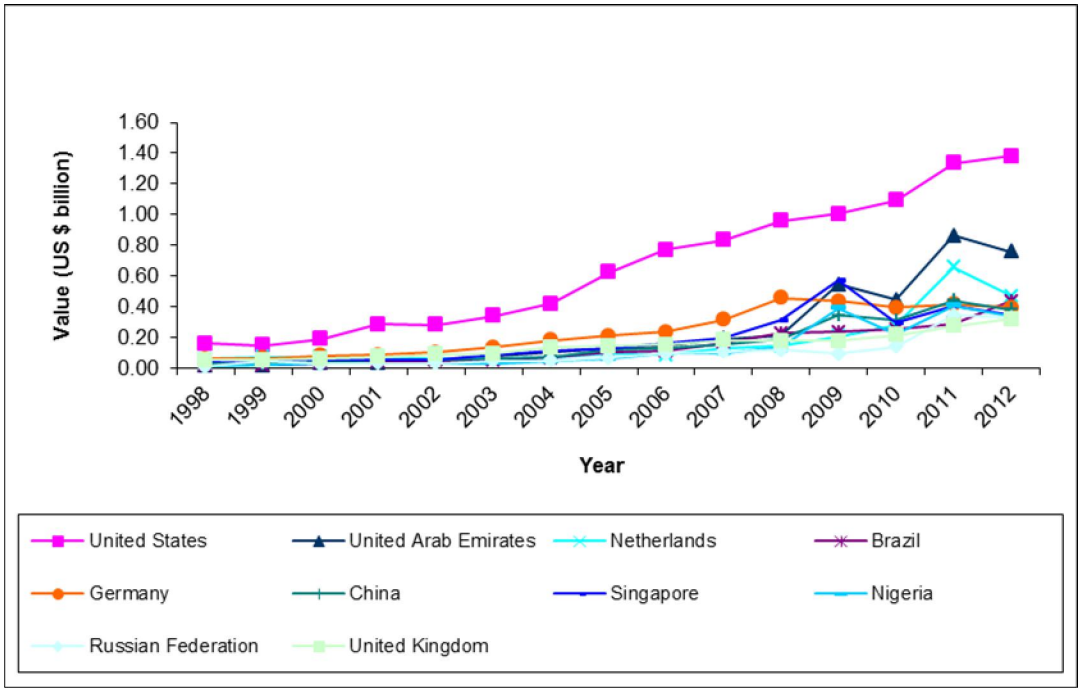
The top ten destinations of high technology products exports for India are United States, United Arab Emirates, Netherlands, Brazil, Germany, China, Singapore, Nigeria, Russian Federation, and United Kingdom. From the following Figure 5 it becomes clear that although the total value of high technology products export from India to its top ten destinations has increased over the years, the same does not hold true for the share of high technology products exports in total exports.

Figure 5: Trend in India's Aggregate High Technology Export to Its Top 10 Destinations

Source: Calculated from data obtained from WITS database

The compound annual growth rates (CAGR) of exports for these countries during the concerned period are United States 16.52, United Arab Emirates 29.93, Netherlands 15.55, Brazil 24.42, Germany 13.99, China 19.60, Singapore 15.07, Nigeria 24.32, Russian Federation 25.65, and United Kingdom 13.40. As can be observed from Figure 6, the US has consistently been the top most export destination for high technology products followed by UAE as the second top most destination. Observing the CAGR we find that India's exports of high technology products is increasing at a faster rate to destination countries like UAE, Russian Federation, Brazil and Nigeria as compared to the other destinations; thus the UAE and the Russian Federation may become the future top most destinations for Indian high technology products exports. Considering the high technology products export figures for 2012, China is observed to be holding the sixth rank among the top ten destinations for Indian high technology products exports.

Figure 6: Trend in India's High Technology Export to Its Top 10 Destinations

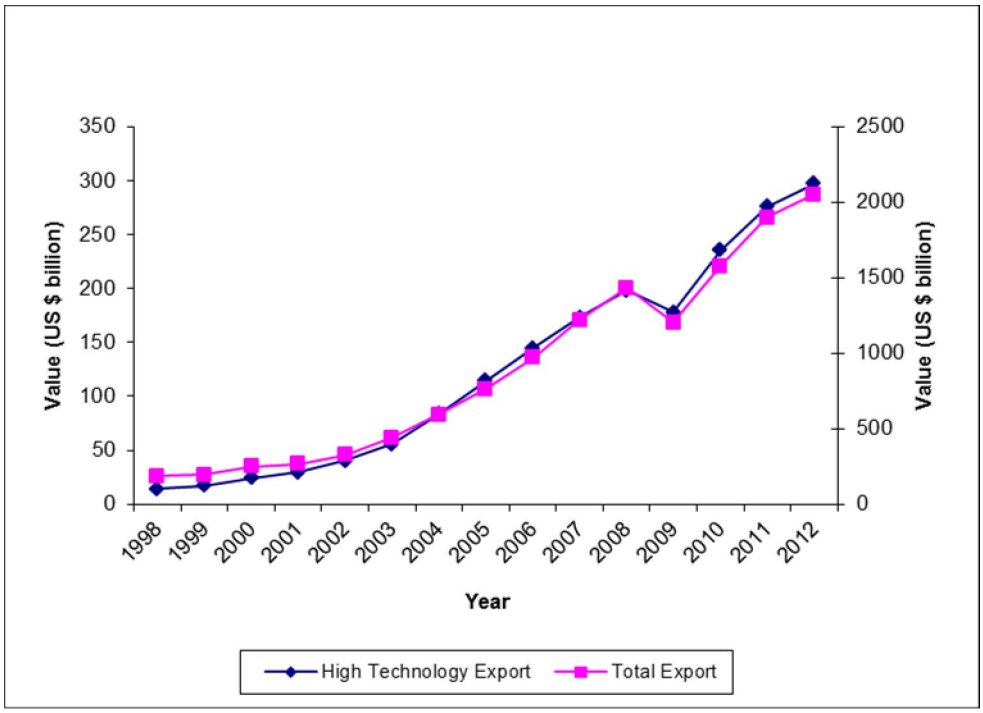


Source: Calculated from data obtained from WITS database

4. China's Trade Dynamics

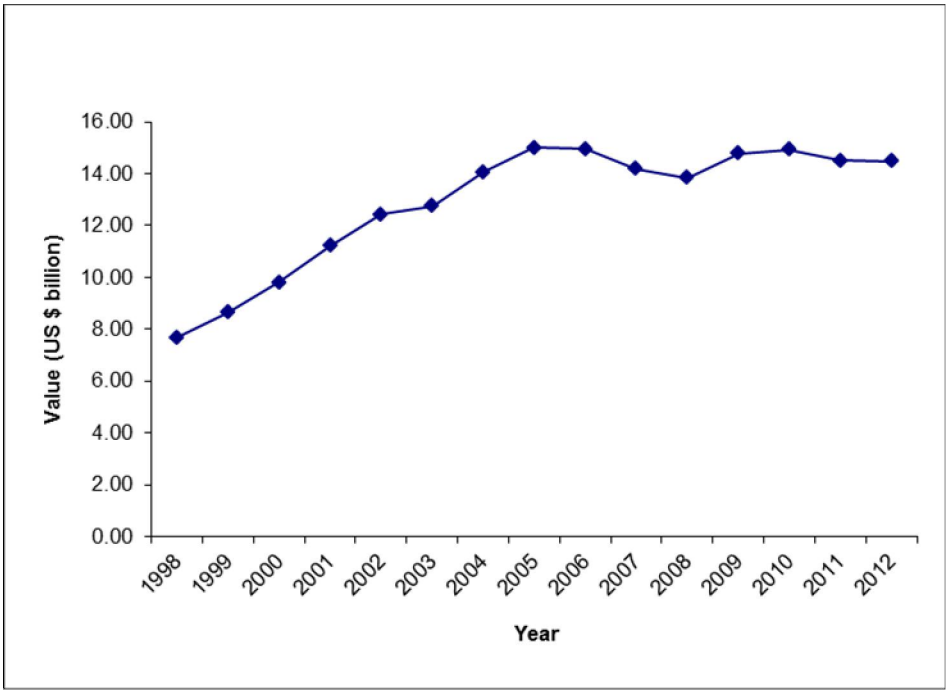
The following Figure 7 and Figure 8 capture China's trade dynamics. For China, the directions of movement in the values of high technology product exports and total exports are very similar during 1998-2012. The CAGR for high technology products exports is 24.31 and that for total exports is 18.79. Thus China reflects a higher CAGR for high technology products exports as compared to total exports, thus implicating the high technology products sector to hold great trade potential for China.

