



**LUISA ALEXANDRA
VARELA FERNANDES**

**Exportações de alta tecnologia dos países em
desenvolvimento: um novo olhar sobre os dados**

**Exports of high technology from developing
countries: a new look into the data**

dissertação apresentada à Universidade de Aveiro para cumprimento dos requisitos necessários à obtenção do grau de Mestre em Economia, realizada sob a orientação científica da Professora Doutora Celeste Amorim Varum, Professora Auxiliar do Departamento de Economia, Gestão e Engenharia Industrial da Universidade de Aveiro

o júri

presidente

Doutor Joaquim Carlos da Costa Pinho
professor auxiliar convidado da Universidade de Aveiro

Doutor Manuel Herédia Caldeira Cabral
professor auxiliar da Universidade do Minho

Doutora Celeste Maria Dias de Amorim Varum
professora auxiliar da Universidade de Aveiro

Pelo incentivo desde a primeira hora e incansável apoio durante o seu desenvolvimento, dedico este trabalho a Daniel Sal.

agradecimentos

Os meus agradecimentos vão, em primeiro lugar, para a minha orientadora, Doutora Celeste Amorim Varum, pelo acompanhamento permanente e orientação valiosa no desenvolvimento e melhoria da presente dissertação. Agradeço ainda a todos quantos, de uma forma ou de outra, possibilitaram e apoiaram a realização deste trabalho, sem deixar de realçar o especial papel dos meus pais e irmã.

palavras-chave

Alta tecnologia, países em desenvolvimento, competitividade, exportações.

resumo

O objectivo do presente trabalho é testar a hipótese de que considerar os países em desenvolvimento como reais exportadores de produtos de alta tecnologia pode ser apenas o resultado de um artefacto estatístico, através de um novo olhar sobre os dados.

O presente trabalho visa complementar estudos realizados anteriormente através da análise dos dados mais recentes e comparáveis, de forma a captar uma perspectiva evolutiva do comércio internacional e, especificamente, a performance do mundo em desenvolvimento no que concerne as exportações de alta tecnologia. O estudo é principalmente empírico e baseado nos dados disponíveis no International Trade Centre, UNCTAD/WTO, extraídos da base de dados COMTRADE. Os dados estão disponíveis para 169 países e para o período 2001-2005.

A análise não rejeita ou contesta totalmente a hipótese de artefacto estatístico. Quatro tendências principais são identificadas: os países em desenvolvimento continuam a melhorar a sua competitividade em termos de (1) exportações de produtos manufacturados em geral e (2) exportações de alta tecnologia em particular, ganhando terreno em relação aos países desenvolvidos; (3) os países em desenvolvimento estão também a importar alta tecnologia em grande escala e uma quarta conclusão incide sobre a (4) heterogeneidade entre as economias em desenvolvimento. A China Índia, México, Malásia ou Hungria parecem estar a desenvolver as suas capacidades locais. Contudo, os restantes países têm ainda um grande caminho a percorrer. Até as Filipinas e a Tailândia, que sugeriam ser economias promissoras nos anos 90, parecem não ter desenvolvido as suas capacidades substancialmente. Enquanto que os países desenvolvidos estão profundamente preocupados com a concorrência emergente de economias em desenvolvimento, estas últimas devem focar-se na promoção e desenvolvimento das suas competências internas. Os desafios são claramente diferentes entre eles.

keywords

high-technology, developing countries, competitiveness, exports

abstract

The purpose of this work is to test the hypothesis that to consider developing countries as high tech exporters may be just the result of a statistical *artifact*, by taking a new look into the data.

The present work intends to contribute to the existing literature by analysing the most recent and comparable data in order to capture an evolutionary perspective of the world trade and, specifically, the developing world performance concerning high tech manufacturing exports. The study is mainly empirical and based on the data from the International Trade Centre, UNTACD/WTO extracted from the COMTRADE database. The data is available for 169 countries and for the period 2000-2005.

The analysis cannot reject or contest fully the statistical *artifact* hypothesis. It also identifies four main trends in the trade data: developing countries continue to improve its competitiveness in terms of the (1) manufacturing exports in general and (2) regarding high-tech exports in particular, clearly catching-up developed economies; (3) developing countries are also importing high tech in great scale, and a fourth conclusion from our analysis relies on (4) the heterogeneity among developing economies. China, India, Mexico, Malaysia or Hungary, do seem to be developing local skills. The remaining developing countries have a long way to trace. Even Philippines and Thailand that appeared to be very promising economies in the 1990's, do not seem to have developed their technological capabilities substantially. While developed countries are deeply concerned with the competition emerging from developing economies, the latter must emphasize the promotion and upgrading of their own internal skills. The challenges are clearly different among them.

Table of Contents

Tables	3
Graphics.....	5
1. Introduction	9
2. The Role of Developing Countries and Technological Complexion of World Trade.....	13
2.1. Exports of Manufactures from Developing Countries	13
2.2. The Technological Complexion of the World Trade in Manufactures	20
2.2.1. Taxonomy.....	23
2.2.2. Growth Rates of High Tech Exports	25
2.2.3. The Catching-Up of Developing Countries.....	27
2.2.3.1. The share of developing countries on total high tech trade.....	27
2.2.3.2. The ratio of high tech exports.....	29
2.3. Summary.....	33
3. Main Features of High Tech Exports from Developing Countries	35
3.1. Net Exports Ratio	35
3.2. Competitiveness of High Tech Exports.....	40
3.3. Developing Countries as an Heterogeneous Group.....	44
3.3.1. Concentration of high tech exports.....	44
3.3.2. Technological intensity.....	50
3.4. Summary.....	54
4. Verification of the Statistical <i>Artifact</i> Hypothesis.....	55
4.1. Product Specialization between Developed and Developing Countries	55
4.2. Patenting Recording of Developing Countries.....	62
4.3. Indicators of High Tech Competitiveness	66
4.4. Summary.....	68
5. Conclusions	69
References	71

Tables

Table 1	Average growth rates of world exports, 2001-2005	14
Table 2	Growth rates of world exports, by product section	14
Table 3	Growth rates of world exports of manufactures, by group of countries	15
Table 4	Export structure of developing countries, 2001 and 2005	16
Table 5	Concentration of exports of manufactures from developing countries, 2001-2005	17
Table 6	Concentration of Exports of Manufactures from Developing Countries, 2001-2005 (including Korea, Singapore, Taiwan and Hong Kong)	19
Table 7	High tech products list (SITC, Rev. 3)	24
Table 8	Growth rates of total manufacturing and high tech exports, 2001-2005	25
Table 9	Growth rates of high tech exports by group of products, 2001-2005	26
Table 10	Growth rates of high tech exports by group of countries, 2001-2005	27
Table 11	The top-20 RCA indices from developing countries	43
Table 12	Concentration in exports of high tech products	44
Table 13	List of the top 15 high tech exporting countries per year	46
Table 14	Concentration in exports of high tech products within each category	47
Table 15	List of the-top 10 high tech exporting developed countries per year	48
Table 16	List of the top-10 high tech exporting developing countries per year	49
Table 17	Share of high tech exports in the total exports of manufactures of the top-20 countries per category – averages of the periods	52
Table 18	Structure of high tech exports of developing and developed countries (average of the period 2001-2005)	56
Table 19	Top-10 high tech exports of developed and developing countries	58
Table 20	Specialization of developed and developing countries within electronics, computing and scientific instruments	60
Table 21	Top high tech exports of developed and developing countries within electronics, computing and scientific instruments categories	61
Table 22	U.S. patent activity by country and grant year, 1998-2005	64
Table 23	Top 15 most emphasized US patent classes for inventors from China, India and Brazil	65
Table 24	Indicators of Technological Competitiveness, 2005 and 2007	67

Graphics

Graphic 1	Share of developing countries in world exports of manufactures	16
Graphic 2	Structure of OECD manufacturing trade by technology intensity, 1996-2005	21
Graphic 3	Growth of high and medium-high technology exports, 1996-2005 – annual average growth rate	22
Graphic 4	The share of developing countries in total world exports of high tech products	28
Graphic 5	The share of developing countries in total world exports of high tech products, including Korea, Hong Kong, Singapore e Taiwan in the developing countries group	28
Graphic 6	Ratio of the high tech exports from developing countries to those from developed countries (at the aggregated level)	29
Graphic 7	Ratio of the high tech exports from developing countries (including Taiwan, Korea, Hong Kong and Singapore) to those from developed countries (at the aggregated level)	30
Graphic 8	Ratio of the high tech exports from developing countries, excluding China to those from developed countries (at the aggregated level)	31
Graphic 9	Ratio of the high tech exports from developing countries to those from developed countries (at the product level)	32
Graphic 10	Net exports ratio	36
Graphic 11	Net exports ratio (including Singapore, Korea, Hong Kong and Taiwan in developing countries)	37
Graphic 12	The top-20 countries in terms of net export ratio, 2001 and 2005	38
Graphic 13	RCA of developed and developing countries in high tech exports	41
Graphic 14	RCA of developed and developing countries in high tech exports (including Singapore, Korea, Hong Kong and Taiwan in developing countries)	42
Graphic 15	Trends in high technology content of world exports of manufactures	51

Graphic 16	Trends in high technology content of world exports of manufactures, including Korea, Hong Kong, Singapore and Taiwan in developing countries group	51
Graphic 17	Ratio of the high tech exports from specific countries to those from the US	53

1. Introduction

The purpose of this work is to test the hypothesis that to consider developing countries as high tech exporters may be just the result of a statistical *artifact*, by taking a new look into the data.

The accelerated process of trade liberalisation in recent decades occurred along changes in the structure of trade worldwide and within certain countries individually. As such, studies on trends, motives and consequences of these developments for economic growth and world balance of power gained momentum. In this regard two issues deserved particular attention: who wins and who loses in the process. Recent empirical literature shows a great change in the location of export production from the industrialized to developing countries and that the latter have grown fast and diversified from the traditional sectors to manufactured goods, included high technology (Lall, 1998, 2000; Mani, 2000; Huang et al., 2008). In this studies it is highlighted the outstanding growth performance of a handful of East Asian countries. Another focus of interest is the structure of trade as liberalization proceeds. Recent evidence for a number of countries shows that an important part of the trade expansion occurs along changes in the structure of trade worldwide or even by country individually (Lall, 1998; Mani, 2000; Huang et al., 2008), eventually giving rise to *specialisation shifts*¹ (Bastos and Cabral, 2007). Studies in the line of Kravis and Lipsey (1992) and Mani (2000) have shown that trade in manufactures has been shifting out of low-tech into high-tech products. More recently, a number of studies also show that the share of developing countries in the world high tech exports has also been increasing. A discussion that emerges in this literature is about developing countries being really high tech exporters or just beneficiaries of a statistical *artifact*, where the globe fragmentation of value chains is an important issue (Akyüz, 2004).

Mani (2000) understood that it would not be very prudent to consider the developing world performance as a mere statistical *artifact*, since they were rapidly catching-up the developed countries. On the other hand, Srholec (2007) considered that many developing

¹ According to Bastos and Cabral (2007), the important trade expansion observed in several countries in determined periods, mostly in terms of exports, occurs in sectors in which they did not have a comparative advantage, but in sectors that were previously net importers or with little impact in the export performance of the country.

countries experienced a fast growth in terms of high tech exports, but did not develop their local technological capabilities. This position was sustained by Huang et al. (2008) when they concluded that, in China, the investment in research and development (R&D hereafter) did not impact neither in the probability nor in the intensity on a firm's exports of manufactures, even though this country had, in 2003, over passed Japan and the European Union regarding the information technologies exports and, in 2004, it had become the leading world exporter of this type of products, leaving the United States behind (OECD, 2005). Akyüz (2004) is also very critical, arguing in favour of a statistical *artifact* rather than a reality. He highlights that developing countries appear to be a lot more successful when their performance is measured in terms of manufacturing trade than in terms of manufacturing value-added and income.

The present work intends to contribute to the existing literature by analysing the most recent and comparable data in order to capture an evolutionary perspective of the world trade and, specifically, the developing world performance concerning high tech manufacturing exports, by applying the methodology developed by Mani (2000) on the same thematic.

The data is from the International Trade Centre, UNTACD/WTO² extracted from the COMTRADE database. The data is available for 169 countries and for the period 2000-2005. The exports statistics of 260 groups of products (annex 1) are classified according to the Standard International Trade Classification (SITC), Revision 3³ at a three digit level. The main focus of the thesis is on manufacturing, which comprises sections 5, 6 (group 68 – non ferrous metals - excluded), 7 and 8. The data covers 169 countries, which were classified as developed / developing according to the list of the World Bank, issued on July 2007⁴ (annex 2)⁵. In agreement with this source, the low and middle income economies may be considered as developing countries even if it does not imply a similar level of

² ITC Home Page. (Online). Available on <http://www.intracen.org>.

³ ITC Home Page. (Online). Available on <http://www.intracen.org/tradstat/welcome.htm>. (Consulted on 27/11/2007).

⁴ World Bank Home Page. (Online). Available on <http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html>. (Consulted on 28/11/2007).

⁵ Taiwan and Hong Kong economies were classified according to the FMI advanced list of economies, once they are not included in the World Bank' list. IMF Home Page. (Online). Available on <http://www.imf.org/external/pubs/ft/weo/2007/01/data/groups.htm#ae>. (Consulted on 28/11/2007).

development or that the high income economies have achieved the final stage of development. Overall, 119 developing were considered as developing.

The application of an existing methodology allows an evolutionary and dynamic picture of the world trade and, at the same time, permit to achieve comparable results that shall conduct to more sustained conclusions about the role of developing countries in the high tech sectors. There are nevertheless a few limitations. The impossibility of obtaining disaggregated data at a five digit level did not allow the precise application of the high tech taxonomy (detailed information in point 2.2.1) developed by Hatzichronoglou (1997). Hence, some results are approximated calculations. Once that the results will be compared to the ones obtained by Mani (2000), it must be recalled here that in Mani's analysis Singapore, Taiwan, Korea and Hong Kong were still considered developing countries, but have been since then upgraded to the group of developed countries. For that reason, and for comparison purposes, in several instances the analysis was conducted with the group of developing countries and then with the same group, but including those 4-Asian economies. Another limitation of this work is common in the studies based on high tech exports statistics. This type of data does not reveal the level of know-how and local skills embodied in the exported products. Notwithstanding, it is considered that with the work carried out along the chapters it is possible to better understand if developing countries are, in fact, high tech exporters or if the statistical *artifact* hypothesis is a reality.

The thesis is organized along five chapters. After the introduction, chapter 2 analyses the worldwide distribution of the world exports highlighting the role of the developing countries. It also considers the technological complexion of the world exports of manufactures. Chapter 3 examine the main features of the high tech exports. In chapter 4 it is tested the statistic *artifact* hypothesis by comparing export specialization between developed and developing countries, studying the patenting activity and analysing competitiveness indicators. Chapter 5 concludes and discusses the results.

2. The Role of Developing Countries and Technological Complexion of World Trade

This chapter analyses the importance of developing countries' in world trade, testing the trends identified by Mani (2000) of a) an increasing role played by this group of countries on world exports, b) the diversity within the developing countries' group; and c) the catching-up of developing countries regarding high tech exports. The analysis includes data for 169 countries during the period 2000-2005, extracted from the COMTRADE database. The countries were classified as developed / developing according to the list of the World Bank, issued on July 2007⁶. For comparison purposes, in several instances the analysis was conducted with the group of developing countries and then with the same group, but including those 4-Asian economies. The exports statistics corresponds to 260 groups of products are classified according to the Standard International Trade Classification (SITC), Revision 3⁷, at a three digit level. The main focus is on manufacturing, which comprises sections 5, 6 (group 68 – non ferrous metals - excluded), 7 and 8.