Figure 7: Trend in China's Total and High Technology Export.



Source: Calculated from data obtained from WITS database

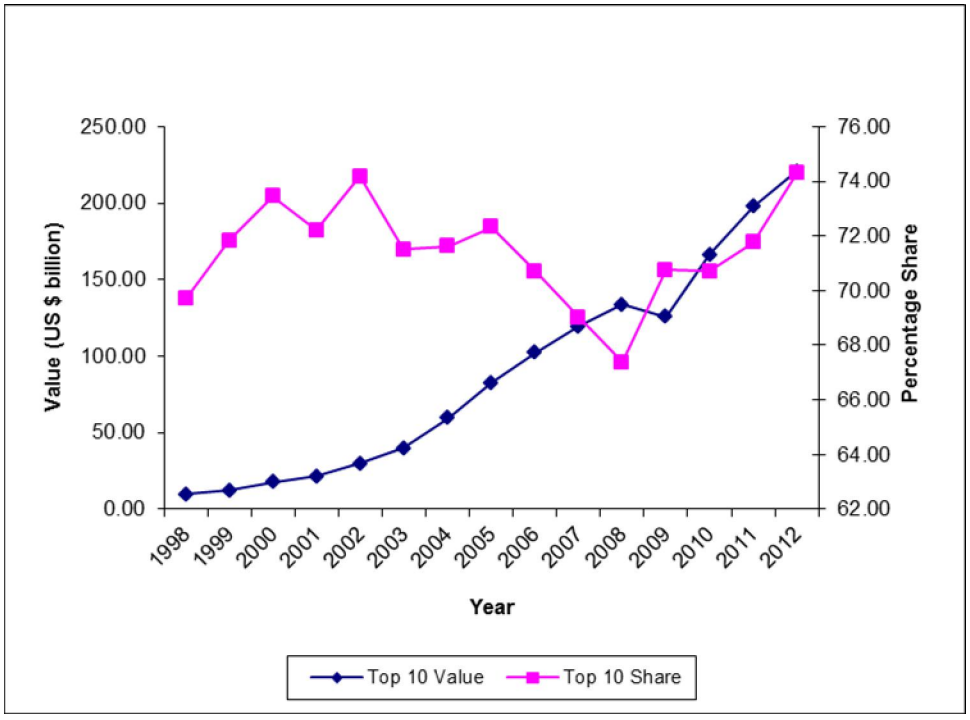
Figure 8: Trend in Share of High Technology Products in China's Total Export



Source: Calculated from data obtained from WITS database

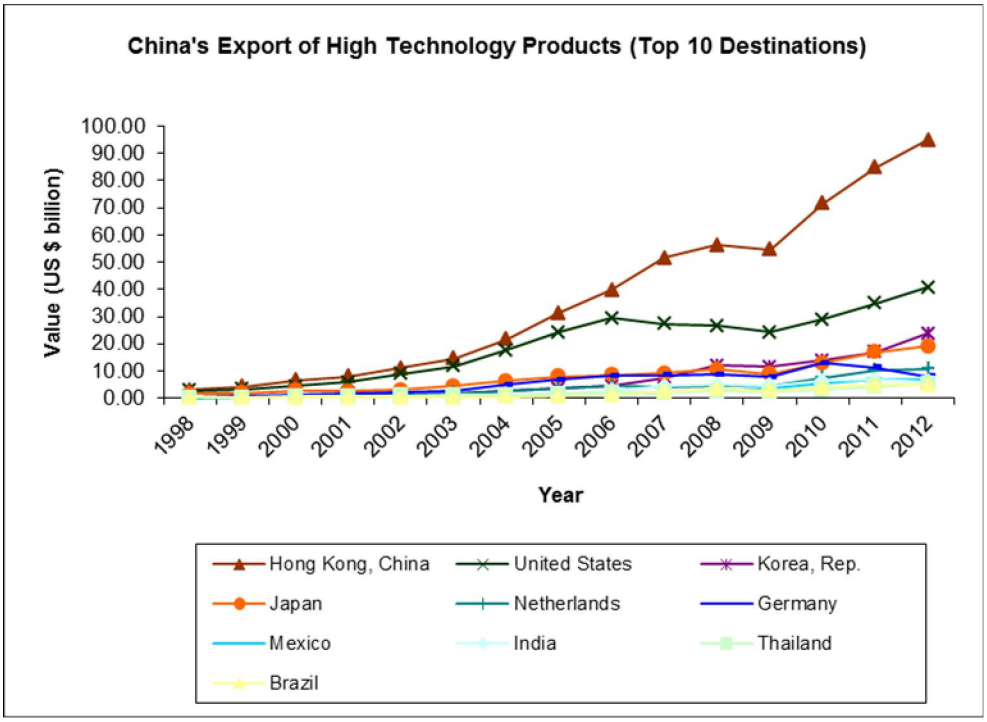
The top ten destinations for China's high technology products exports consist of Hong Kong (China), United States, Korea Republic, Japan, Netherlands, Germany, Mexico, India, Thailand and Brazil. The CAGR of high technology products exports of China for these countries for the concerned time period are Hong Kong (China) 27.49, United States 21.16, Korea Republic 32.04, Japan 18.69, Netherlands 23.79, Germany 20.70, Mexico 34.48, India 31.55, Thailand 26.60 and Brazil 29.78. As can be observed that India's exports of high technology products from China is increasing very rapidly, indicating that in future India may become one of the top importers of high technology products for China.

Figure 9: Trend in China's Aggregate High Technology Export to Its Top 10 Destinations



Source: Calculated from data obtained from WITS database

Figure 10: Trend in China's High Technology Export to Its Top 10 Destinations



Source: Calculated from data obtained from WITS database

5. Comparison of Overall Trade Dynamics of India and China

Looking at the overall trade dynamics for India and China, we observe that for China, the total export and the high technology products exports move along very similar paths during 1998-2012, whereas for India, the same holds true except for the year 2009. For this year there has been an increase in high technology products exports although overall exports have declined over time. China's value of exports (evaluated in US $) to the world, overall as well as high technology products, is also substantially higher than that of India. Also, China reflects a higher CAGR (24.31) as compared to India (18.24) for high technology products exports during 1998-2012 thus indicating that China can potentially outcompete India in the export of high technology products to the world market.

Looking at the top ten destinations for high technology products exports for these two countries during 1998-2012, we find that United States, Netherlands, Brazil and Germany show up as the common destinations, although with different rankings with respect to the concerned countries. For example, the USA is consistently the top most export destination for high technology products with respect to India and the volume of export to USA is significantly higher than that to United Arab Emirates, which is the second top most destination for Indian high technology products exports. But USA ranks second among the top ten destinations for Chinese high technology products exports, with Hong Kong, China topping the list. With respect to India, Netherlands, Brazil and Germany respectively hold third, fourth and fifth ranks among the top ten destinations for high technology products exports, while with respect to China, the same countries rank fifth, sixth and tenth respectively. However, looking at the CAGR for high technology products exports to these common destinations, we observe that the CAGR of high technology products exports from India to United States is 16.52, Netherlands 15.55, Brazil 24.42, Germany 13.99, and that from China to United States is 21.16, Netherlands 23.79, Brazil 29.78 and Germany 20.70. Thus, China has a higher CAGR for high technology products exports as compared to India to the common destinations. This implies that in future India might lose these markets to China.

One interesting observation is that each of China and India shows up in the list of top ten destinations for high technology products exports of the other. China ranks sixth among the top ten destinations for Indian high technology products exports during the concerned period, while India holds the eighth rank among the top ten export destinations for Chinese high technology products exports. However, growth in India's high technology products export to China is much less than the growth in China's high technology products export to India (as reflected by the

concerned CAGR figures); this is indicating that in future China's position as a high technology products importer for India may decline whereas India may become one of the top most export destinations for China. This implies that in case of trade in high technology products, China is likely to enjoy a more favourable terms of trade against India in future.

6. Constant Market Share Analysis to Understand the Dynamics of Export Changes

Constant Market Share (CMS) analysis[9] is a very useful tool for understanding and assessing the changes in exports of a country. A change in demand for imports is evaluated through the comparison of a constant market share and a changing market share. Several economic factors are then identified to which the change in market share is attributed. Finally, the residual effect of the changing market share is identified as the effect of change in competitiveness. CMS has become a popular tool of analysis since it uses a very simple model that involves very easy calculations using only trade data. Data on price and cost are required for calculating competitiveness. However, price and cost data are handled internally in the reduced form CMS model. The direct application of price and cost variables is done away with in the final formula thus making the estimation process simpler, since it is very difficult to obtain price and cost data for international trade. So the effects of competitiveness can be captured through using the data on imports and percentage change in imports for a country.

The fundamental assumption of this analysis is that a country's export share in a given market should remain invariant over time. Three factors account for the difference between the actual export growth from a country into a given market and the unchanging export share implied by

[9]The description of the CMS model in this section is inspired by and closely follows the description of CMS modeling in Nag and Chatterjee (2009).

the "*constant market share*" norm. These three factors are first, the effects of a general increase in demand for imports in the given market; second, commodity composition; and third, effects of competitiveness.

This model expresses the competitiveness term as negative or positive in order to make adjustments for actual change in market share. In the CMS model, the competitiveness effect calculates, to what extent, the macro share gain or loss of the country can be attributed to the sum of gains and losses of market shares of individual products.

$$X(t) - X(0) = mX(0) + \sum_i [(m_i - m)X_i(0)] + \sum_i [X_i(t) - X_i(0) - m_i X_i(0)]$$

Where

X: Exports of country A to country B

X_i: Commodity i exports of country A to country B

m: Percentage increase in country B's total imports from period 0 to period t

m_i: Percentage increase in country B's imports of commodity i between period 0 and period t

and $X = \sum X_i$

The right hand side can be divided into three components:

1. The general rise in country B's total imports;
2. The commodity composition of country A's exports to B in period 0;

3. And unexplained residual indicating the difference between country A's actual exports increase to country B and the hypothetical increase if country A maintained its share of exports of each commodity group in country B.

7. CMS India and China

In this section the CMS model has been experimented using the data on high tech product trade for India and China. It evaluates the change in competitiveness comparing three periods, e.g. 1998-2002, 2002-2007 and 2007-2012 (treating the years 1998, 2002 and 2007 as period 0 respectively). If for a particular country in a specific year the data of import of high tech product is not available then we substitute it by taking world export of that commodity in that particular year to that country, assuming the import from World is equal to export of the world.

7.1 CMS India

The calculated percentage values of the three components from the CMS model for India are presented in the following Tables 1-11, for the world as a whole and the top ten destination countries for high technology products exports. Table 1 shows that for the world as a whole the components *General Increase in Demand for Imports* and *Effects of Competitiveness* have remained positive for all the three periods, 1998-2002, 2002-2007 and 2007-2012, although its value has declined during 2007-2012. The decline in general demand is likely to be a consequence of the financial meltdown during 2008-2009. The effects of this meltdown have not disappeared for many countries even after three years. Another reason for this decline may be that either the World market is becoming saturated for India or some other countries have started exporting similar products. So India needs to figure out the reasons for this decline and formulate policies accordingly to boost up the demand for its export items in the high technology products

group. Both the *Change in Commodity Composition* component and the *Effects of Competitiveness* component have declined during 2002-2007 and increased after that. The *Change in Commodity Composition* component, however, remains negative throughout our period of analysis. From the dataset used for our analysis we find that certain high technology products, which India used to export in or till 2007 were no longer exported by this country in 2012, although it has started exporting some new high technology items in 2012. Thus the negative sign may be due to the fact that the changes in India's export items did not work favourbaly for the country. The *Effects of Competitiveness* component, however, has remained positive throughout and has reflected a continuous increase in its value thus indicating that India is quite competitive in the world market for high technology products exports.

Table 1: CMS India World

	2002	2007	2012
General increase in demand for imports	39.67	68.36	8.38
Change in commodity composition	-4.26	-22.94	-6.90
Effects of competitiveness	64.59	54.58	98.51

Source: Calculated from data obtained from WITS database

Table 2 shows that the component, *General Increase in Demand for Imports*, is negative for 1998-2002, but is positive for both 2002-2007 and 2007-2012 for Brazil, although it has declined during 2007-2012. Looking at the growth rate figures for Brazil[10], we find that during 1998-2002, Brazil's growth rate had been quite low. During 2002-2007, the growth rate figures are higher, reaching 6.1 per cent in 2007. During 2007-2012 growth rate declined again reaching 0.9 per cent in 2012. Thus the negative sign of the component *General Increase in Demand for Imports* during 1998-2002 is very likely to be due to lower demand for imports arising from low

[10] The growth rate figures for all the countries considered in this and the subsequent sections are available at http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?page=2 (accessed on November 7, 2013)

growth rates of Brazil's GDP. The subsequent rise in the value of this component during 2002-2007 also can be linked to the higher levels of GDP growth rate during this period and the following decline during 2007-2012, to the fall in growth rates during this period. The component *Change in Commodity Composition* remains positive throughout, marking a decline during 2002-2007 and then increasing during 2007-2012. The dataset used for our analysis here suggests that certain high technology items that India used to export to Brazil in 2002, were not exported in 2007 although some new high technology items India started exporting since 2007 which it never exported before. The decline in the *Change in Commodity Composition* component suggests that this change in the export items did not contribute favourably to the level of exports during 2002-2007. However, for many of the items that India started exporting since 2007, the level of exports increased remarkably by 2012. This is one possible reason for the increase in the value of the *Change in Commodity Composition* component during 2007-2012. The third component, *Effects of Competitiveness* remains positive during 1998-2002 and 2002-2007, although declining drastically during 2007-2012, and turns negative during 2007-2012 hence implying further decline in competitiveness of Indian high technology products for this period. This implies that India is facing competition from other countries which export high technology products to Brazil. The very fact that certain items which India started exporting to Brazil from 2007 do not show up in India's list of high technology items exported to Brazil in 2012, reflects that those items could not survive in the competition with the same type of products exported by other countries. So India needs to address this issue and formulate policies to make its high technology products exports more competitive in Brazil.