2.1. Exports of Manufactures from Developing Countries

In the period under analysis, world exports registered an annual average growth rate of all product sections of nearly 13 percent. Animal and vegetable oils, fats and waxes as well as crude materials, inedible, except fuels registered growth rates well above the average for all products. The average of the world manufacturing exports registered a lower annual growth rate of 10 percent. Lower economic activity at the global level caused a deceleration in the expansion of world merchandise (and services) trade, which reflects the general decreasing of manufacturing exports shown in Table 1. Indeed, after reaching a three-decade peak in 2004, global economic growth decelerated in 2005, mainly due to

⁶ World Bank Home Page. (Online). Available on <<http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html>>. (Consulted on 28/11/2007). Taiwan and Hong Kong economies were classified according to the FMI advanced list of economies, once they are not included in the World Bank' list. IMF Home Page. (Online). Available on <http://www.imf.org/external/pubs/ft/weo/2007/01/data/groups.htm#ae>. (Consulted on 28/11/2007).

⁷ ITC Home Page. (Online). Available on <<http://www.intracen.org/tradstat/welcome.htm>>. (Consulted on 27/11/2007).

weaker economic activity in Europe, the United States and in growing economies like the Republic of Korea and Taiwan, for instance (WTO, 2006).

Table 1: Average growth rates of world exports, 2001-2005

Period	01-02	02-03	03-04	04-05	Average annual growth rate
Average growth rate of all sections	5,73	20,29	18,05	6,24	12,58
Average growth rate of manufacturing sections^a	4,12	16,45	18,57	1,34	10,12

a) Note: Manufactures comprises sections 5, 6 (group 68 - non-ferrous metals - excluded), 7 and 8, in compliance with Mani (2000)

Source: Own elaboration based on COMTRADE database

Observing the growth rates by product, presented in Table 2, it's easily concluded that, despite the general declining in 2005, the negative results in total exports of manufactures is mainly due to the regression on Section 7 – machinery and transport equipment. Even though the other sections continue to show positive growth rates, in absolute terms, the decreasing in Section 7 has an enormous weight in total exports and, mostly, in total exports of manufactures, which results in a regression of the manufactures' exports volume in aggregated terms.

Table 2: Growth rates of world exports, by product section

SITC Section	Category	01-02	02-03	03-04	04-05	Average annual growth rate
0	Food and live animals	4,53	15,56	11,30	1,55	8,23
1	Beverages and tobacco	5,06	14,65	11,34	4,13	8,79
2	Crude materials, inedible, except fuels	3,36	18,99	24,94	11,43	14,68
3	Mineral fuels, lubricants and related materials	-8,39	26,80	24,23	3,92	11,64
4	Animal and vegetable oils, fats and waxes	32,24	25,49	16,52	2,01	19,06
5	Chemicals and related products, n.e.s.	10,45	20,03	21,59	7,93	15,00
6	Manufactured goods classified chiefly by material	4,66	16,31	25,01	9,02	13,75
7	Machinery and transport equipment	0,10	14,72	12,46	-12,97	3,58
8	Miscellaneous manufactured articles	1,26	14,75	15,23	1,38	8,16
9	Commodities and transactions not classified elsewhere in the SITC	4,04	35,57	17,87	34,04	22,88
	Average growth rates of all sections	5,73	20,29	18,05	6,24	12,58

Source: Own elaboration based on COMTRADE database

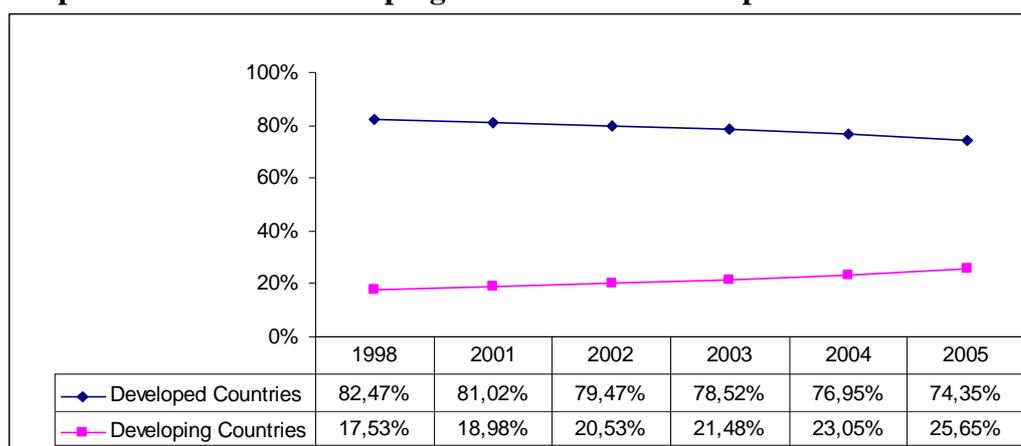
In what concerns growth rates of manufacturing exports by group of countries, it was verified that, while exports from developed countries increased at an average of 6.27 percent annual growth rate, developing countries' exports grew about 10.54 percent. Until 2004 the exports annual growth rates of manufactured products from developing countries were significantly higher than the ones from developed economies, achieving a difference of more than 6.5 percentage points. Even the decline registered in 2005 had more emphasis in developed economies – a decreasing of 4.43 percent against 2.36 percent in developing countries.

Table 3: Growth rates of world exports of manufactures^a, by group of countries

Group / Period	01-02	02-03	03-04	04-05	Average annual growth rate
Developing Countries	4,96	19,27	20,30	-2,36	10,54
Developed Countries	1,46	14,10	13,94	-4,43	6,27

a) Note: Manufactures comprises sections 5, 6 (group 68 excluded), 7 and 8, as in Mani (2000).
Source: Own elaboration based on COMTRADE database

As a result of the export performance of both groups throughout the period, the respective shares in the world total manufactures have been approaching. Looking at the data on the share of developing countries in world exports, it can be confirmed the trend of their increasing share in total exports of manufactures. For 1998 Mani (2000) found the share for developing countries to be nearly 18 percent. As shown in Graphic 1, the share has increased continuously, reaching nearly 26 percent in 2005, even without the 4-Asian economies that were meanwhile classified as developed.

Graphic 1 – Share of developing countries in world exports of manufactures

Note: Data for 1998 was extracted from Mani (2000).

Source: Own elaboration based on COMTRADE database

The export structure of developing countries' exports reveals the re-direction into manufacturing. As shown in Table 4, about three quarters of exports are of manufactured goods⁸, falling the traditional natural resources and labour-intensive products to a second plan⁹. Machinery and transport equipment (Section 7) remains as leading sector in the export structure of the developing countries.

Table 4 – Export structure of developing countries^a, 2001 and 2005

SITC Section	Category	2001	2005
0	Food and live animals	8%	7%
1	Beverages and tobacco	1%	1%
2	Crude materials, inedible, except fuels	4%	5%
3	Mineral fuels, lubricants and related materials	18%	15%
4	Animal and vegetable oils, fats and waxes	1%	1%
5	Chemicals and related products, n.e.s.	5%	6%
6	Manufactured goods classified chiefly by material	15%	18%
7	Machinery and transport equipment	30%	30%
8	Miscellaneous manufactured articles	16%	14%
9	Commodities and transactions not classified elsewhere in the SITC	2%	3%
	Total	100%	100%

a) **Note:** See annex 3 for detailed data by product/ country

Source: Own elaboration based on COMTRADE database

⁸ Manufactures comprises sections 5, 6 (group 68 excluded), 7 and 8, as in Mani (2000).

⁹ Mani (2000) obtained higher shares for these SITC categories, but the difference is probably related to the difference in the classification of Singapore, Hong Kong, Korea and Taiwan as developing / developed countries. Indeed, the share of those four economies in the total exports of manufactured products represented averages of about 10%, 11% and 12% in sections 6, 7 and 8, respectively.

Notwithstanding, to consider developing countries as a group hides significant diversity among them regarding trade patterns and industrialization over the past three decades. The analysis of the data at country level reveals that the performance of the developing world is not widespread and that export dynamics remain concentrated in only a few countries, with three centres: Asia, Eastern European Countries (EEC hereafter) and Latin America as demonstrated in Table 5.

In 1997, about 90 percent of the exports of manufactures from developing countries were concentrated in ten countries (C_{10}), mostly from the Asian East: China, Korea, Singapore, Mexico, Malaysia, Thailand, Brazil, India, Indonesia and Philippines (Mani, 2000). From 1997 to 2001 the C_{10} percentage declined around 14 percentage points. Nevertheless, the extraordinary performance of China on this type of exports over the period completely reversed the declining trend to a growing concentration level again. The share of this country on total manufactures' exports from developing countries grew from 27 percent to 45 percent, increasing the C_{10} to more than 85 percent even with the re-classification of 4-Asian economies as developed.

Table 5 - Concentration of exports of manufactures from developing countries

Rank	Country	2001		2003		2005	
		US\$ '000	% on total developing	US\$ '000	% on total developing	US\$ '000	% on total developing
1	China	235.839.506	27,36%	397.010.129	34,30%	700.369.833	45,36%
2	Mexico	134.849.852	15,64%	134.270.346	11,60%	162.878.220	10,55%
3	India	33.120.369	3,84%	48.007.672	4,15%	72.164.032	4,67%
4	Poland	28.561.701	3,31%	43.466.985	3,76%	69.783.393	4,52%
5	Brazil	31.170.284	3,62%	37.280.653	3,22%	61.402.623	3,98%
6	Turkey	25.591.365	2,97%	39.501.315	3,41%	59.246.049	3,84%
7	Thailand	48.184.008	5,59%	60.087.593	5,19%	56.762.467	3,68%
8	Malaysia	70.427.350	8,17%	80.196.486	6,93%	49.193.262	3,19%
9	Hungary	25.948.930	3,01%	37.544.114	3,24%	44.365.748	2,87%
10	Russian Federation	21.922.151	2,54%	28.378.942	2,45%	43.957.950	2,85%
C_{10} on total developing		655.615.516	76,06%	905.744.235	78,25%	1.320.123.577	85,51%
H Index		0,12		0,15		0,23	

Source: Own elaboration based on COMTRADE database

Despite being an index that measures industry concentration, to analyze the level of concentration of manufactures' exports among all developing countries, it was also computed the Herfindahl index (H index) by summing the squares of the shares of the 119 developing countries in the total exports of manufactured products from the same group of countries.

$$H = \sum_{i=1}^n s_i^2$$

where s_i is the share of the developing country i in total developing countries' exports of manufactures, and n is the number of developing countries ($n= 1, \dots, 119$).

The results revealed an increasing concentration within the group, trend due to the impact of the rising share of China previously referred. In 2005, this country concentrated almost half of the total manufactures' exports of all the 119 countries. However, except for China and Mexico, no other country achieved a share above the 5 percent in total developing. Thailand, Malaysia and Hungary even saw their shares diminishing throughout the period.

The re-classification of Singapore, Taiwan, Korea and Hong Kong as high income economies, as mentioned earlier, had an important role in the concentration and in the top leading exporters composition considered by Lall (2000) and Mani (2000). Having this in mind was tested the impact of the 4-Asian economies, by included them in the developing countries' group.

Table 6 - Concentration of exports of manufactures from developing countries, (including Korea, Singapore, Taiwan and Hong Kong)

Rank	Country	2001		2003		2005	
		US\$ '000	% on total developing	US\$ '000	% on total developing	US\$ '000	% on total developing
1	China	235.839.506	16,88%	397.010.129	22,70%	700.369.833	34,10%
2	Korea	135.527.394	9,70%	177.566.546	10,15%	172.527.911	8,40%
3	Mexico	134.849.852	9,65%	134.270.346	7,68%	162.878.220	7,93%
4	Hong Kong	181.968.460	13,03%	143.872.357	8,23%	145.856.468	7,10%
5	Taiwan	114.783.798	8,22%	134.775.670	7,71%	103.259.006	5,03%
6	Singapore	102.590.028	7,34%	135.034.768	7,72%	88.468.928	4,31%
7	India	33.120.369	2,37%	48.007.672	2,75%	72.164.032	3,51%
8	Poland	28.561.701	2,04%	43.466.985	2,49%	69.783.393	3,40%
9	Brazil	31.170.284	2,23%	37.280.653	2,13%	61.402.623	2,99%
10	Turkey	25.591.365	1,83%	39.501.315	2,26%	59.246.049	2,88%
C₁₀ on total developing		1.024.002.757	73,31%	1.290.786.441	73,81%	1.635.956.463	79,65%
H Index		0,08		0,09		0,15	

Source: Own elaboration based on COMTRADE database

The relevance of the 4-Asian countries is still remarkable. With their inclusion, the top-5 positions are dominated by Asian economies, except for Mexico. When they are integrated in the developing group the shares of other economies decrease significantly, including China. Consequently, the obtained results for the H index, in the three analysed years, show lower levels of concentration, but confirm again the increasing trend supported on China's growing share and on the reduction on the 4 Asian Tigers shares, mainly Singapore (from 7.72 to 4.31 percent, in 2003 and 2005, respectively).

An analysis of the data, additionally to Mani's findings (2000), confirms that developing countries are increasingly very heterogeneous, not being expectable to show similar performances for very long time. Compared to previous results, data reveals, the following trends:

- First, the cases of China, Mexico, Brazil and India that emerged as leading exporters in mid 1990s, continued to gain weight in the most recent period. The sustained growth of China's exports is particular outstanding. Recall also that Mexico outperformed even Singapore, Taiwan and Hong Kong, in terms of the total volume of manufactures' exports;

- Second, the emergence of a few countries from Eastern Europe in the top ranking. The cases of Poland, Ukraine, Hungary and Russian Federation deserve a careful look;
- Otherwise, the results show that some countries lost momentum. For example, Philippines, Thailand and Malaysia, registered a negative evolution on the volume of manufactured exports. The previously expanding 4-Asian economies, inverted the cycle, registering continuous declines in the export volume in the first decade of the XXI century.

2.2. The Technological Complexion of the World Trade in Manufactures

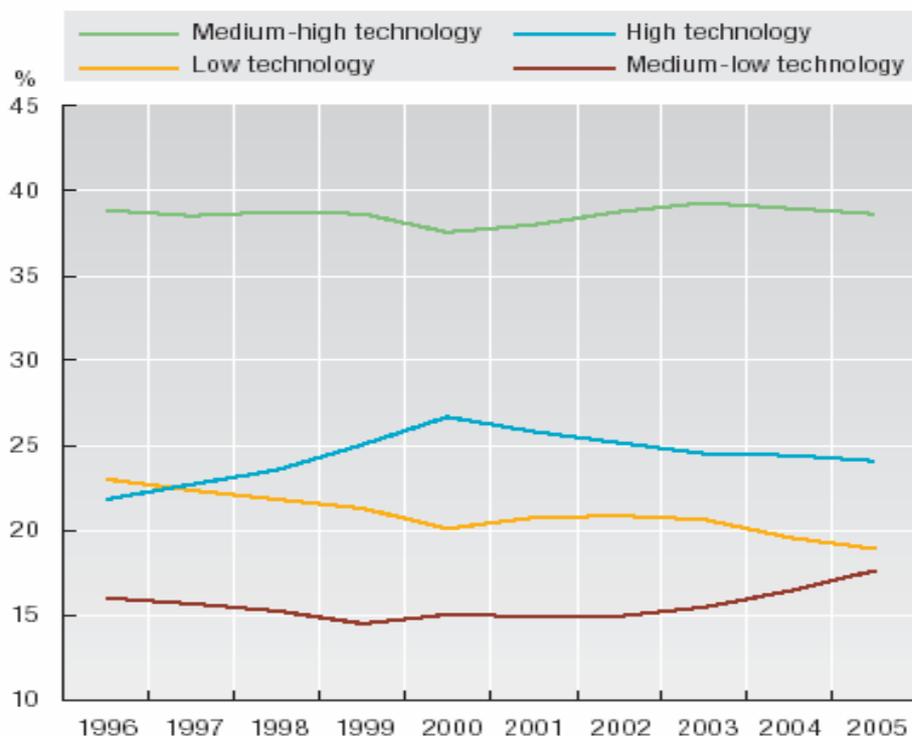
One important suggestion of recent models of growth is that specialization in high technology industries is associated with higher levels of economic growth (Hausmann et al. 2005; Rodrik, 2006). Feenstra and Rose (2000) found a strong relation between having an advanced export structure and fast growth rates. Crespo, Cuaresma and Wörz (2005) study of 45 countries and 33 industries, over the period 1981-1997, support the view of positive potential of technology intensive industries on productivity levels. Fagerberg et al. (2007) have demonstrated that technology and skills had been two determinant factors in the fast growth of the Asian Tigers. Hence, the technological complexity of trade, its causes and consequences, has gained relevance in the international trade and growth literature (Bastos and Cabral, 2007; Cabral, 2008). Therefore, in this part, the changes in the technological complexion of the world trade are analysed. It is not the purpose of this thesis to evaluate the causes or consequences of such developments. The results may however open avenues for future research in that line.