Table 2: CMS India Brazil

	2002	2007	2012

General increase in demand for imports	-15.14	68.37	52.06
Change in commodity composition	24.88	14.84	58.42
Effects of competitiveness	90.26	16.80	-10.48

Source: Calculated from data obtained from WITS database

In Table 3 we observe that *General Increase in Demand for Imports* from China remains positive throughout for all the concerned periods, though recording an increase during 2002-2007 followed by a substantial decline during 2007-2012. The growth rate figures for China show that during 1998-2002, China's GDP had been growing consistently reaching 9.1 per cent in 2002 from 7.8 per cent in 1998. This increasing trend continues during 2002-2007 reaching 14.2 per cent in 2007. After that, however, there is a decline during 2007-2012, and the growth rate reaches 7.8 per cent in 2012. Thus the increase in the *General Increase in Demand for Imports* component during 2002-2007 and the subsequent decline in it during 2007-2012 are likely to be the direct consequences of the respective increase and decline in China's GDP growth rate during 2002-2007 and 2007-2012. However, *Change in Commodity Composition* is positive for 1998-2002, remains negative during both 2002-2007 and 2007-2012, although recording a substantial increase 2007-2012. Looking at the list of high technology items that India exports to China from our dataset, we find that certain items India exported to China in 2002 those were not exported during 1998 or 2007. A few of such items, however, have been exported during 2012. A few high technology products were exported in 1998, but not in 2002, and again were exported both during 2007 and 2012. There are a number of high technology items that India started exporting to China since 2007 and continued to export them even during 2012. Thus the changes in the high technology export items to China during 2002-2007 did not contribute positively to India's exports, but the changes during 2007-2012 did have a positive impact on Indian high technology products exports to China. The *Effects of Competitiveness* component is negative during 1998-2002 and increases substantially thus turning positive during 2002-2007 and

remains almost at the same level during 2007-2012. This implies that India's competitive strength as opposed to the other countries who export high technology products to China improved during 2002-2007 and India has been able to maintain it more or less at the same level during 2007-2012.

Table 3: CMS India China

	2002	2007	2012
General increase in demand for imports	123.02	138.06	61.61
Change in commodity composition	0.74	-79.83	-3.40
Effects of competitiveness	-23.76	41.77	41.79

Source: Calculated from data obtained from WITS database

For Germany, as reflected by Table 4, the *General Increase in Demand for Imports* component remains positive recording a substantial increase during 2002-2007 followed by a decline during 2007-2012. The GDP growth rate figures for Germany show that during 1998-2002, Germany's growth rate had been low never exceeding 2 per cent except for reaching 3.1 per cent in 2000. During 2002, Germany's growth rate was zero per cent, which increased to 3.3 per cent in 2007, but again declined to 0.7 per cent during 2012. Thus the direction of the changes in the *General Increase in Demand for Imports* component is quite similar to the direction of changes in the growth rates of GDP during the concerned period. Therefore the changes in this component are very likely to be directly resulting from the changes in GDP growth rates of Germany during our period of analysis. The *Change in Commodity Composition* component declines continuously thus turning negative during 2007-2012. Our dataset shows that there are some high technology products which India has exported to Germany in 1998, 2002, 2007 and 2012. In most cases, India has exported the high technology products either in 1998 and then again in 2012, but not during 2002 or 2007, or in 2002 and 2007 but not during 1998 or 2012 etc. thus suggesting that

India has changed the high technology export items to Germany quite often. From the direction of change in the *Change in Commodity Composition* component we can infer that such changes has not helped India's exports to grow in the German market. An underlying implication of this is that India needs to understand the requirement of the German market more appropriately and serve it accordingly by selecting the right kind of high technology export items. The *Effects of Competitiveness* component declined during 2002-2007, but increases during 2007-2012 and stays positive throughout. This implicates that the competitive strength of Indian high technology exports as compared to other countries who export high technology products to Germany although had declined in between but has recovered to some extent also.

Table 4: CMS India Germany

	2002	2007	2012
General increase in demand for imports	6.13	57.64	43.59
Change in commodity composition	3.77	2.68	-4.75
Effects of competitiveness	90.10	39.68	61.16

Source: Calculated from data obtained from WITS database

As suggested by Table 5, for Netherlands, *General Increase in Demand for Imports* remains positive throughout although it continuously declines during both 2002-2007 and 2007-2012. The growth rate figures for this country indicate that GDP growth rate had been higher in 1998 (3.9 per cent) than in 2002 (0.1 per cent), again rose to 3.9 per cent in 2007, but declining to -1 per cent in 2012. This suggests that decline in GDP growth rate for Netherlands might have resulted in decline in its import demand during 1998-2002 and 2007-2012, which has also led to a decline in India's high technology products exports to the country. However, during 2002-2007, when Netherland's GDP growth rate had improved, demand for Indian high technology products did not increase. Thus India needs to take note of it and figure out how to improve its

export potentials to Netherlands. The *Change in Commodity Composition* component increases substantially to reach from a negative value during 1998-2002 to a positive value in 2002-2007, but declines during 2007-2012 although remaining positive still. The number of high technology products which India exports to Netherlands is not very large (as observed from our data set). Moreover, in case of most of these export items, there is no definite pattern in the level of exports over the concerned period, i.e. India has exported certain items in certain specific years and never before or after, for some items, abruptly there is export from India to Netherlands during two or three years in our considered time period. The direction of changes in the *Change in Commodity Composition* component indicates that changing the export items to Netherlands, India has gained during 1998-2002 and 2002-2007, but the same does not hold true during 2007-2012. To prevent it from further declining and enhancing its value would require India to identify the nature of high technology products that the Dutch market requires and select its high technology export items accordingly. The *Effects of Competitiveness* declines drastically during 2002-2007 thus turning negative and then increasing substantially during 2007-2012 turning positive again. This indicates that India's competitive strength as compared to other countries who export high technology products to the Dutch market had diminished during 2002-2007 but has recovered again during 2007-2012.

Table 5: CMS India Netherlands

	2002	2007	2012
General increase in demand for imports	269.33	124.68	7.33
Change in commodity composition	-262.61	61.00	3.75
Effects of competitiveness	93.28	-85.68	88.92

Source: Calculated from data obtained from WITS database

For Nigeria, as observed from Table 6, the *General Increase in Demand for Imports* is positive throughout marking an increase during 2002-2007 followed by a decline during 2007-2012. If we look at the growth figures for this country, we find that the rate of growth of GDP had been rising at a slow pace during 1998-2000 and declined during 2000-2002, thus reaching 1.5 per cent during 2002. However, it has increased substantially during the following two years, 2003 and 2004, being more than 10 per cent during both these years followed by a decline after that. In 2007 the growth rate was 6.4 per cent, and after that it has remained at more than 6 per cent level, reaching 6.6 per cent in 2012. Thus the rise in demand for Indian high technology products in the Nigerian market during 2002-2007 is likely to result from the surge in its GDP growth rate in the intermediate years. But since during 2007-2012, GDP growth rate for Nigeria had been through both up and down in its level, the decline in the demand for Indian high technology products is difficult to be explained solely in terms of its rate of growth of GDP. There are likely to be other factors responsible for this phenomenon. The *Change in Commodity Composition* component increases drastically during 2002-2007 thus acquiring a high positive value, from a negative value during 1998-2002 and declines substantially during 2007-2012, although still remains positive. Our dataset suggests that there have been changes in the composition of Indian high technology exports to Nigeria both during 2002-2007 as well as 2007-2012. The changes in the direction of the *Change in Commodity Composition* component suggests that the changes in high technology export composition during 2002-2007 had been favourable for India while that during 2007-2012 was not so. The *Effects of Competitiveness* component falls substantially during 2002-2007 turning negative from a positive value during 1998-2002, and then increases although still remains negative during 2007-2012. This suggests that India's competitive strength vis-à-vis other exporters to the Nigerian market had declined during 2002-2007 and improved

relatively during 2007-2012. But to fare better in the Nigerian market and to retain this market India needs to make its high technology products exports more competitive, since the *Effects of Competitiveness* component stays negative even during 2012.

Table 6: CMS India Nigeria

	2002	2007	2012
General increase in demand for imports	33.35	133.61	9.01
Change in commodity composition	-25.67	791.56	280.30
Effects of competitiveness	92.32	-825.18	-189.32

Source: Calculated from data obtained from WITS database

For Russian Federation, as we observe from Table 7, the *General Increase in Demand for Imports* component is positive throughout, recording a drastic increase during 2002-2007, followed by a decline during 2007-2012. The growth rate figures for the Russian Federation suggests that there had been a significant improvement in the rate of growth for this country during 2002-2007, in 2002 the growth rate was 4.7 per cent while in 2007, it was 8.5 per cent. However, most likely due to the financial crisis during 2008, the growth rate of GDP declined after that turning negative in 2009. Though there is a recovery, but still after that till 2012, the growth rate has never gone above 5 per cent. Thus the enhancement and decline in the demand for Indian high technology products by the Russian Federation is quite likely to be a direct consequence of the changes in the growth rates of its GDP. A substantial decline in the *Change in Commodity Composition* component occurs thus turning it negative during 2002-2007, followed by a marked improvement thus turning it positive again during 2007-2012. There are a number of high technology products that India used to export to the Russian Federation during 2002 but not during 2007 while some new high technology products it exported during 2007 which it did not used to export during 2002. The same pattern is observed for 2007 and 2012.

The changes the directions of the *Change in Commodity Composition* component suggests that the changes in the composition of high technology exports had been adverse to India during 2002-2007 while the opposite holds for such changes during 2007-2012. The *Effects of Competitiveness* component improves substantially during 2002-2007 thus turning positive from a high negative value and then declines although still remains positive during 2007-2012, thus implying that India needs to adopt appropriate policies to maintain competitiveness in the high tech products sector. This reflects that India's competitive strength as against other contenders in case of high technology products exports had substantially improved during 2002-2007, followed by a decline. Thus India needs to pay attention to improve its competitive strength to retain its position in the Russian market or to improve it further.

Table 7: CMS India Russian Federation

	2002	2007	2012
General increase in demand for imports	3.79	145.88	29.14
Change in commodity composition	426.23	-86.56	52.09
Effects of competitiveness	-330.02	40.68	18.77

Source: Calculated from data obtained from WITS database

Table 8 shows that for Singapore, the *General Increase in Demand for Imports* component stays positive throughout, declines slightly during 2002-2007 and remains almost at the same level thereafter. The growth rate figures for this country reflect a lot of fluctuations during 1998-2012. Therefore the changes in the direction of the *General Increase in Demand for Imports* component are likely to have been caused by some additional factors and not just the growth rate of GDP. Since Singapore has full capital account convertibility (which was a major factor behind this economy being so hard hit by the South-East Asian financial crisis during 1997), some level of volatility is present in this economy. This volatility is a highly probable factor behind the

fluctuating nature of demand for high technology products. The *Change in Commodity Composition* component stays positive throughout, recording an increase during 2002-2007 and then a decline during 2007-2012. India exports a large number of high technology products to Singapore. Most of these products are being exported throughout our period of analysis. However, there are a few of these products which are exported only in specific years and not always. So the directions of changes in the *Change in Commodity Composition* component suggest that the changes in the composition of high technology products exports acted favourably for India during 2002-2007 but not during 2007-2012. Therefore India needs to recognize the specific needs of the Singapore market and target it in a better way in order to improve its export performances in that market. The *Effects of Competitiveness* component remains negative throughout, declining during 2002-2007 and increasing during 2007-2012. This clearly suggests that India needs to be really careful in making its high technology products exports in Singapore more competitive as compared to its contenders. Although the direction of changes in the *Effects of Competitiveness* component reflects some moves in this direction, but unless India can improve its competitiveness in case of high technology items substantially, it might lose this market in future.

Table 8: CMS India Singapore

	2002	2007	2012
General increase in demand for imports	60.33	56.81	56.18
Change in commodity composition	79.86	137.11	56.51
Effects of competitiveness	-40.19	-93.92	-12.69

Source: Calculated from data obtained from WITS database

The *General Increase in Demand for Imports* component for UAE remains positive throughout, increasing quite a bit during 2002-2007 and declining during 2007-2012, as observed from Table

9. The GDP growth rates for this country had been above 8 per cent during 2003, 2004 and 2006. Thus the increase in the *General Increase in Demand for Imports* component may be a result of high GDP growth between 2002 and 2007. After 2007, especially during the years immediately following the crisis, the growth rates for this country are negative. The *Change in Commodity Composition* component declines and turns negative during 2002-2007 and increases but still stays negative during 2007-2012. Although UAE is the second top most destination for Indian high technology export items, our dataset shows that there are only a number of high technology products that India exports to UAE consistently during all the years considered for our analysis. Improvement in the value of the *Change in Commodity Composition* component during 2007-2012 indicates that the high technology products that India had been exporting during this period are the ones more appropriate for the UAE market. But since it is still negative, India needs to study the UAE market more deeply to understand its specific requirements for high technology products and select the export items accordingly. The *Effects of Competitiveness* component remains positive throughout, declining during 2002-2007 and then increasing markedly during 2007-2012. This implies that India had been lagging in terms of competitiveness in high technology products exports behind its contending exporters to UAE during 2002-2007, but has been able to improve her position during the next five years.

Table 9: CMS India UAE

	2002	2007	2012
General increase in demand for imports	29.58	97.45	11.66
Change in commodity composition	20.53	-32.06	-4.89
Effects of competitiveness	49.89	34.61	93.22

Source: Calculated from data obtained from WITS database

For UK, as observed from Table 10, the *General Increase in Demand for Imports* component increases substantially during 2002-2007 but declines drastically during 2007-2012. The GDP growth rates for this country are never very high during 2002-2007, always staying below 4 per cent per annum, but the growth rate has been more or less steady during these years. However, both during 2008 and 2009 the growth rate has been negative owing to the financial crisis. Although it has recovered after that, it has never crossed 2 per cent. Thus the reduction in the *General Increase in Demand for Imports* component during 2007-2012 is likely to be a direct consequence of the financial crisis during 2008 and its aftermath during the following years. The *Change in Commodity Composition* component remains negative throughout but improves continuously during 2002-2007 and 2007-2012. Observing the list of India's high technology export items to the UK it is found that most of the commodities in this list India has been exporting consistently during the time period considered, although some few new commodities have entered the list while some other commodities have dropped out. The gradual improvement in the value of the *Change in Commodity Composition* component indicates that India is over the time addressing the needs of the UK market better. But since the value of this component is still negative, this implies that India needs to reflect more on this and target the market with more appropriate types of high technology items. The *Effects of Competitiveness* component is positive throughout showing a decline in 2002-2007 and an increase during 2007-2012 thus reflecting an improvement in India's competitive strength during 2007-2012 vis-à-vis other contenders in the UK market.