The data at the end of the 1990s revealed that manufactured goods with low technological intensity were giving place to the high tech products, changing the technological complexion of the world trade. However, the first 5-years of the present decade are marked by a decline on the share of high tech industries in international trade. Even the medium-high technology industries lost part of its share between 2003 and 2005. See Graphic 2.

These recent developments contrast markedly with the trends identified in previous decades (for example, Mani, 2000). According to the OECD (2007), the remarkable spurt in the value of trade in medium-low technology is partly due to recent significant increases in commodity prices for oil and basic metals, notably the metals in great demand for the manufacture of ICT goods. Prices for fuels and metals expanded more than 30% in 2004, according to the IMF commodity price index (WTO, 2005).

The World Trade Organization even defends that higher oil prices were one of the reasons for the improvement of the terms of trade of developing countries as a group, and, in particular, those of the developing regions of the Middle East, Africa and Latin America. Strong commodity prices and the recovery in the trade of office and telecommunications equipment resulted in a sharp increase in the merchandise exports from developing economies (WTO, 2005).

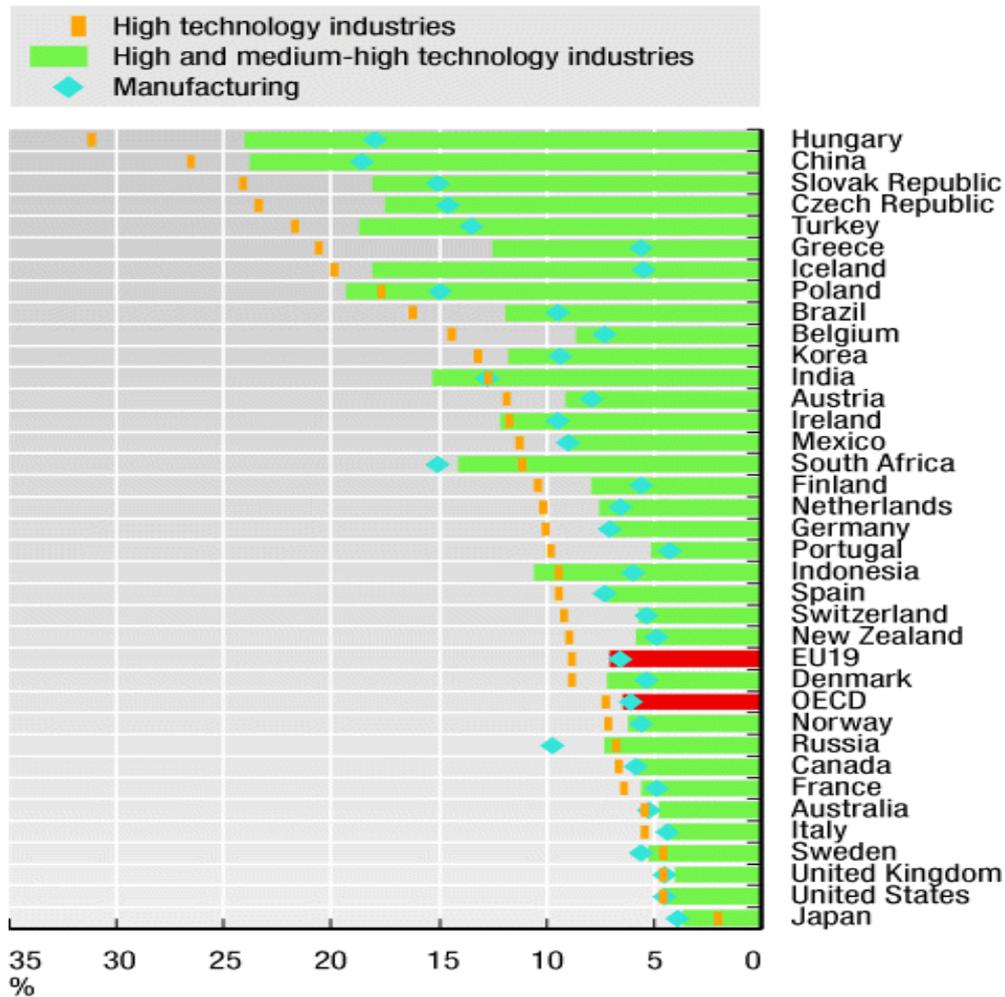
Graphic 2 - Structure of OECD manufacturing trade by technology intensity, 1996-2005¹⁰



Source: OECD Science, Technology and Industry Scoreboard 2007, p. 212

¹⁰ Excluding Luxembourg and the Slovak Republic. Trade - average value of total OECD exports and imports of goods.

Graphic 3 - Growth of high and medium-high technology exports, 1996-2005 – annual average growth rate¹¹



Source: OECD Science, Technology and Industry Scoreboard - 2007, p. 215

The deceleration in high tech trade is obvious, but it seems to affect more profoundly developed economies. It is notorious that less developed economies such as Hungary, Turkey, Brazil, Mexico, Poland and India had, over the period, significant higher levels of growth in high tech exports than developed economies like France, Italy or Denmark, for instance. Hungary leads the growth rates among the represented economies, showing great improvement along the decade 1996-2005. This country had an average growth rate of more than 30 percent in high tech exports against nearly 18 percent in its total manufacturing.

¹¹ OECD and EU aggregates exclude Luxembourg. Underlying data for China include exports to Hong Kong.

Yet, countries such as the US, UK and Australia registered, for the considered ten years, an average growth of high tech exports equal to total manufacturing (around 5 percent each) and Japan or Sweden had an average even lower than for total manufacturing exports.

Considering this evidence, next it is examined in particular the movements and dynamics in developing countries in the high tech sector. These countries may often face a trade-off between specializing according to existing comparative advantage (in low-technology goods) and entering sectors in which they currently lack a comparative advantage, but may acquire such an advantage in the future as a result of the potential for productivity growth (in high-technology goods) (Redding, 1999). Section 2.2.1 discusses the taxonomy applied to classify the industries as high tech. Sections 2.2.2 and 2.2.3 show the results obtained in the analysis for the case of developing economies.

2.2.1. Taxonomy

The high tech indicator is still very discussed and contested, being the main arguments the base statistics and the lack of standardization that conduct to different results by different authors and organizations (Godin, 2004). Consequently, it has been developed several methodologies to measure the technological content of the world trade, i.e., the technology embodied in the products that are exported from a country. Yet, it is quite certain that no one is perfect or complete. Here it was used the taxonomy developed by Hatzichronoglou (1997) and used by OECD in order to catch results comparable to Mani (2000).

The taxonomy consists in a list of high technology products corresponding to the SITC, Revision 3, which results from calculations on R&D intensity, for a sample of six countries (US, Japan, Germany, Italy, Sweden and Netherlands). It was not possible to obtain statistic data disaggregated up to five digits, hence, for this dimension, the analysis was developed on a three digits level according to the established in Table 7.

Table 7 – High tech products list^a (SITC, Rev. 3)

Product Description	SITC, Rev 3 Codes (4/5 Digits)	SITC, Rev 3 (3 Digits)
Aerospace	Sum (7921...7925), 79291, 79293, Sum (71441...71491), 87411	Sum 792, Sum 714 ¹²
Computing and office equipment	75113, Sum (75131...75134), Sum (7521...7527), 5997	Sum 751, Sum 752 ¹³
Electronics and telecommunication	76381, 76383, Sum (7641...76492), 7722, 77261, 7318, 77625, 77627, 7763, 7764, 7768, 89879	Sum 763, Sum 764, Sum 772, Sum 776 ¹⁴
Electric equipment	Sum (77862...77865), 7787, 77884	Sum 778
Non electric equipment	71489, 71499, 71871, 71877, 71878, 72847, 7311, 73131, 73135, 73142, 73144, 73151, 73153, 73161, 73163, 73165, 73312, 73314, 73316, 7359, 73733, 73735	Sum 714, Sum 718, Sum 731, Sum 733, Sum 737 ¹⁵
Scientific instruments	Sum (7741...7742), 8711, 8713, 8714, 8719, 87211, Sum (87412 ...8749), 88111, 88121, 88411, 88419, 89961, 89963, 89966, 89967	Sum 774, Sum 871, Sum 874, Sum 881, Sum 884, Sum 899 ¹⁶
Chemicals	Sum (52222...52269), 5251, 5259, 5311, 5312, 57433, 5911, 5912, 5913, 5914	Sum 522, Sum 525, Sum 531, Sum 591 ¹⁷
Pharmaceuticals	5413, 5415, 5416, 5421, 5422	Sum 541, Sum 542
Armaments	8911, 8912, 8913, 8919	Sum 891

a) Note: More details on the product classification are provided in (annex 4).

¹² The item 84711 is included on scientific instruments, since the group 874 has more expression in that category.

¹³ Taking into account that just one item of the 759 group should be considered, it was decided to exclude it, since it could distort the results.

¹⁴ It were excluded the groups 773 and 898 for the same reason mentioned in the previous note.

¹⁵ It were excluded the groups 728 and 735. In terms of calculations, the group 714 is excluded from this section since it has more expression in aerospace.

¹⁶ It was excluded the group 872.

¹⁷ It was excluded the group 574.

2.2.2. Growth Rates of High Tech Exports

The results reveal clearly that, by contrast to the 1990s decade, in the 5- most recent years, high tech exports have been growing, but slower than total manufacturing exports. Over the period, the high tech sector, at an aggregated level, registered an average growth rate of 4.14 percent whilst total manufacturing achieved an average rate of 7.63 percent.

Table 8 – Growth rates of total manufacturing and high tech exports, 2001-2005

Period	01-02	02-03	03-04	04-05	Average annual growth rate
Total Manufacturing.	2,54	15,73	16,01	-3,73	7,63
Total High Tech	0,34	14,38	13,26	-11,39	4,14

Source: Own elaboration based on COMTRADE database

In spite of the overall deceleration, pharmaceuticals and scientific instruments registered very positive performances. Medicaments (including veterinary medicaments) and optical instruments and apparatus, for example, achieved average growth rates of 20.53 and 40.54 percent, respectively. On the other hand, Table 9 also highlights that there are mainly four types of products responsible for the generalized declining in 2005, concentrated in computing, electronics and chemicals. Except for chemicals, all the products are integrated in the SITC Section 7, which sustains the previous results on growth rates of total world exports presented on point 2.1. The group of “thermionic, cold cathode or photo-cathode valves and tubes” (776) shows the worst results with an average rate of minus 16.66 percent, throughout the period.

Table 9 – Growth rates of high tech exports by group of products, 2001-2005

Group	Product	01-02	02-03	03-04	04-05	Average 01-05
Aerospace	Product group: 792 - Aircraft and associated equipment; spacecraft (including satellites) and spacecraft launch vehicles; parts thereof	6,37	-7,09	7,75	11,05	4,52
	Product group: 714 - Engines and motors, non-electric (other than those of groups 712, 713 and 718); parts, n.e.s., of these engines and motors	-5,89	3,07	14,55	-13,20	-0,37
Computing and office equipment	Product group: 751 - Office machines	-15,84	2,17	8,43	18,07	3,21
	Product group: 752 - Automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machine	-10,53	17,20	4,98	-47,91	-9,06
Electronics and telecommunication	Product group: 772 - Electrical apparatus for switching or protecting electrical circuits or for making connections to or in electrical circuits (e.g., switches, relays, fuses,	-7,08	16,75	1,47	-47,26	-9,03
	Product group: 763 - Sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media	20,02	31,62	32,07	9,80	23,38
	Product group: 764 - Telecommunications equipment, n.e.s., and parts, n.e.s., and accessories of apparatus falling within groups 761, 762 and 763	-0,58	10,49	29,25	0,10	9,81
	Product group: 776 - Thermionic, cold cathode or photo-cathode valves and tubes (e.g., vacuum or vapour or gas-filled valves and tubes, mercury arc rectifying valves and tubes,	-5,11	16,90	-13,83	-64,59	-16,66
Electric equipment	Product group: 778 - Electrical machinery and apparatus, n.e.s.	4,38	15,98	22,69	9,94	13,25
Non electric equipment	Product group: 714 - Engines and motors, non-electric (other than those of groups 712, 713 and 718); parts, n.e.s., of these engines and motors	-5,89	3,07	14,55	-13,20	-0,37
	Product group: 718 - Power-generating machinery, and parts thereof, n.e.s.	8,38	22,36	19,50	16,82	16,77
	Product group: 731 - Machine tools working by removing metal or other material	-10,71	14,90	31,55	13,36	12,28
	Product group: 733 - Machine tools for working metal, sintered metal carbides or cermet, without removing material	-7,34	18,14	19,13	12,74	10,67
	Product group: 737 - Metalworking machinery (other than machine tools), and parts thereof, n.e.s.	-0,38	21,49	30,36	11,83	15,82
Scientific instruments	Product group: 774 - Electrodiagnostic apparatus for medical, surgical, dental or veterinary purposes, and radiological apparatus	7,95	18,73	15,37	10,42	13,11
	Product group: 871 - Optical instruments and apparatus, n.e.s.	1,81	62,18	60,85	37,31	40,54
	Product group: 874 - Measuring, checking, analysing and controlling instruments and apparatus, n.e.s.	0,05	15,13	24,70	5,89	11,44
	Product group: 881 - Photographic apparatus and equipment, n.e.s.	-4,45	2,07	15,79	-7,81	1,40
	Product group: 884 - Optical goods, n.e.s.	-9,46	18,65	27,46	13,65	12,57
	Product group: 899 - Miscellaneous manufactured articles, n.e.s.	8,43	23,50	18,52	10,08	15,13
Chemicals	Product group: 522 - Inorganic chemical elements, oxides and halogen salts	-4,00	16,11	30,57	15,71	14,60
	Product group: 525 - Radioactive and associated materials	25,23	4,61	4,39	13,69	11,98
	Product group: 531 - Synthetic organic colouring matter and colour lakes, and preparations based thereon	6,98	8,95	5,11	-0,05	5,25
	Product group: 591 - Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up in form	-7,83	17,00	5,15	-45,91	-7,90
Pharmaceuticals	Product group: 541 - Medicinal and pharmaceutical products, other than medicaments of group 542	15,54	23,08	19,62	10,17	17,11
	Product group: 542 - Medicaments (including veterinary medicaments)	27,54	21,10	23,25	10,24	20,53
Armaments	Product group: 891 - Arms and ammunition	23,14	-1,20	15,23	-0,61	9,14
Average growth rates of all sections		2,25	15,44	18,09	-0,36	8,86

Source: Own elaboration based on COMTRADE database

When looking at groups of countries, the data corroborate the fact that high tech exports from developing economies have been registering growth rates significantly above that in developed economies, as shown in Table 10. Indeed, the difference between the average growth rates is extraordinary – 16 percent in developing countries against only 1.4 percent in the developed group.

It is even more interesting to verify that high tech exports continue to grow above exports of manufactures in the developing countries, which is not the case for the group of developed economies. In the period from 2001 to 2005, the high tech exports from developed economies grew less 4.87 percentage points in an average than total manufacturing. On the contrary, developing economies' exports have been raising at a two digit rates. Besides, high tech exports from this group have grown nearly more 5.5 percentage points than total manufacturing.

Table 10 – Growth rates of high tech exports by group of products, 2001-2005

Period	01-02		02-03		03-04		04-05		Average annual growth rate	
	Manuf.	HT	Manuf.	HT	Manuf.	HT	Manuf.	HT	Manuf.	HT
Developing Countries	4,96	13,35	19,27	26,17	20,30	25,61	-2,36	-1,01	10,54	16,03
Developed Countries	1,46	-2,11	14,10	11,80	13,94	10,22	-4,43	-14,30	6,27	1,40

Source: Own elaboration based on COMTRADE database

Next it is analysed the impact of these developments on developing countries' role on total high tech trade.

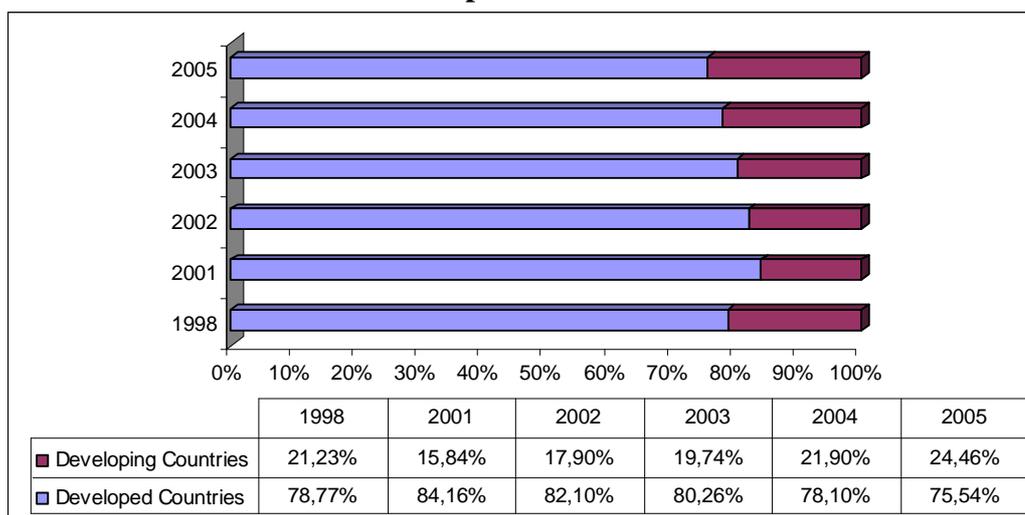
2.2.3. The Catching-Up of Developing Countries

2.2.3.1. The share of developing countries on total high tech trade

Regarding the share of developing countries in total exports of high tech products the data shows an increasing trend, similar to Lall (2000) and Mani (2000). There is however considerable difference between Mani's results for 1998 and these for 2001. In order to test

if this is due to re-classification of the 4-Asian countries, it was performed the same calculations as if Korea, Hong Kong, Singapore and Taiwan were included in the group of developing countries (see Graphics 4 and 5).

Graphic 4 – The share of developing countries in total world exports of high tech products



Data for 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

Graphic 5 – The share of developing countries in total world exports of high tech products, including Korea, Hong Kong, Singapore e Taiwan in the developing countries group



Data for 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

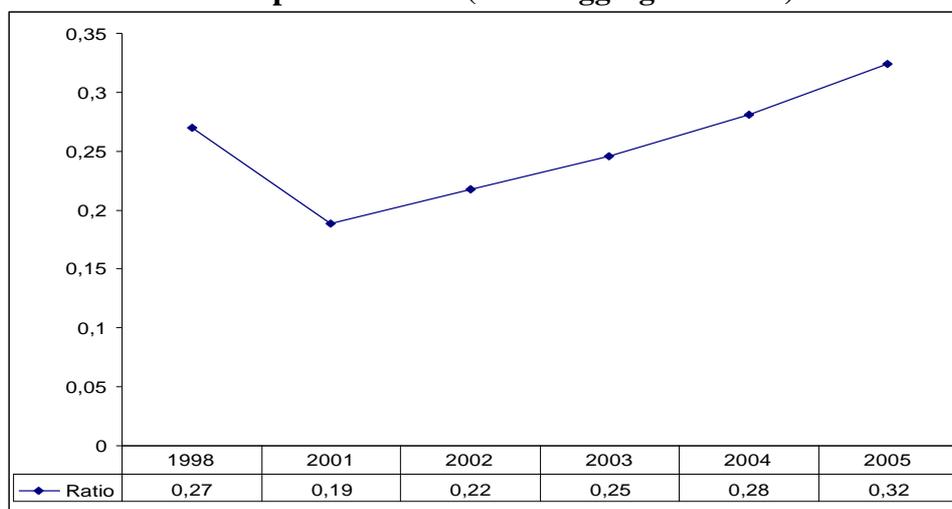
With the inclusion of Korea, Singapore, Taiwan and Hong Kong, in 2005, the share of developing countries would be 33.95 percent instead of 24.46 percent, i.e., more 9.49 percentage points.

Either way, it is observed that not only exports of manufactured products from developing countries are growing significantly, as they are growing in dynamic areas as the high tech markets, registering an increasing share of high tech on the total manufactures.

2.2.3.2. The ratio of high tech exports

To study the performance of the high tech exports from developing countries and the evolution of the catching-up defined by Mani (2000) as one of the main features, the ratio of the high tech exports from developing countries to those from developed countries was calculated, first at the aggregated level and than per type of product.

Graphic 6 – Ratio of the high tech exports from developing countries to those from developed countries (at the aggregated level)



Note: Data for 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

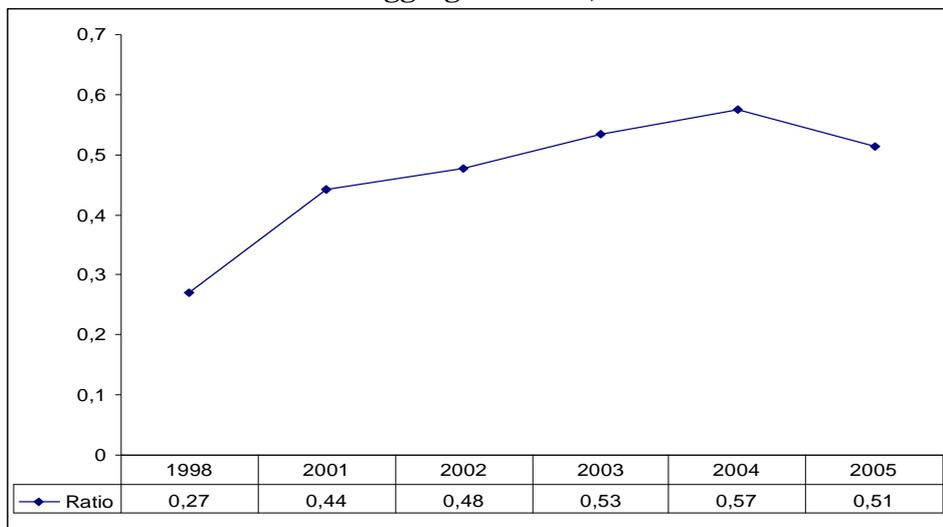
Despite the vertical fall between 1998 and 2001 (Graphic 6), for which is necessary to remember that the group of developing countries analysed in the period 2001-2005 do not count with the performance of the 4-Asian Tigers, the ratio increases significantly over the period - from 0.19 to 0.32. Hence, there has been a continuous catching up of the

developing countries with those of developed countries, as the previous results on exports shares of high tech products made preview.

Nevertheless, if the 4-Asian economies had continued in the developing group, the ratio evolution would have registered results around the double, as represented in Graphic 10. The ratios of 0.19 and 0.32 should be replaced by 0.44 and 0.51, for 2001 and 2005, respectively. The same is to say that, in this situation, the total volume of high tech exports from developing countries would be equivalent to 51 percent of those from the developed group, in the last year of the analysed period.

On the other hand, the findings reveal again that the 4-Asian Tigers lost momentum in 2005 and that the developments in these economies have an extraordinary impact in the world high tech exports.

Graphic 7 – Ratio of the high tech exports from developing countries (including Taiwan, Korea, Hong Kong and Singapore) to those from developed countries (at the aggregated level)

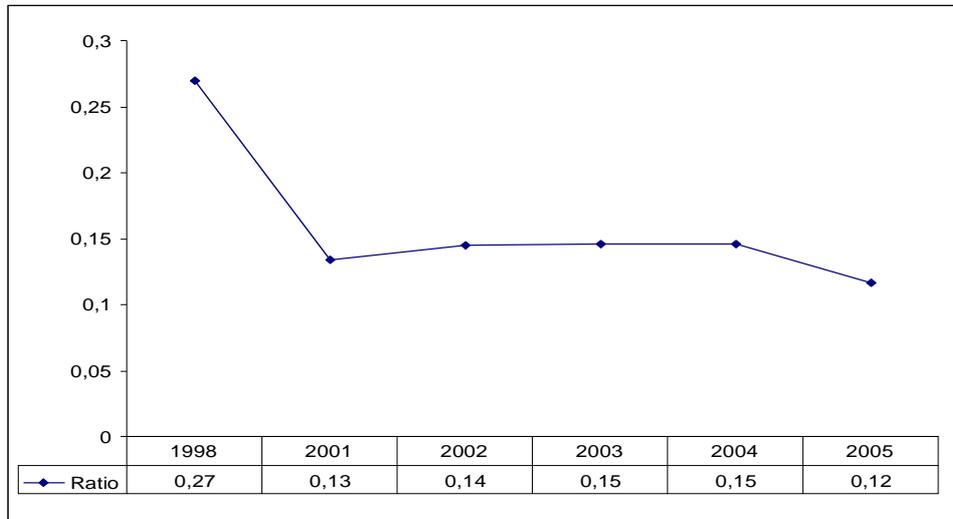


Note: Data for 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

Taking into account the share of China in the total exports of manufactured products from developing countries, it was considered relevant to this study to also compute the ratio excluding China of the group in order to test the impact of this country in the catching-up of the developing world in terms of high tech exports.

Graphic 8 – Ratio of the high tech exports from developing countries, excluding China to those from developed countries (at the aggregated level)



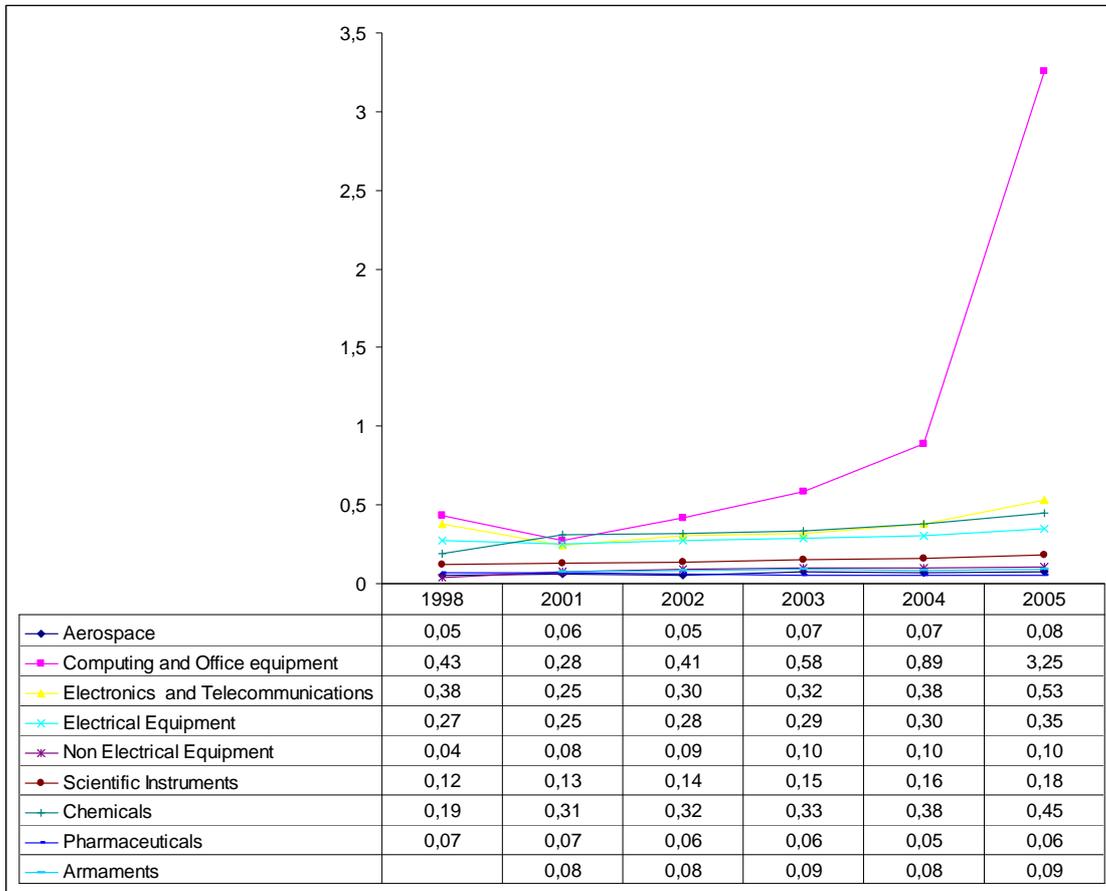
Note: Data for 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

As expected, the results leave no doubt about the weight of China in the developing group and in the global high tech exports. Without China, the ratio would be practically half of the one represented in Graphic 6, being almost stable throughout the period. Besides, only China assures that the high tech exports from developing countries do not decline after 2004. In fact, the findings in this study shows that, in 2005, the total amount of high tech exports from China are equivalent to 20 percent of the export volume of the whole developed countries group, considering the difference in the ratios obtained in Graphics 6 (0.32) and 8 (0.12).

At this stage it is important to know in what type of products the catching-up have been occurring with most relevance. To this effect the same calculations were applied to each type of product (results on Graphic 9).

Graphic 9 – Ratio of the high tech exports from developing countries to those from developed countries (at the product level)



Note: Data for 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

The results left extremely clear that not all products have the same relevance in the developing countries’ performance. Actually, the increasing trend has been concentrated mainly in only four of the eight categories of high tech products and, yet, with very different significance levels.

Developments on the computing and office equipment category have been outstanding and most responsible for the results obtained at the aggregated level, essentially between 2003 (0.58) and 2005 (3.25). Both groups of countries decreased their total amount of computing and office equipment exports, in 2005. However, whereas developed countries decreased the amount to nearly 25 percent of the amount registered in 2004, in developing countries the declining was only 10 percent. Considering that, in the previous year, both shares were

already very approached (0.89 ratio), in 2005, developing countries registered an export volume three times higher than that from developed countries.

The second more important type of products in the catching-up of developing countries is electronics and telecommunications. In the last year of the studied period, the group accounted for more than one third of the world total in this type of products.

Chemicals and electrical equipment, by this order, are the other two groups most important in the developing world performance. In what concerns chemicals, the absolute values are not very significant in either group of countries. Notwithstanding this, developed countries have been decreasing their exports volume while developing countries have been increasing it.

Pharmaceuticals and aerospace, probably two of the most knowledge-based industries, show the worst results for developing countries and seem to continue concentrated in the developed world, as well as non-electrical equipment and armaments.

Further discussion on these subjects will take place in the section related to product specialization.

2.3. Summary

This chapter shows that developing countries continue to catching-up the developed economies not only in terms of manufactures' exports, but also in what concerns high tech exports, essentially in areas such as electronics and telecommunications and computing and office machines. Even with the generalized slow-down in the global economic growth, in 2005, developing countries outperformed developed ones.

Nonetheless, the observation on the exports concentration of manufactured products evidences that attributing this performance to all developing countries may be precipitated. Besides, it may not be associated to technological capabilities of developing countries' economies, as stated before in the existing literature.