Table 10: CMS India UK

	2002	2007	2012
General increase in demand for imports	23.73	71.64	13.91
Change in commodity composition	-35.20	-22.39	-17.33

Effects of competitiveness	111.47	50.75	103.42

Source: Calculated from data obtained from WITS database

From Table 11, we find that, the *General Increase in Demand for Imports* component is positive throughout remaining almost at the same level during 1998-2002 and 2002-2007. During 1998-2007, the GDP growth rates for this country has varied between 1per cent and 5 per cent, but has never changed very drastically in any direction. Since the US had been the country where the financial crisis of 2008 originated, it GDP growth turned negative during the same year and even in 2009 it stayed negative. It has recovered after that, but the GDP growth rates are still not very high (the growth rates have never exceeded 3 per cent till 2012). So the onset of the crisis and its aftermath is likely to be the major reason behind the reduction in the *General Increase in Demand for Imports* component during 2007-2012. The *Change in Commodity Composition* component declines and turns negative during 2002-2007 and increases drastically thereafter acquiring a high positive value during 2007-2012. From our dataset it emerges that though most of the high technology items that India exports to the USA have been exported consistently, there are many new items, which India started exporting since 2007 or 2012 and some items it has exported in 2002, but not during 2007 or 2012. The direction of the changes in the *Change in Commodity Composition* component suggests that the selection of the high technology export items during 2007-2012 addresses the requirements of the US market more appropriately. The *Effects of Competitiveness* component increases during 2002-2007 and then declines drastically turning negative during 2007-2012. So an obvious policy implication is to adopt measures for enhancing competition in the high technology products sector in order to make its exports more competitive in the US market as compared to other contending exporters. Otherwise India might lose its position in the top most destination for its high technology products exports.

Table 11: CMS India USA

	2002	2007	2012
General increase in demand for imports	35.95	35.31	23.98
Change in commodity composition	10.67	-5.24	101.96
Effects of competitiveness	53.38	69.93	-25.94

Source: Calculated from data obtained from WITS database

7.2 CMS China

The following Tables 12-22 provide the percentage values of the three components as mentioned in Section 6 from the CMS model for China. Table 12 below suggests that for the world as a whole *General Increase in Demand for Imports* component increases during 2002-2007 and declines during 2007-2012 although stays positive throughout. . Just like India, for this country also the major reason for the reduction in the *General Increase in Demand for Imports* component during 2007-2012 for the whole world is the global financial meltdown during 2008. This financial meltdown has led to an overall reduction in demand for imports from the world and therefore for the high technology products as well. The *Change in Commodity Composition* component remains low throughout, even acquiring a negative value during 2007 and then recovering to a positive value during 2012. The *Effects of Competitiveness* component remains positive throughout although declining during 2002-2007 and then recovering to its previous level during 2007-2012 thus reflecting China's competitive strength in the high technology products sector as opposed to other countries who export high technology products.

Table 12: CMS China World

	2002	2007	2012
General increase in demand for imports	15.05	34.77	15.11
Change in commodity composition	0.37	-10.55	0.17
Effects of competitiveness	84.58	75.77	84.71

Source: Calculated from data obtained from WITS database

Brazil's demand for imports of high technology products from China has experienced a sustained increase as reflected through the steady rise in the *General Increase in Demand for Imports* component throughout during 1998-2012. Brazil GDP growth rate has gone through many ups and downs during the concerned period. However, it fell only very drastically to turn negative during 2009. Despite that, since the demand for Chinese high technology products has been continuously rising, it indicates that Chinese high technology products satisfy the requirements of the Brazilian market quite appropriately. Thus even during the years recording low growth rates there is no impact on the demand for Chinese high technology imports. The same pattern is observed for the component *Change in Commodity Composition*. . Our dataset suggests that China started exporting some new items during 2002, 2007 and 2012. Observing the directions of change in the component *Change in Commodity Composition*, we can make out that it worked favourably for China. However, the *Effects of Competitiveness* component marks a continuous decline throughout 1998-2012 and finally turns negative during 2012 indicating a reduction in China's competitive strength vis-à-vis its contenders for the Brazilian market for high technology products. So China needs to adopt measures to prevent the decline in its competitive strength in context of Brazil.

Table 13: CMS China Brazil

	2002	2007	2012
General increase in demand for imports	-52.13	13.58	72.87
Change in commodity composition	-68.64	13.18	50.27
Effects of competitiveness	220.77	73.24	-23.14

Source: Calculated from data obtained from WITS database

For Germany, as reflected in table 14, the *General Increase in Demand for Imports* component has increased during 2002-2007 but falls drastically after that thus turning negative during 2012..

Germany's growth rate of GDP has moved upward and downward many a time during our concerned period of analysis. It has turned negative once during 2003 and another time during 2009. After 2009, however, there has been a recovery. But still the demand for imports of high technology products from China declines substantially as reflected from the calculated values of the *General Increase in Demand for Imports* component. It appears that during 2002-2007 the German market had a demand for Chinese high technology items, but possibly due some changes in consumers' preferences this is not so any more during 2007-2012. The *Change in Commodity Composition* component declines continuously during 1998-2012, turns negative during 2007 and acquires a very high negative value during 2012. During the period of analysis, as observed from our dataset, there have been some changes in the list of high technology export items from China to Germany in terms of new products being included; products exported earlier being dropped from the list and some products being exported in certain years but not always. It appears that none of these changes have acted in favour of China for which we observe the continuous decline in the *Change in Commodity Composition* component. The *Effects of Competitiveness* component has increased throughout and quite substantially during 2007-2012 thus reflecting China's growing competitive strength.

Table 14: CMS China Germany

	2002	2007	2012
General increase in demand for imports	1.64	35.95	-193.35
Change in commodity composition	22.75	-22.57	-228.18
Effects of competitiveness	75.61	86.63	521.53

Source: Calculated from data obtained from WITS database

Table 15 suggests a continued rise in the demand for Chinese exports to Hong Kong, as reflected by the sustained increase in the *General Increase in Demand for Imports* component during

1998-2012. Despite experiencing fluctuations in growth rates of GDP and even recording a negative growth rate during 2009, the continuous increase in the *General Increase in Demand for Imports* component indicates Hong Kong's strong preference towards Chinese high technology products. The *Change in Commodity Composition* component records a marked increase during 2002-2007 followed by a decline during 2007-2012. There are certain products that China has stopped exporting to Hong Kong after 2002 and some products it has started exporting since 2007. The direction of changes in the value of the *Change in Commodity Composition* component suggests that China has gained from the changes in the list of high technology export items to Hong Kong during 2002-2007 and lost from such changes during 2007-2012. The *Effects of Competitiveness* component declines drastically during 2002-2007, turning negative, but improves again during 2007-2012, turning positive again during 2012 indicating that China has recovered during 2007-2012 from the loss in competitive strength in the high technology products sector as opposed to other contenders in the Hong Kong market during 2002-2007.

Table 15: CMS China Hong Kong

	2002	2007	2012
General increase in demand for imports	4.53	21.42	58.93
Change in commodity composition	26.13	964.63	19.91
Effects of competitiveness	69.34	-886.05	21.15

Source: Calculated from data obtained from WITS database

India reflects a continued rise in demand for Chinese imports as indicated by the sustained increase in the *General Increase in Demand for Imports* component in Table 16. If we look at the growth rate figures for India during 1998-2012, we find that India has experienced high growth rates during most of these years and the growth rate never dropped below 3 per cent. Although in

2008, India's growth rate had declined to the level of 3.2 per cent, in 2009 in stark contrast to many countries, India experienced a growth rate of 8.5 per cent followed by a growth rate of 10.5 per cent during 2010. But then in 2011 there had been a lower growth rate of 6.3 per cent, followed by an even lower growth rate of 3.2 per cent in 2012. Thus India's more or less consistently high growth rate compounded by the fact that this country was relatively more insulated than many other countries from the adverse impact of the financial meltdown of 2008 is likely to have contributed to a sustained increase in the import demand for high technology products from China. However, the *Change in Commodity Composition* and the *Effects of Competitiveness* components decline throughout turning negative during 2012. Observing our dataset we find that the list of high technology export items has changed a number of times during our period of analysis which as it appears has not contributed to the growth of Chinese imports in the Indian market. India herself is a large exporter of high technology products and looking at the lists of high technology products exported by both India and China, we find that there are many common items between these two lists. Therefore it might very well be the case that India is able to produce and sell in its own market such common high technology items at cheaper rates as compared to their Chinese counterparts. If this is indeed the case then China is very likely to lose its competitive strength.

Table 16: CMS China India

	2002	2007	2012
General increase in demand for imports	8.93	47.57	346.74
Change in commodity composition	6.90	6.08	-59.77
Effects of competitiveness	84.16	46.35	-186.97

Source: Calculated from data obtained from WITS database

Japan's demand for Chinese imports has increased during 2002-2007, and then declined during 2007-2012 as reflected in the fluctuations in the *General Increase in Demand for Imports* component in Table 17. This is likely to arise from the slight increase in GDP growth rate during 1998-2002, followed by a steady growth rate during 2002-2007, and the subsequent decline in this growth rate during and after 2008. The *Change in Commodity Composition* component declines both during 2002-2007 and 2007-2012, thus suggesting that China has not benefited from the changes in the list of exports of its high technology products to Japan (as observed from our dataset, a number of high technology items have been exported to Japan during certain years but not consistently throughout). The *Effects of Competitiveness* component declines during 2002-2007 and then increases during 2007-2012 indicating that China has been able to regain its competitive strength in context of the Japanese market during 2007-2012.

Table 17: CMS China Japan

	2002	2007	2012
General increase in demand for imports	25.31	43.42	39.38
Change in commodity composition	5.77	5.43	2.34
Effects of competitiveness	68.92	51.15	58.28

Source: Calculated from data obtained from WITS database

From Table 18 we observe that the *General Increase in Demand for Imports* component increases during 2002-2007 and then declines substantially though still remaining positive during 2007-2012. The average growth rate of Korea during 2007-2012 is lower during 2007-2012 as compared to 2002-2007 and this is a very likely reason for the lower value of the *General Increase in Demand for Imports* component during this period. The *Change in Commodity Composition* component falls, acquiring a negative value during 2002-2007 but then improves drastically to acquire a high positive value during 2007-2012. This indicates that China has

gained through starting to export some new high technology items to Korea Republic since 2007 and also from stopping the export of a few other commodities. The *Effects of Competitiveness* component increases during 2002-2007 and then declines to reach a negative value during 2012 thus indicating a reduction in China's competitiveness in the high technology products sector in context of its exports to the Korea Republic as compared to other contending exporters to the same country.

Table 18: CMS China Korea Republic

	2002	2007	2012
General increase in demand for imports	30.24	33.13	0.47
Change in commodity composition	14.62	-4.61	110.67
Effects of competitiveness	55.15	71.49	-11.14

Source: Calculated from data obtained from WITS database

Demand for China's exports to Mexico rises continuously during 1998-2012 as observed from the movement in the percentage value of the component *General Increase in Demand for Imports* in Table 19. Although the GDP growth rate for Mexico declined substantially during 2009 (turning negative) and was not so high even after that, still the sustained increase in the demand for imports from China is likely to be caused by other factors, e.g. strong preferences for Chinese high technology products among the Mexican consumers. The *Change in Commodity Composition* component declines during 2002-2007 turning negative during 2007 and then increasing to acquire a positive value during 2012. China has, as can be found from our dataset, started exporting some high technology since 2007 and discarded certain earlier export items and it has gained from such changes. The *Effects of Competitiveness* component increases during 2002-2007 and declines during 2007-2012 indicating China's receding competitive strength in the Mexican market vis-à-vis other contending exporters.

Table 19: CMS China Mexico

	2002	2007	2012
General increase in demand for imports	12.98	14.07	15.84
Change in commodity composition	38.21	-11.84	44.91
Effects of competitiveness	48.81	97.77	39.25

Source: Calculated from data obtained from WITS database

Netherland's demand for Chinese imports as captured by the movement in the *General Increase in Demand for Imports* component in Table 20, increases during 2002-2007 and declines during 2007-2012. Netherlands experienced more or less steady growth rates (which were not very high though) during 1998-2007, like most other European countries, had faced the adverse impact of the global financial meltdown and thus experienced negative growth rate during 2009 and again during 2012. This sort of movement is likely to be the reason for the directions of movements in the *General Increase in Demand for Imports* component during our period of analysis. The *Change in Commodity Composition* component declines throughout acquiring a negative value during 2007 and falling further during 2007-2012. Form our dataset it emerges that most of the high technology products that China has been exporting to Netherlands have been exported consistently during our period of analysis. However, there are some items which China has exported to this country in certain years but not always and it appears that such changes in its list of high technology export items has not helped China gain. The *Effects of Competitiveness* component declines during 2002-2007 and increases during 2007-2012 thus reflecting an improvement in China's competitive strength in context of its exports to Netherlands.

Table 20: CMS China Netherlands

	2002	2007	2012
General increase in demand for imports	18.94	51.02	11.37
Change in commodity composition	9.32	-0.53	-1.11
Effects of competitiveness	71.74	49.52	89.74

Source: Calculated from data obtained from WITS database

The *General Increase in Demand for Imports*, *Change in Commodity Composition* and the *Effects of Competitiveness* components decline during 2002-2007 and then increasing 2007-2012 for Thailand as reflected in Table 21. For the *Change in Commodity Composition* component, the increase is quite substantial during 2007-2012 thus making it acquire a positive value during 2012 from a negative value during 2007. Even Thailand, once an Asian Tiger, having full capital account convertibility contains a lot of volatility in its economy and therefore, the kind of changes in its demand for imports that we observe in the movements of the *General Increase in Demand for Imports* component does not follow a definite relationship with the movement in growth rate of GDP. But China has been able to recover its competitive strength in the Thailand market. However, China's selection of high technology products to be exported to Thailand did not help China gain during 2002-2007, but China did gain from changing its composition of high technology exports to Thailand during 2007-2012.

Table 21: CMS China Thailand

	2002	2007	2012
General increase in demand for imports	22.30	99.39	47.82
Change in commodity composition	-9.58	-32.42	9.53
Effects of competitiveness	87.27	33.03	42.65

Source: Calculated from data obtained from WITS database

Demand for China's exports in the USA increases during 2002-2007 and remains almost at the same level during 2007-2012, as can be observed from the changes in the percentage value of the *General Increase in Demand for Imports* component in Table 22. Despite the negative growth rates of GDP during 2008 and 2009, the demand for Chinese high technology items 2007-2012 has remained more or less at the same level indicates that the Chinese high technology products

have strong acceptance in the US market. The *Change in Commodity Composition* component remains negative throughout, declining during 2002-2007 and increasing during 2007-2012 indicating that China is gaining from the changes in the composition of its high technology export items. The *Effects of Competitiveness* component declines continuously although retaining high positive values throughout thus implying that China's rival exporters are enjoying more competitive strength in the US market. So in order to retain its position in the US market, China needs to make its high technology export items more competitive.