In the next chapter it will be examined a) if the developing world as a whole is a net exporter or importer of high tech products, b) indices of Revealed Comparative Advantage (RCA) in the high tech sectors, c) technological complexity and heterogeneity within the developing countries' group, and if this has any impact on the hypothesis of statistical *artifact*.

3. Main Features of High Tech Exports from Developing Countries

In the following sections, first, it is computed a net export ratio to verify if the developing world became a net exporter of high tech products according to the trend found by Mani and if this may have any impact on the hypothesis of statistical *artifact* verification. Next, it is examined the Revealed Comparative Advantage (RCA) of the developing group in the high tech sectors by comparing it to the RCA of developed countries. If results show great discrepancy between groups, this may be a symptom of a statistical *artifact*, despite the discussion around the indicator. Finally, it is analysed the issue of heterogeneity within the developing countries' group, in terms of concentration of high tech exports and technological intensity. This shall allow the perception of the group diversity and, thus, to conclude if the hypothesis can be applied to all countries or if just a few ones can be considered as potential real high tech exporters.

By applying Mani's methodology to the period 2001-2005, data allowed to observe that some features prevailed throughout the years, while others seem not to sustain the author's conclusions.

3.1. Net Exports Ratio

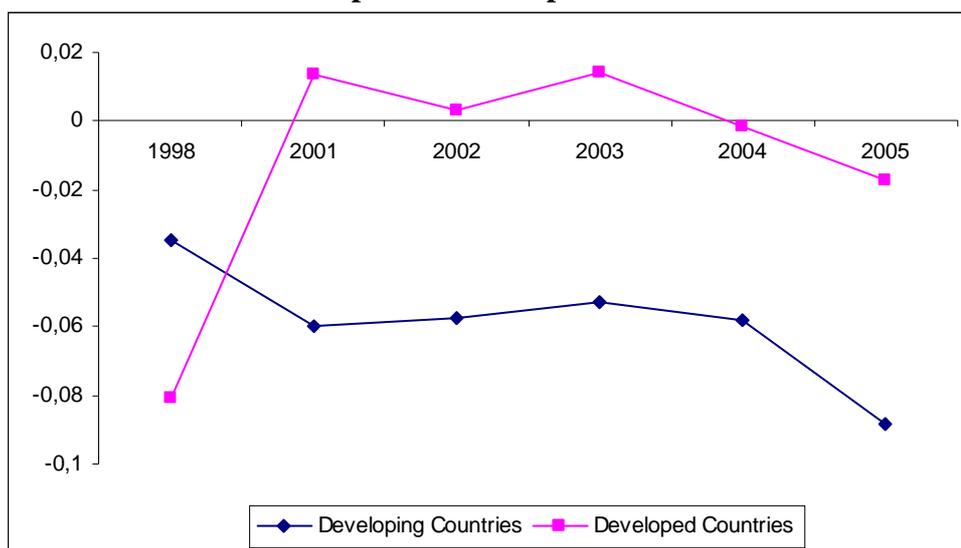
The possibility that the observed patterns of specialization might suffer from statistical bias because of multiple counting of components in trade statistics is further investigated. Looking solely at the specialization in high-tech exports, it could easily be concluded that some developing countries have been extremely successful in technological catching up, even overtaken the United States, Japan and the EU in terms of the technological intensity of their economies. To test this hypothesis, Srholec (2007) analysed imports and exports of electronics, as one of the most important section in the export structure of high tech exports from developing countries, to show that technological capabilities explain a certain portion of cross country differences in export specialization in electronics, but the propensity to import electronics components is also a relevant explanatory factor. The basic idea is that electronics components - as intermediate inputs - can be imported for the assembly of final products or for further processing and re-exported to serve foreign markets. According to

this author, it is not surprising to see lower income countries with high imports of electronics components because processing of components or their assembly into final products is obviously intensive on endowments other than technological capabilities.

Notwithstanding this, it is also true that there is very little difference between the rankings of the main traders in terms of either exports or imports of high tech products, in which are included the most advanced economies like US and Japan (Meri, 2008).

Mani evaluated the performance of developing countries in what concerns imports of high tech products by defining the ratio of net exports (high tech exports minus high tech imports) to gross exports. By applying this ratio, the author concluded that, while the ratio of the developed economies declined, the ratio for the developing economies increased over the period 1988-1998. Moreover, in 1998, the ratio was higher for developing economies. To observe the evolution and verify if the increasing trend of developing countries continued even with all the significant changes in the international trade and economic conjuncture in recent years, the same ratio was computed for the period 2001-2005.

Graph 10 – Net exports ratio



Note: Data for 1998 was extracted from Mani (2000)

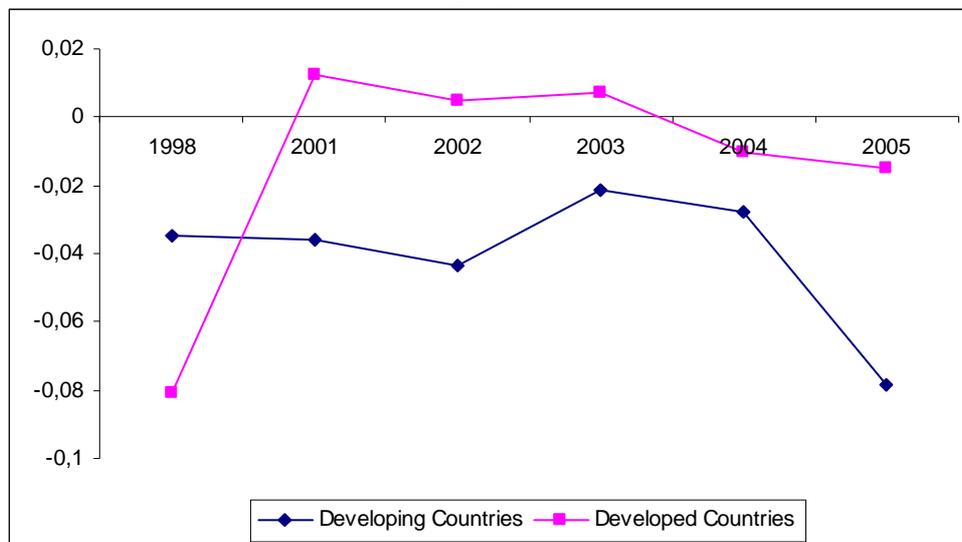
Source: Own elaboration based on COMTRADE database

In this work, the obtained results revealed a completely different situation compared to the one referred above for the period 1989-1998. Not only the ratio for developed economies is

persistently above that for developing ones, as the later show a negative trend concerning net high tech exports over the period, with only a slight recover between 2001 and 2003 (see Graphic 10). Only the decreasing trend of the developed countries is consistent with that observed by Mani (2000). Even though, in his study the developed group did not register any positive ratio after 1994, which is not the case in this research.

In order to verify if the results were due to the re-classification of the Asian Tigers, the same calculations were done with these economies in the developing group. Albeit the difference between both groups decline, the developing countries ratio, including the 4-Asian economies, does not even reach positive values in any time. In addition, the negative trend is higher after 2004. Regarding developed countries, with the exclusion of the 4-Asian, the ratio register lower results and the declining trend starts in 2003 instead of 2004. See Graphic 11.

Graphic 11 – Net exports ratio (including Singapore, Korea, Hong Kong and Taiwan in developing countries)



Note: Data for 1998 was extracted from Mani (2000)

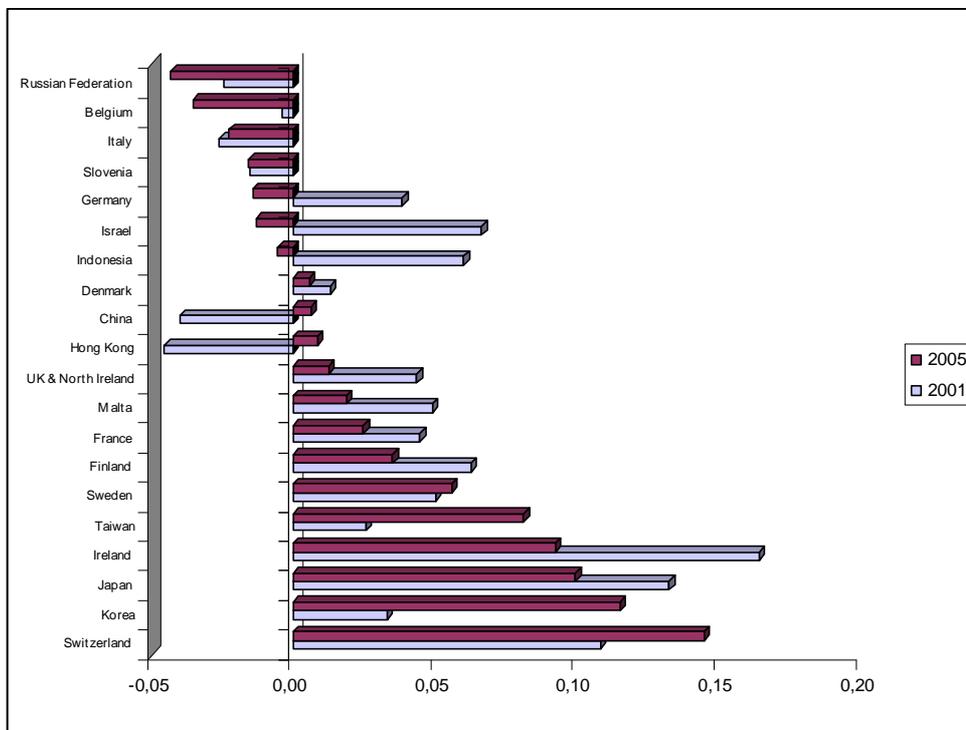
Source: Own elaboration based on COMTRADE database

To avoid possible bias, it was tested the results by taking out the petroleum exports (SITC group 333, 334, 335 and 344) from the total gross exports. However, this had little impact in the net exports ratio of both groups.

Next, it is analysed the net export ratio at country level. In Graphic 12, countries are ranked according to the twenty higher net export ratios in 2005. There are very few developing countries with a position in the top-20. Only China, Indonesia and Russian Federation can be found in the graphic. Mexico, Malaysia and Thailand, that had an average ratio in the top-20, in the period 1988-1998, are no longer mentioned in the graphic representation. Yet, if the ranking was based in the values of 2001, Philippines, Guinea, Indonesia and Malaysia could be found among the top-20 and the only country with a negative ratio would be the US.

The graph representation confirms the general trend for the increase of the high tech imports. Except for Korea, Switzerland, Taiwan, Sweden, Hong Kong and China, almost every country reduced its ratio between 2001 and 2005, some of them dramatically (case of Germany, Indonesia and Israel). Notably, the US does not even surge among in the top-20. The cases of China and Hong Kong are extraordinary. These economies passed from a situation of net importers to net exporters of high tech products in only five years.

Graphic 12 - The top 20 countries in terms of net export ratio, 2001 and 2005



Source: Own elaboration based on COMTRADE database

The results of this section seem to conduct the conclusion that not only the global high tech imports increased significantly, especially from 2003 forward, as developing countries, as a whole, import a lot more high tech products than export this type of products.

Taking into account the great discrepancy between this study and the one conducted by Mani (2000), this area would need complementary investigation, namely on the data for the years of 1999 and 2000 and on the global trade changes in that period.

Yet, in order to get sustainability to the present results, some additional research was done. In fact, trade statistics from World Trade Organization (2005) confirm that, in 2004, the growth rates of imports in regions such as South and Central America, CIS, Africa and Middle East and North America were significantly above the growth rates for exports. Only Asia (Japan, China, India and the 4-Asian Tigers) and Europe contradicted this trend.

In general, it was observed in this section that developing countries, except for China, are very far to be net exporters of high technology. According to Srholec (2007) this could be a symptom for a statistical *artifact*, despite it would be needed further investigation at a much more disaggregated level. However, given:

- The negative results obtained for developed countries (especially those excluding the 4-Asian economies – Graphic 10);
- That real advanced economies like Germany or US are, in fact, net importers of high technology;
- The conclusions of Meri (2008) which confirm that there is very little difference between the rankings of the main traders in terms of either exports or imports of high tech products;

These results, by themselves, have little impact in the verification of the statistical *artifact* hypothesis.

3.2. Competitiveness of High Tech Exports

The Revealed Comparative Advantage (RCA) is often taken as an indicator for export industrial competitiveness. Trade specialization in the sense of the RCA index of Balassa reflects sectoral competitiveness. It reveals a country's sectoral export- import ratio in relation to the export- import ratio of its total economy (Borbély, 2004).

Yet, despite being quite accepted and used in innumerable studies on trade patterns, this indicator have been subject to several criticisms. Some authors understand as one of the problems of implementing the RCA indices the fact that real (observed) trade patterns may be distorted by government interventions, thus causing misrepresentation of underlying comparative advantage. Import restrictions, export subsidies and other protectionist policies of governments, to an extent, may distort RCA indices (Utkulu and Seymen, 2004). Another problem pointed out by some authors is that its value is asymmetric; it varies from one to infinity for products in which a country has a revealed comparative advantage, but only from zero to one for commodities with a comparative disadvantage (Fertő and Hubbard, 2003). Consequently, a wide range of modifications have been developed with the objective of refine it being commonly used in the economic literature.

Following Mani's methodology, in this study it is computed a modified version of the classical RCA index, by dividing the share of high tech exports (*ht*) of a country in the world by its share of world total exports (*t*):

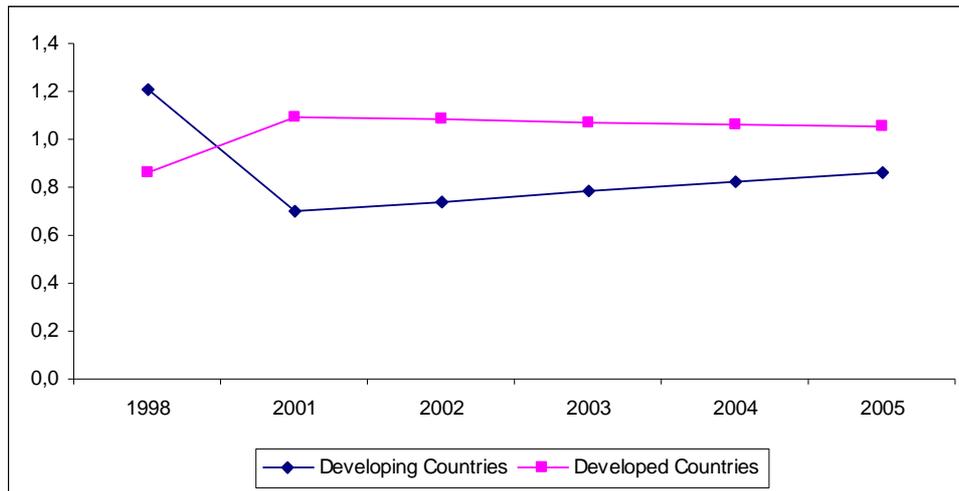
$$RCA_{ght} = \left(\frac{\frac{X_{ght}}{\sum X_{wht}}}{\frac{X_{gt}}{\sum X_{wt}}} \right)$$

where *g* stands for the group of countries and *w* for the world total.

Contrary to what was expected, the results represented in Graphic 13 do not sustain those from Mani (2000), notwithstanding there is a recovering trend on the RCA_I from

developing countries. In this study, developed countries reveal a higher but declining RCA_I

Graphic 13 – RCA of developed and developing countries in high tech exports



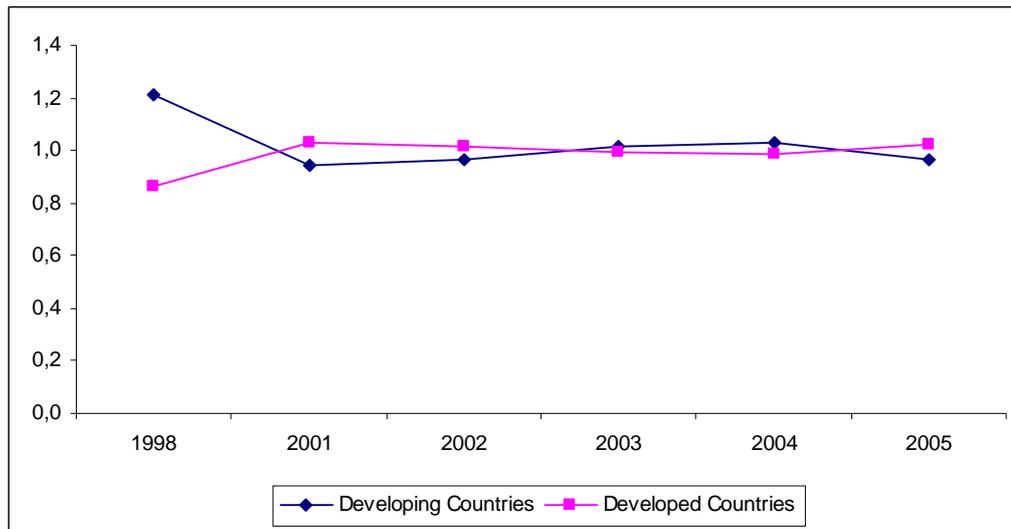
Note: Data for 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

Taking into account the results for 1998 and the observed growth rates in previous sections, it was necessary to develop further research capable of explaining it. Again, it was tested the results by taking out the petroleum exports from the total gross exports. Nevertheless, the changes were not relevant. In 2001, instead of 0.7 and 1.09, indices would be 0.75 and 1.07 for developing and developed countries, respectively. In 2005, the indices for developing countries would rise from 0.86 to 0.91 and the ones for developed countries from 1.03 to 1.06.

Another attempt to justify the difference among this study and the one carried out by Mani was to examine how the Asian Tigers re-classification influenced the performance of the developing countries conducting the same exercise of including them together with the developing countries. Indeed, as demonstrated in Graphic 14, the RCA_I of the developing countries would be very close, and most of the time above the RCA_I of the developed countries if Singapore, Korea, Hong Kong and Taiwan were part of the first group.

Graphic 14 – RCA of developed and developing countries in high tech exports (including Singapore, Korea, Hong Kong and Taiwan in developing countries)



Note: Data for 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

Even though the 4-Asian economies re-classification explains some of the discrepancy between results, part of it is still not justified. For this is necessary to have in mind the following points:

- The exports structure of developing countries presented by Mani (2000) had a far more intensive share on Section 7 (machinery and transport equipment), very significant in terms of the specialization of developing countries in high tech products (see point 2.1);
- Additionally, while Section 7 reduced its share considerably, mainly due to the exclusion of the 4-Asian, Section 6 (manufactured goods classified chiefly by materials), in which are included the non ferrous metals, declined very little and even registered an increasing over the period 2001-2005. Recall that no product from Section 6 is included in high tech group of products;
- Moreover, the total Section 3 (mineral fuels, lubricants and related materials) rose more than double from 1998 to 2001;

- As it was sustained by WTO (2006), in 2005, export prices of electronic goods continued to decline while those of iron and steel products and chemicals recorded above average increases.

Furthermore, when looking at the individual level it can be seen that the countries with the highest RCA indices in Mani's work that still remain in the developing group (Philippines, Malaysia and Thailand) have been losing their competitiveness, as verified before in this study. See Table 11.

Notwithstanding this, RCA_I of developing countries are registering significant recover and are getting closer from developed countries' indices. For this, are contributing essentially China, Hungary and Mexico. Jordan, Morocco and Costa Rica also revealed good results on this indicator. The rest of the developing economies seem to maintain their indices more or less stable with little significant results.

Table 11 – The top-20 RCA indices from developing countries

Country	1997	1998	2001	2002	2003	2004	2005
China	0,61	0,69	1,02	1,12	1,30	1,47	1,70
Philippines	2,47		2,61	2,79	2,77	1,48	1,59
Hungary			1,14	1,29	1,42	1,60	1,34
Mexico	0,82	0,87	1,05	1,02	1,01	1,04	1,08
Malaysia	2,29	2,48	1,87	1,88	1,94	1,95	1,03
Jordan			0,72	0,67	0,62	0,65	0,80
Morocco			0,58	0,63	0,69	0,76	0,73
Thailand	1,44		0,84	0,95	1,11	1,12	0,62
Costa Rica			0,52	0,49	0,54	0,77	0,62
Croatia			0,46	0,52	0,53	0,59	0,54
Brazil			0,55	0,48	0,36	0,37	0,45
Latvia			0,29	0,30	0,33	0,34	0,42
Tunisia			0,40	0,39	0,46	0,46	0,38
Poland			0,29	0,30	0,33	0,34	0,37
Lithuania			0,34	0,30	0,34	0,32	0,36
India			0,33	0,35	0,35	0,31	0,35
Indonesia			0,46	0,49	0,46	0,52	0,35
Bulgaria			0,28	0,31	0,32	0,31	0,35
Slovakia			0,30	0,26	0,28	0,36	0,34
Guatemala			0,32	0,38	0,38	0,39	0,33

Note: Data for 1997 and 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

3.3. Developing Countries as an Heterogeneous Group

3.3.1. Concentration of high tech exports

Some of the outcomes of this work, such as the concentration in the exports of manufactured products from developing countries, the impact of China in the ratio of high tech exports from developing countries to those from developed economies, as well as the individual RCA indices, have been conducting to the assumption that high tech exports remain concentrated in only a few developing countries and, in consequence, that the performance of the group as a whole depends on those few, as found by Mani to the period 1988-1998. The purpose in this section is to verify if that situation continues to verify in the recent years, despite the global trade changes occurred since Mani first study these patterns. The concentration shall be analysed not only within developing group, but also among developed countries in order to verify if this feature applies to both groups or exclusively to one of them. If the first hypothesis applies there will be little fundament in consider the developing group as non high tech exporters based on this argument.

Table 12 – Concentration in exports of high tech products

Year	Share of the top-10 high tech exporting countries	Share of the top-15 high tech exporting countries
1998	77%	-
2001	68%	81%
2002	66%	80%
2003	67%	80%
2004	67%	81%
2005	70%	82%

Note: Data 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

The data analysis demonstrates that high tech exports are still concentrated in both groups, notwithstanding, some changes have occurred in the meantime. Regarding the level of concentration at the aggregated level, the results show that it, in 2005, 70 percent of total high tech exports were from only ten countries. In 1998, the same number of countries concentrated 77 percent of these exports. Despite the slight declining it was observed an increasing trend between 2001 and 2005. The spread of concentration was tested by

including five more countries in the exercise, but the results show that more than 80 percent of high tech exports are still dominated by just fifteen economies. See Table 12.

The detailed data on the top-15 of high tech exporters presented on Table 13 evidences that only three developing countries are among the leaders, namely China, Malaysia and Mexico. Besides, just China maintains an increasing trend during the period, the opposite of the other two countries that show very unstable positions.

There are still two relevant facts to consider. One is related to the fact that, except for Singapore in 2005, the 4-Asian Tigers can permanently be found among the top high tech exporters, which would greatly change the developing countries situation if still classified as such. The other one is the extraordinary evolution of China within the period. According to the methodology used in this work, in 2005, China reached the position of the leading high tech exporter in the world, leaving the US behind, as it happened, in 2004, in the information technologies area (OECD, 2005).

Table 13 - List of the top-15 high tech exporting countries per year (US\$' 000)

Country	2001	Country	2002	Country	2003	Country	2004	Country	2005
United States of America	253.875.387	United States of America	234.777.905	United States of America	236.276.847	Germany	204.818.731	China	250.576.266
Germany	131.774.773	Germany	129.937.295	Germany	157.479.519	China	189.331.420	United States of America	198.706.324
Japan	127.049.543	Japan	120.990.926	Japan	137.888.154	United States of America	179.463.443	Japan	165.016.965
UK & North Ireland	85.611.959	China	83.641.295	China	128.312.852	Japan	165.402.396	Germany	157.822.426
France	76.730.918	France	77.430.160	France	86.452.399	France	100.010.035	France	106.972.239
China	63.335.755	UK & North Ireland	69.862.160	Singapore	76.955.664	Singapore	95.378.491	Korea, Republic of	56.240.340
Singapore	60.813.639	Singapore	62.924.477	UK & North Ireland	63.328.610	Korea, Republic of	83.110.819	Belgium	51.546.635
Hong Kong	55.899.679	Taiwan,	51.655.542	Korea, Republic of	62.515.843	Netherlands	75.929.420	Italy	48.731.072
Taiwan,	46.086.901	Korea, Republic of	49.603.026	Netherlands	58.142.170	UK & North Ireland	66.992.630	Netherlands	44.745.733
Korea, Republic of	43.465.097	Malaysia	40.720.111	Taiwan,	57.032.260	Hong Kong	54.963.439	Mexico	44.448.182
Netherlands	41.430.896	Netherlands	40.281.843	Malaysia	45.471.915	Malaysia	53.558.225	UK & North Ireland	44.355.928
Mexico	38.877.584	Belgium	38.273.737	Belgium	44.385.606	Belgium	52.773.824	Switzerland	44.005.323
Malaysia	38.397.818	Ireland	37.641.909	Hong Kong	44.248.069	Italy	45.568.870	Canada	38.296.222
Italy	33.625.908	Mexico	37.579.852	Italy	38.294.344	Switzerland	44.800.621	Taiwan,	34.836.782
Ireland	31.210.036	Hong Kong	36.850.653	Switzerland	37.618.735	Mexico	42.507.546	Hong Kong	30.463.053

Source: Own elaboration based on COMTRADE database

In addition to the exports concentration at an aggregated level, it is also important to verify how do countries perform within their groups, which economies represent de main volume of high tech exports of the developed and the developing world and if the level of concentration has the same emphasis in both groups.

Table 14 - Concentration in exports of high tech products within each category

Year	Share of the top 5 high tech exporting developed countries	Share of the top 10 high tech exporting developed countries	Share of the top 5 high tech exporting developing countries	Share of the top 10 high tech exporting developing countries
1998	72%	-	95%	-
2001	58%	79%	79%	92%
2002	55%	76%	80%	93%
2003	54%	77%	81%	93%
2004	53%	76%	83%	93%
2005	57%	76%	86%	94%

Note: Data for 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

Despite the level of concentration is still notorious, especially within the top-10 groups of countries, there is a clear decrease in the concentration of the five leading exporters in both groups as indicated in Table 14. The integration of the 4-Asian are responsible for part of the declining in the developed group, since they have a significant share of the world high tech exports. Nevertheless, this is a symptom that more countries are improving their performance in this area and are raising their share in global trade of high tech products.

By the time Mani studied the exports concentration, the top-5 high tech exporters of the developing world were Singapore, Korea, Malaysia, China and Mexico. In what concerns the developed group of countries, the author identified as the top-5 exporters the US, Japan, Germany, UK and France. Given the re-classification of Singapore and Korea, the top-5 leading exporters of both groups changed over the years, as shown in Tables 15 and 16. Regarding the developing countries category, in 2005, the first five positions were dominated by China, Mexico, Malaysia, Hungary and Brazil. On the developed side the top-5 high tech exporters were US, Japan, Germany, France and Korea.

Table 15 - List of the-top 10 high tech exporting developed countries per year (US\$' 000)

Country	2001	Country	2002	Country	2003	Country	2004	Country	2005
US	253.875.387	US	234.777.905	US	236.276.847	Germany	204.818.731	US	198.706.324
Germany	131.774.773	Germany	129.937.295	Germany	157.479.519	US	179.463.443	Japan	165.016.965
Japan	127.049.543	Japan	120.990.926	Japan	137.888.154	Japan	165.402.396	Germany	157.822.426
UK & North Ireland	85.611.959	France	77.430.160	France	86.452.399	France	100.010.035	France	106.972.239
France	76.730.918	UK & North Ireland	69.862.160	Singapore	76.955.664	Singapore	95.378.491	Korea	56.240.340
Singapore	60.813.639	Singapore	62.924.477	UK & North Ireland	63.328.610	Korea	83.110.819	Belgium	51.546.635
Hong Kong	55.899.679	Taiwan	51.655.542	Korea	62.515.843	Netherlands	75.929.420	Italy	48.731.072
Taiwan	46.086.901	Korea	49.603.026	Netherlands	58.142.170	UK & North Ireland	66.992.630	Netherlands	44.745.733
Korea	43.465.097	Netherlands	40.281.843	Taiwan	57.032.260	Hong Kong	54.963.439	UK & North Ireland	44.355.928
Netherlands	41.430.896	Belgium	38.273.737	Belgium	44.385.606	Belgium	52.773.824	Switzerland	44.005.323

Source: Own elaboration based on COMTRADE database

Table 16 – List of the top-10 high tech exporting developing countries per year (US\$' 000)

Country	2001	Country	2002	Country	2003	Country	2004	Country	2005
China	63.335.755	China	83.641.295	China	128.312.852	China	189.331.420	China	250.576.266
Mexico	38.877.584	Malaysia	40.720.111	Malaysia	45.471.915	Malaysia	53.558.225	Mexico	44.448.182
Malaysia	38.397.818	Mexico	37.579.852	Mexico	37.536.933	Mexico	42.507.546	Malaysia	16.033.669
Philippines	19.610.244	Philippines	22.665.325	Philippines	22.532.424	Thailand	23.437.814	Hungary	13.834.680
Thailand	12.728.942	Thailand	14.915.151	Thailand	19.983.578	Hungary	19.226.952	Brazil	10.009.883
Hungary	8.101.091	Hungary	10.189.029	Hungary	13.725.242	Philippines	12.717.147	Thailand	9.329.132
Brazil	7.464.843	Brazil	6.621.370	Russian Federation	6.926.275	Brazil	7.716.000	India	7.059.509
Indonesia	6.053.385	Indonesia	6.502.637	Indonesia	6.361.830	Indonesia	7.329.962	Poland	6.446.067
Russian Federation	4.277.289	India	4.198.233	Brazil	5.900.090	India	5.449.871	Russian Federation	5.339.493
India	3.452.458	Russian Federation	4.016.550	India	4.954.863	Poland	5.370.121	Indonesia	4.942.297

Source: Own elaboration based on COMTRADE database

The data also reveals that, as for exports of manufactures, Singapore and Philippines lost momentum in 2005. In that year these economies did not even reach the ten first positions of the correspondent groups. The UK & North Ireland registered a persistent decreasing trend over the period.

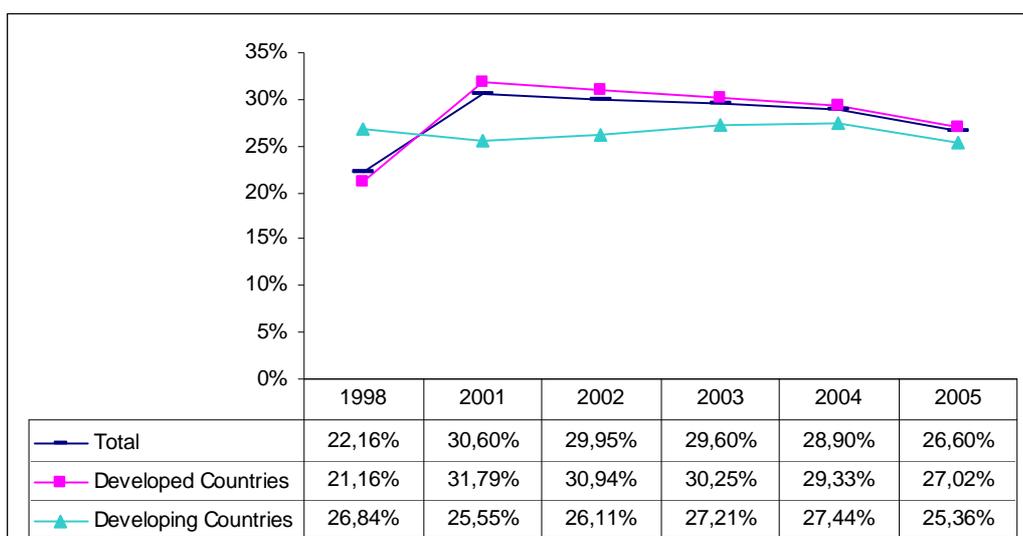
On the other hand, India and Poland revealed an improving trend within the period. In 2005, those two countries achieved the seventh and eight positions in the ranking of the leading exporters from developing world.