Table 22: CMS China USA

	2002	2007	2012
General increase in demand for imports	12.38	32.45	32.43
Change in commodity composition	-14.03	-17.64	-0.75
Effects of competitiveness	101.65	85.18	68.32

Source: Calculated from data obtained from WITS database

8. Comparison

As we have observed earlier in Section 5, the common destinations of high technology products exports from India and China among the top ten destinations are Germany, Netherlands, Brazil and USA and also the two countries figure out in each other's top ten high technology product export destinations list. In this section we make an attempt to compare the performance of these two countries in terms of the high technology products exports with specific reference to the CMS analysis presented in Section 7. In terms of exports to the world as a whole, the *General Increase in Demand for Imports* component is much more fluctuating in nature for India than for China. The *Change in Commodity Composition* component is more or less similarly behaving for the two countries. As far as the *Effects of Competitiveness* component is concerned, for both the countries this component has declined during 2002-2007 and increased during 2007-2012, but its

percentage value is higher for India than for China during 2012, thus indicating India's greater competitive strength in the high technology products sector, as compared to China.

With respect to Brazil, the *General Increase in Demand for Imports* component remains lower for India than for China, during 2002 and 2007, but turns higher for China during 2012, thus indicating a rise demand for China's exports in Brazil. The *Change in Commodity Composition* component is higher for India as compared to China throughout thus indicating higher gains from changes in the composition of high technology products exports to Brazil by India. The *Effects of Competitiveness* component has declined for both India and China throughout, China having a lower percentage value of this component as compared to India during 2012 thus implying that India is having more competitive strength than China in exports of high technology products to Brazil in recent times. Thus for Brazil, India and China are competitors in terms of total exports, but they have their respective advantages in terms of the specific components. For India, the advantage lies in selection of high technology export items during different years and producing more competitively in the high technology products sector, while for China the advantage is more in terms of the general increase in demand for Chinese exports. Thus India and China can both do well in the Brazilian market by playing complementary roles through strengthening their areas of respective advantages further and negotiating among themselves through bilateral trade agreements to enhance such complementary roles.

The *General Increase in Demand for Imports* component, in context of Germany, remains higher for India than for China throughout, with the difference widening drastically during 2012, thus reflecting a substantially higher demand for India's exports than for China's exports of high technology products in Germany. The *Change in Commodity Composition* component remains lower for India only during 2002, but is higher during both 2007 and 2012, thus reflecting higher

gains for India from selection of high technology products exports to Germany during 2002-2012. However, in terms of the *Effects of Competitiveness* component for India does better than China only during 2002 but after that, China always reflects a better performance. Therefore, in case of Germany also, we observe India and China to have advantages in different components, and thus again both the countries play a complementary role in context of Germany. Both the countries, in context of the German market, can reap benefits through effective bilateral trade agreement.

In case of Netherlands, the *General Increase in Demand for Imports* component declines for India throughout, while for China it increases during 2002-2007 and declines during 2007-2012. But still this component is higher for China than for India during 2012. The *Change in Commodity Composition* component remains substantially lower for India only during 2002, but is higher during both 2007 and 2012, thus indicating a higher level of product diversification for Indian high technology products exports to Netherlands during 2002-2012. The *Effects of Competitiveness* component for India is much more fluctuating in nature than that for China; it was higher for India during 2002, and lower during 2007, finally during 2012, India and China record very close values for this component with the figure for China being slightly higher. India and China are close contenders, while for product diversification, India has an advantage over China and for general demand, China has an advantage over India. Both these countries therefore, still play a complementary role to a certain extent, and thus can have some bilateral trade agreement to reap benefits from their complementarity in context of the Dutch market.

With respect to USA, the *General Increase in Demand for Imports* component records a gradual decline for India throughout, while for China it increases during 2002-2007 and remains almost at that level during 2007-2012. It is higher for China than for India during 2012, thus indicating

that the demand for Chinese high technology products is increasing in China as compared to their Indian counterparts in the USA market. In terms the *Change in Commodity Composition* component, India records substantially higher values than China, thus implying that the selection of high technology export items by India to USA is more gainful for it as compared to China. In terms of the *Effects of Competitiveness* component, India experiences an increase during 2002-2007 followed by a substantial decline during 2007-2012, and this component is always lower for India as compared to China. Since USA is the top most destination for Indian high technology products export consistently during 1998-2012, as noted earlier in section 5 as well, India needs to adopt policies carefully in order to maintain its competitive strength and secure its market in the USA.

The *General Increase in Demand for Imports* component in context of India's high technology products exports to China, increases during 2002-2007 and declines during 2007-2012, while just the opposite happens in context of China's high technology products exports to India. The *Change in Commodity Composition* component also declines during 2002-2007 and increases during 2007-2012 in context of India's high technology products exports to China, while in context of China's high technology products exports to India, there is a continuous decline in this component with a high negative value during 2012. The *Effects of Competitiveness* component increases for India's high technology products exports to China throughout, while that for China's high technology products exports to India declines throughout turning to a high negative value during 2012. In this context also, the role of an effective bilateral trade, which can help the growth of the high technology products sector in both the countries, agreement becomes very important.

9. Conclusion

We have observed that there is an overall rising trend in high technology products exports of India and China during 1998-2012. We have also evaluated the performances of these two countries in terms of their high technology products exports to their top ten destinations respectively, first observing the absolute volumes and values of the exports of high technology products and then conducting a Constant Market Share (CMS) analysis based on the high technology products exports data for both the countries during 1998-2012. The findings have been discussed in detail in Section 8. The CMS analysis suggests that in terms of their exports of high technology products to the world, India has gained in terms of its competitiveness and China has gained in terms of increased demands for its exports. As far as policy implications are concerned, to enhance the demand for its exports, a country needs to understand the specific characters of the destination markets in order to assess their requirements and produce accordingly. Understanding of such specific requirements is also required for deciding the composition of exports. Selecting the right kind of export items becomes to a large extent decisive for how much these commodities would be demanded in the destination markets. To improve competitiveness of their products, the governments of the exporting countries can adopt various direct or indirect measures. For example, subsidizing some inputs resulting in lower costs of production would eventually lead to low priced (and thus more competitive) exports. This is an example of direct support. The governments can raise skilled labour through training programmes or fund research and development activities resulting in generation of cost reducing techniques. Employment of skilled labour or adoption of cost reducing production techniques are likely to save some costs, finally resulting in low-priced exports. So, funding research and development activities and raising skilled workforce are the examples of indirect supports by the governments of exporting countries.

Both India and China used to have import substituting industrialization policies, with emphasis on self-sufficiency, during their early years of independence and later changed their positions by opening up the economies, with China liberalizing in 1978 and India in 1991[11]. India has been a member of the World Trade Organization (WTO) since its inception as an independent nation, while China joined WTO in 2001. China has experienced a consistently high level of FDI, packaged with skill and knowledge of foreign markets, which has helped China to address the demand in markets abroad effectively. This, however, didn't happen to India, where the level of FDI had never been as high as China and FDI had also never been much export-oriented[12]. But since both these countries have the largest pools of skilled workforce in the world[13], and have complementary areas of advantages in terms of the trade in high technology products (as emerged from the CMS analysis presented above), their mutual co-operation is likely to prove beneficial for both.

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