In sum, results confirmed that the concentration feature found by Mani continues to apply to both group in terms of high tech exports, yet, with significantly more expression in developing countries. The same number of countries concentrates more 30 percent of their total high tech exports in the developing countries than in developed countries, which is mostly due to China's performance. Hence, this fact cannot be disregarded when concluding on statistical *artifact*. It is a reality, however, that some developing countries are improving their performances.

3.3.2. Technological intensity

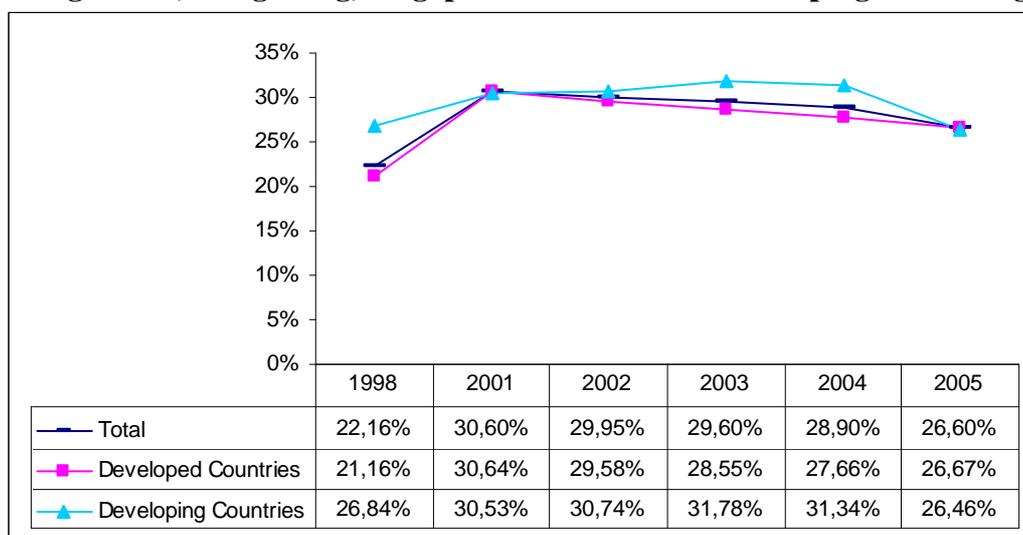
In spite of the growth rates over the last decade or so, this study confirms a declining trend in the technological content of exports in the first years of the present decade (as shown in Graphic 2 for OECD economies). From 30.6 percent of total exports of manufactures in 2001, high tech declined to 26.6 percent in 2005 (Graphic 15). Yet, whereas the decline is notorious in the export structure of developed countries, the share of high tech exports from developing countries in their total manufactures continued to rise, in spite of a slight decline in 2005. Nowadays, high tech exports account for very similar shares in developed and developing countries' export structures.

Nevertheless, these results contrast substantially from Mani's in 1998 (2000). Taking into account the important role of the Asian Tigers in the high tech exports already observed, it was computed the same exercise by including them in the group of developing countries. See Graphic 16.

Graphic 15 – Trends in high technology content of world exports of manufactures

Data for 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

Graphic 16 – Trends in high technology content of world exports of manufactures, including Korea, Hong Kong, Singapore and Taiwan in developing countries group

Note: Data for 1998 was extracted from Mani (2000)

Source: Own elaboration based on COMTRADE database

As expected, the share of high tech exports for the group of developing countries and 4-Asian is above that of developed countries. Additionally, it is also possible to see that the performance of those economies influences the decreasing trend previously observed. With

its exclusion, the developed countries group has a less emphasised decrease in its technological content.

Regarding the technological intensity at country level, data revealed great heterogeneity among developing countries performances, as in previous analysis.

Table 17 – Share of high tech exports in the total exports of manufactures of the top-20 countries per category – averages of the periods

Developed countries					Developing countries				
Ranking	Country	HT Average export intensity (1988-1998)	Country	HT Average export intensity (2001-2005)	Ranking	Country	HT Average export intensity (1988-1998)	Country	HT Average export intensity (2001-2005)
1	Ireland	42,82%	Singapore	54,69%	1	Singapore	42,82%	Philippines	64,71%
2	US	31,90%	Ireland	43,74%	2	Malaysia	31,90%	Malaysia	52,47%
3	Japan	25,11%	Switzerland	39,90%	3	Philippines	25,11%	Hungary	34,91%
4	UK	24,96%	US	38,89%	4	Thailand	24,96%	China	32,99%
5	Netherlands	21,71%	Taiwan	38,06%	5	Korea	21,71%	Mexico	28,01%
6			UK	34,81%	6			Thailand	27,85%
7			Netherlands	34,43%	7			Morocco	23,34%
8			Korea	34,07%	8			Jordan	21,99%
9			Japan	31,55%	9			Costa Rica	21,04%
10			France	30,86%	10			Guatemala	19,67%
11			Australia	29,67%	11			Indonesia	19,45%
12			Israel	29,56%	12			Brazil	17,78%
13			Hong Kong	28,96%	13			Russian Fed.	16,77%
14			Finland	28,79%	14			Croatia	16,05%
15			Estonia	28,69%	15			Kazakhstan	13,51%
16			Sweden	28,54%	16			Latvia	12,92%
17			Denmark	27,87%	17			Chile	12,29%
18			Germany	25,83%	18			Tunisia	11,71%
19			Norway	25,80%	19			Lithuania	11,64%
20			Belgium	21,17%	20			Colombia	11,53%

Notes: Data for 1998 was extracted from Mani (2000)

Several countries of both groups presented average rates of technological intensity above some of the ones mentioned in the table. However, due to the very weak expression in absolute terms, it was not taking into account. Medium and low income economies - Saint Kitts and Nevis, Guinea, Seychelles, Papua New Guinea, Senegal, Georgia, Algeria, Cuba, Suriname, Saint Lucia among others. High income economies – Iceland, Greenland, Cyprus and Trinidad and Tobago.

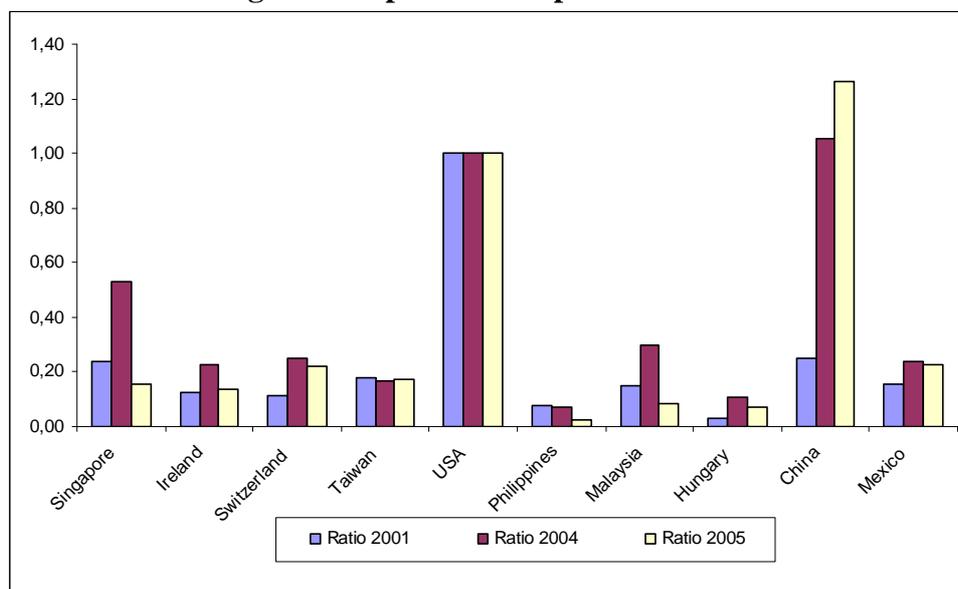
Source: Own elaboration based on COMTRADE database

In the period 2001-2005, almost 65 percent (average) of the total exports of manufactured products from Philippines were exports of high tech products. This country was, in fact, the world leader in terms of technological intensity of the manufactures' exports.

Despite from Philippines, the countries that most contributed to the improvement of the technological content of the total exports of manufactured products from developing world were Malaysia, Hungary and China presenting average high tech shares above the 30 percent; in the case of Malaysia, even above the 50 percent.

By measuring the catching-up of the top-5 countries of both groups, in terms of technological intensity, to the US, the largest exporter of high tech products from developed countries, data shows that, with the exceptions of China and Singapore, there are no significant differences between the analysed developed and developing countries. Inclusively, in 2004, Malaysia presented better results than Ireland and Switzerland.

Graphic 17 – Ratio of high tech exports from specific countries to those from the US



Source: Own elaboration based on COMTRADE database

Graphic 17 also highlights the extraordinary catching-up of China between 2001 and 2005, outperforming the US, at least in terms of exports volume.

Nevertheless, to a large extent, developing economies under the first five positions register lower levels of technological intensity than those from the developed group.

3.4. Summary

Developing countries as a whole revealed to be net importers of high tech product while the developed group revealed to be net exporter in the first years of the analysed period. However, given the generalized decreasing trend in both groups after 2004, as well as the negative ratios obtained for developing and developed countries at the individual level, in terms of net export ratio, the results in this work were inconclusive.

In respect with the analysis on competitiveness levels, it was verified that developing countries are not only increasing its share in the world exports as they are gaining competitiveness in this sector as confirmed by the measure of the correspondents RCA indices. Notwithstanding this, the developing world still registers RCA indices significantly under developed countries. Data also confirmed that most of these results are due to China's performance and only to a few more countries, as stated on RCA indices at the individual level as well as on the exports concentration.

Results on exports concentration also demonstrated that in the developing world the same number of countries concentrates significantly more high tech exports than in the developed one.

Similar conclusions can be taken over the analysis on technological intensity. Except for the five leading countries of both groups, the gross of developing countries show shares of high tech exports in its total manufactures considerably lower than those from developed countries. It is a fact, however, that in terms of the top-5, some developing countries have higher levels of technological intensity than those from the developed group.

These are important findings to the hypothesis under verification in this study that may conduct to think that developing countries as a group are still far from being considered real high tech exporters. However, some particular countries may be close to achieve that stage. Yet, some additional investigation is still necessary. The next chapter will discuss the differences in the product specialization between both groups and will attempt to analyse the local technological capabilities by analysing the patenting activity and competitiveness indicators.

4. Verification of the Statistical *Artifact* Hypothesis

The hypothesis of statistical *artifact* comes essentially from the fact that the same product can have different processes in different locations and what seems to be revealed by the statistics may not be the truth. According to Lall (2000) the semiconductors may involve designs and complex fabrications in a given country (genuine high tech) and just the final assembly in another (low technology). As there are many exports from developing countries on the latter type of processes, this could probably mean a statistical *artifact*. The question is if this is applied to all high tech exports from the developing world. Mani (2000) proposed the verification of this hypothesis by examining:

- The product specialization between developed and developing economies. The author considered that, if the specialization of each group was not very different it would be difficult to maintain the *artifact* hypothesis;
- The innovative activity of the developing countries with respect to high technology areas, through its patenting record;
- Four indicators of high tech competitiveness developed by the Technology Policy Assessment Centre (TPAC): national orientation; socio-economic infrastructure; technological infrastructure and the productive capacity (detailed explanation in section 4.3).

In this work the same methodology is applied to the statistic data obtained for the period from 2001 to 2005.

4.1. Product Specialization between Developed and Developing Countries

Changes in the world export structure have been taking place over the years. Looking in particular to the high tech exports structure represented in Table 18 it can be observed that almost every industry suffered some evolution one way or another. Electronics and telecommunications dominate and have been increasing its share within high-tech exports. The exports from these industries gained relevance in both groups of countries, but are

particularly important on the developing countries, dominating almost half of their total high tech exports.

Table 18 - Structure of high tech exports of developing and developed countries (average of the period 2001-2005)

Product	Mani W.	World	Developing	Developed
Aerospace	13,05%	10,88%	3,33%	12,79%
Office and Computing	27,33%	11,75%	23,12%	8,87%
Electronics and telecommunications	34,66%	37,31%	47,45%	34,74%
Electrical equipment	2,63%	7,35%	8,39%	7,09%
Non electrical equipment	3,75%	3,05%	1,31%	3,49%
Scientific instruments	10,15%	13,27%	8,82%	14,40%
Chemicals	4,56%	2,96%	3,91%	2,72%
Pharmaceuticals	3,87%	13,03%	3,52%	15,44%
Armaments	-	0,39%	0,15%	0,45%
Total		100,00%	100,00%	100,00%

Source: Own elaboration based on COMTRADE database

Pharmaceuticals in particular and scientific instruments assume an important share and also gained weight on high-tech exports overall reaching shares over 13 percent each. This applies more significantly on the export structure of developed countries. The difference between groups is especially emphasised in pharmaceuticals. Where developed countries group concentrates a share of more than 15 percent of its total high tech exports in this type of products, the developing world remains with a share of only 3.5 percent.

Aerospace is another industry with a significant contribution to world trade, being considerable more important for the case of developed countries.

Electrical equipment also increased its relevance overall and in both groups of countries, registering little difference from each other.

The largest decline as share on the total high tech exports is observed in office and computing category. From an average of 27.33 percent in the period 1988-1998, this group of products declined their share to 11.75 percent within 2001-2005. The decline was

primarily in the developed countries. This group of products is still the second most important on developing countries' high-tech exports.

In sum, it can be said that differences among both groups have increased compared to the table built by Mani. However, it is still true that the export structure of developing and developed countries concentrates the main shares on electronics and telecommunications, albeit the significant role of computing and office equipment in the first and pharmaceuticals, scientific instruments and aerospace in the latter.

The next step is to examine the product specialization of developed and developing countries; first in general terms and then within the categories with higher shares in the respective high tech export structures.

Regarding the top-10 high tech exports (Table 19), it is verified that 60 percent of the product groups are the same in both developed and developing countries, namely, “telecommunications equipment and parts and accessories of apparatus”; “electrical machinery and apparatus”; “sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media”; “thermionic, cold cathode or photo-cathode valves and tubes”; “optical instruments and apparatus” and “measuring, checking, analysing and controlling instruments and apparatus”. The other products most exported by developed countries are, as expected, from the aerospace and pharmaceuticals categories and, one of them, from non electrical equipment. In developing group, all the top-10 most exported goods are included in electronics and telecommunications, computing and office equipment and scientific instruments, except for “inorganic chemical elements, oxides and halogen salts”.

Table 19 Top-10 high tech exports of developed and developing countries, 2001 and 2005 (US\$' 000)

Product	Developing		Product	Developed	
	2001	2005		2001	2005
Telecommunications equipment, n.e.s., and parts, n.e.s., and accessories of apparatus falling within groups 761, 762 and 763	42.521.096	100.600.439	Medicaments (including veterinary medicaments)	92.494.822	195.478.417
Automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machine	39.958.646	86.874.859	Telecommunications equipment, n.e.s., and parts, n.e.s., and accessories of apparatus falling within groups 761, 762 and 763	165.303.619	194.755.222
Electrical machinery and apparatus, n.e.s.	18.217.311	37.992.090	Aircraft and associated equipment; spacecraft (including satellites) and spacecraft launch vehicles; parts thereof	100.941.253	118.671.132
Sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media	8.857.918	26.281.014	Electrical machinery and apparatus, n.e.s.	71.656.947	108.762.949
Thermionic, cold cathode or photo-cathode valves and tubes (e.g., vacuum or vapour or gas-filled valves and tubes, mercury arc rectifying valves and tubes)	42.758.072	23.930.930	Measuring, checking, analysing and controlling instruments and apparatus, n.e.s.	66.428.579	98.324.185
Electrical apparatus for switching or protecting electrical circuits or for making connections to or in electrical circuits (e.g., switches, relays, fuses)	17.914.132	18.642.832	Medicinal and pharmaceutical products, other than medicaments of group 542	32.087.011	60.742.683
Miscellaneous manufactured articles, n.e.s.	7.506.504	13.059.013	Thermionic, cold cathode or photo-cathode valves and tubes (e.g., vacuum or vapour or gas-filled valves and tubes, mercury arc rectifying valves and tubes)	197.070.591	57.237.769
Optical instruments and apparatus, n.e.s.	1.139.941	12.148.690	Engines and motors, non-electric (other than those of groups 712, 713 and 718); parts, n.e.s., of these engines and motors	52.947.953	49.364.281
Measuring, checking, analysing and controlling instruments and apparatus, n.e.s.	6.024.929	11.866.468	Sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media	18.200.309	35.698.117
Inorganic chemical elements, oxides and halogen salts	5.411.198	10.510.953	Optical instruments and apparatus, n.e.s.	11.110.199	32.526.857
Total of the above tem items	190.311.748	341.909.293	Total of the above tem items	808.243.284	951.563.617
Total high tech exports	220.229.926	391.579.348	Total high tech exports	1.169.823.115	1.209.298.226
Percentage of the top 10 items to the total high tech exports	86,42%	87,32%	Percentage of the top 10 items to the total high tech exports	69,09%	78,69%

Source: Own elaboration based on COMTRADE database

The table also reveals that, except for “thermionic, cold cathode or photo-cathode valves and tubes” that have been losing weight in the high tech exports of both groups, in general

the other product show significant growth rates, especially in the developing group where the amounts in 2005 are more than double than in 2001.

Even considering that 60 percent of the most exported products from both groups are the same, the weight of the top-5 items in total high tech reveal that there is still considerable differences between groups. Developed countries show great level of specialization in industries fundamentally knowledge-based like pharmaceuticals and aerospace, while developing countries are essentially specialized in products that are more subject to the fragmentation of global value chains. In the next tables, this thematic is discussed by analysing the specialization in electronics, computing and scientific instruments.

In Table 20 it was calculated the share of each three digit group of products on the total exports of the respective category for each group of countries. By doing this it was possible to see that, within electronics and telecommunications, both developed and developing countries have been reacting almost the same way for each group of products and both are increasing its share of “telecommunications equipment and parts, and accessories of apparatus”. In general the export structure in this category does not differ significantly.

On the contrary, in terms of computing and office equipment, the specialization is completely different. Developing countries concentrate almost its total share (0.94) on “automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machine”, in opposition to developed countries that have a significant share in the group of “office machines” (0.34).

In what concerns scientific instruments, developed countries present a significant specialization in “measuring, checking, analysing and controlling instruments and apparatus” while the developing economies have been spreading its specialization between “optical instruments and apparatus”, “measuring, checking, analysing and controlling instruments and apparatus” and “miscellaneous manufactured articles”, from 2001 to 2005.

Table 20 - Specialization of developed and developing countries within electronics, computing and scientific instruments

Electronics and Telecommunications	Developing		Developed		Computing and office equipment	Developing		Developed		Scientific Instruments	Developing		Developed	
	2001	2005	2001	2005		2001	2005	2001	2005		2001	2005	2001	2005
Sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media	0,08	0,16	0,04	0,11	Office machines	0,06	0,06	0,07	0,34	Electrodiagnostic apparatus for medical, surgical, dental or veterinary purposes, and radiological apparatus	0,03	0,04	0,11	0,11
Telecommunications equipment, n.e.s., and parts, n.e.s., and accessories of apparatus falling within groups 761, 762 and 763	0,38	0,59	0,37	0,61	Automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machine	0,94	0,94	0,93	0,66	Optical instruments and apparatus, n.e.s.	0,06	0,27	0,08	0,14
Thermionic, cold cathode or photo-cathode valves and tubes (e.g., vacuum or vapour or gas-filled valves and tubes, mercury arc rectifying valves and tubes)	0,38	0,14	0,44	0,18						Measuring, checking, analysing and controlling instruments and apparatus, n.e.s.	0,30	0,26	0,47	0,43
Electrical apparatus for switching or protecting electrical circuits or for making connections to or in electrical circuits (e.g., switches, relays, fuses)	0,16	0,11	0,15	0,10						Photographic apparatus and equipment, n.e.s.	0,15	0,05	0,09	0,07
										Optical goods, n.e.s.	0,10	0,10	0,12	0,11
										Miscellaneous manufactured articles, n.e.s.	0,37	0,29	0,12	0,14
Total	1,00	1,00	1,00	1,00	Total	1,00	1,00	1,00	1,00	Total	1,00	1,00	1,00	1,00

Note: The ratio corresponds to the share of each three digit group of products on the total exports of the respective category for each group of countries:

$$R_{pg} = \frac{X_{pg}}{\sum X_{cg}}$$

where as p stands for the group of products at a three digit level, c for the total category of products in which p is integrated and g for the group of countries.

Source: Own elaboration based on COMTRADE database

Another form to check the degree of specialization in these categories was to rank the products in terms of exports value. See Table 21.

Table 21– Top high tech exports of developed and developing countries within electronics, computing and scientific instruments categories (US\$' 000)

Product	Developing		Product	Developed	
	2001	2005		2001	2005
Telecommunications equipment, n.e.s., and parts, n.e.s., and accessories of apparatus falling within groups 761, 762 and 763	42.521.096	100.600.439	Telecommunications equipment, n.e.s., and parts, n.e.s., and accessories of apparatus falling within groups 761, 762 and 763	165.303.619	194.755.222
Automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machine	39.958.646	86.874.859	Measuring, checking, analysing and controlling instruments and apparatus, n.e.s.	66.428.579	98.324.185
Sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media	8.857.918	26.281.014	Thermionic, cold cathode or photo-cathode valves and tubes (e.g., vacuum or vapour or gas-filled valves and tubes, mercury arc rectifying valves and tubes)	197.070.591	57.237.769
Thermionic, cold cathode or photo-cathode valves and tubes (e.g., vacuum or vapour or gas-filled valves and tubes, mercury arc rectifying valves and tubes)	42.758.072	23.930.930	Sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media	18.200.309	35.698.117
Electrical apparatus for switching or protecting electrical circuits or for making connections to or in electrical circuits (e.g., switches, relays, fuses)	17.914.132	18.642.832	Optical instruments and apparatus, n.e.s.	11.110.199	32.526.857
Miscellaneous manufactured articles, n.e.s.	7.506.504	13.059.013	Electrical apparatus for switching or protecting electrical circuits or for making connections to or in electrical circuits (e.g., switches, relays, fuses)	68.864.556	31.737.584
Optical instruments and apparatus, n.e.s.	1.139.941	12.148.690	Miscellaneous manufactured articles, n.e.s.	17.519.817	30.661.051
Measuring, checking, analysing and controlling instruments and apparatus, n.e.s.	6.024.929	11.866.468	Optical goods, n.e.s.	17.525.486	25.767.425
Office machines	2.730.004	5.380.208	Electrodiagnostic apparatus for medical, surgical, dental or veterinary purposes, and radiological apparatus	15.138.904	24.129.084
Optical goods, n.e.s.	2.007.897	4.627.570	Automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machine	144.234.291	18.743.298
Photographic apparatus and equipment, n.e.s.	2.985.681	2.052.749	Photographic apparatus and equipment, n.e.s.	13.131.144	14.725.166
Electrodiagnostic apparatus for medical, surgical, dental or veterinary purposes, and radiological apparatus	615.645	1.591.373	Office machines	10.882.270	9.606.364
Total of the top 5 items	152.009.864	256.330.074	Total of the top 5 items	458.113.297	418.542.150
Total high tech exports	220.229.926	391.579.348	Total high tech exports	1.169.823.115	1.209.298.226
Percentage of the top 5 items to the to total high tech exports	69,02%	65,46%	Percentage of the top 5 items to the to total high tech exports	39,16%	34,61%
Percentage of the above items to the to total high tech exports	79,47%	78,41%	Percentage of the above items to the to total high tech exports	63,72%	47,46%

Source: Own elaboration based on COMTRADE database

Within the three main categories of exports concentration, it can be verified three of the top-5 groups are the same in both categories of countries – “telecommunications equipment and parts and accessories of apparatus”; “sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media” and “thermionic, cold cathode or photo-cathode valves and tubes”. However, while developed countries are also specializing in scientific instruments, developing countries concentrate the top-5 items in electronics, telecommunications and computing.

In addition the top-5 high tech exports in these three categories represent more than 65 percent of its total high tech exports in developing countries whereas, in developed countries, the share is about 35 percent, since they have a less concentrated export structure.

The analysis of export specialization would need further statistical details to be more precise. However, the data in this work permitted to observe that considerable differences among groups exist, even that some of the most exported groups are the same. Not only developing countries are considerable dependent of just five types of products in terms of high tech exports, as all these products are from electronics, telecommunications and computing categories very affected by global fragmentation. Developed countries, despite the importance of electronics and telecommunications, have a much less concentrated high tech export structure being specialized in areas like pharmaceuticals and aerospace. In sum, the findings cannot sustain evidence that developing countries are real exporters of high technology and eliminate the statistical *artifact* hypothesis.

4.2. Patenting Recording of Developing Countries

Patent statistics provide a measure of innovation output, as they reflect the inventive performance of countries, regions, technologies or firms. They are also used to track the level of diffusion of knowledge across technology areas or can serve to measure the output of R&D, its productivity, structure and the development of a specific technology/industry (DSTI, OECD, 2007).

Mani (2000) evaluated the innovative performance of some developing countries by examining the trends in the number of patents granted to researchers from a country in the US, between 1985 and 1998. The same exercise was done for the period 1998-2005.

By the time the author's study was developed, Korea and Taiwan were the developing countries with the best performance in patenting activity. It was even expected that, in the future, those countries surpass UK. Well, not just the two countries surpassed UK, as they became advanced economies.

China and Singapore were the countries with the fastest growth in US patents. In fact, these economies continued to show high growth rates in patenting. China has four times more US patents, in 2005, than it had in 1998 and Singapore three times more.

In what concerns the new group of developing countries, except for China, India and Brazil (in a smaller scale), there are no countries with relevant patenting activity (Table 22). Mexico, Malaysia and Hungary show an increasing trend, but with less expression and Philippines and Thailand have a very small number of total patents.

Through Table 22 it can be observed that there is a generalised decreasing in the patent number, in 2005, which match with the general decreasing of the high tech exports previously found.

Table 22– U.S. patent activity by country¹⁸ and grant year, 1998-2005

Country	1998	1999	2000	2001	2002	2003	2004	2005
Australia	720	707	705	876	859	902	953	910
Brazil	74	91	98	110	96	130	106	77
China	72	90	119	195	289	297	404	402
Korea	3259	3562	3314	3538	3786	3944	4428	4352
Germany	9095	9337	10235	11260	11280	11444	10779	9011
Hong Kong	160	155	179	237	233	276	311	283
Hungary	50	39	36	60	48	72	48	46
India	85	112	131	178	249	342	363	384
Ireland	71	90	121	141	127	163	186	156
Israel	754	743	783	970	1040	1193	1028	924
Japan	30840	31104	31295	33223	34858	35515	35348	30341
Malaysia	23	30	42	39	55	50	80	88
Mexico	57	76	76	81	94	85	86	80
Philippines	8	11	2	12	14	22	21	18
Singapore	120	144	218	296	410	427	449	346
Switzerland	1279	1279	1322	1420	1364	1308	1277	995
Taiwan	3100	3693	4667	5371	5431	5298	5938	5118
Thailand	13	20	15	24	44	25	18	16
UK	3467	3576	3669	3967	3843	3631	3450	3148
USA	80289	83905	85068	87600	86971	87892	84271	74637

Source: USPTO Web Site

Despite no correspondence between US patents and SITC has been found to clearly define the high tech patents, patents in high tech areas were identified in the three countries with more significant patenting activity mentioned above, with more emphasis in China and India (Table 23). Although the classes with the highest number of patents are not in the three areas that have the bigger share in the exports structure of high tech products from developing countries, especially in the cases of China and Brazil.

¹⁸ Patent origin is determined by the residence of the first-named inventor.

Table 23 – Top 15 most emphasized US patent classes for inventors from China, India and Brazil

China	Cumulative number of patents 2001-2005	India	Cumulative number of patents 2001-2005	Brazil	Cumulative number of patents 2001-2005
Electrical Connectors	269	Organic Compounds (includes Classes 532-570)	308	Refrigeration	30
Drug, Bio-Affecting and Body Treating Compositions (includes Class 514)	106	Drug, Bio-Affecting and Body Treating Compositions (includes Class 514)	264	Drug, Bio-Affecting and Body Treating Compositions (includes Class 514)	19
Electricity: Electrical Systems and Devices	52	Chemistry: Molecular Biology and Microbiology	106	Pumps	18
Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making	36	Synthetic Resins or Natural Rubbers (includes Classes 520-528)	53	Wells (shafts or deep borings in the earth, e.g., for oil and gas)	13
Organic Compounds (includes Classes 532-570)	28	Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems	35	Organic Compounds (includes Classes 532-570)	13
Chemistry: Molecular Biology and Microbiology	28	DP: Database and File Management or Data Structures (Data Processing)	30	Fluid Handling	12
Synthetic Resins or Natural Rubbers (includes Classes 520-528)	27	Chemistry of Inorganic Compounds	29	Receptacles	11
Active Solid-State Devices (e.g., Transistors, Solid-State Diodes)	23	Coded Data Generation or Conversion	29	Surgery (Medicators and Receptors)	11
Image Analysis	21	Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making	26	Chemistry: Molecular Biology and Microbiology	10
Pulse or Digital Communications	21	Multicomputer Data Transferring (Electrical Computers and Digital Processing Systems)	25	Joints and Connections	10
Refrigeration	20	DP: Measuring, Calibrating, or Testing (Data Processing)	24	Optics: Systems and Elements	9
Electric Heating	19	Electronic Digital Logic Circuitry	18	Paper Making and Fiber Liberation	9
Illumination	18	Multiplex Communications	18	Synthetic Resins or Natural Rubbers (includes Classes 520-528)	8
Optical Waveguides	18	Food or Edible Material: Processes, Compositions, and Products	17	Electrical Generator or Motor Structure	8
Miscellaneous Active Electrical Nonlinear Devices, Circuits, and Systems	17	Computer Graphics Processing and Selective Visual Display Systems	16	Prosthesis (i.e., Artificial Body Members), Parts Thereof, or Aids and Accessories Therefor	8
Cumulative total for the above 15 categories	703	Cumulative total for the above 15 categories	998	Cumulative total for the above 15 categories	189
Cumulative total for all patent classes	1587	Cumulative total for all patent classes	1516	Cumulative total for all patent classes	519

Source: USPTO Web Site

In general, the analysis on patenting activity does not support the development of strong local capabilities in developing countries. Even the countries that presented the highest levels of technological intensity (Philippines, Malaysia, Hungary and Mexico) show very little patenting activity with minor improvements. Only China and India seems to have registered considerable progress over the period.

4.3. Indicators of High Tech Competitiveness

The four indicators developed by TPAC, and that were included in Mani's analysis, are defined as follows (Porter et al, 2008):

- National Orientation (NO): evidence that a nation is undertaking directed action to achieve technological competitiveness. Such action can be manifested at the business, government, or cultural levels, or any combination of the three;
- Socioeconomic Infrastructure (SE): the social and economic institutions that support and maintain the physical, human, organizational and economic resources essential to the functioning of a modern, technology-based industrial nation;
- Technological Infrastructure (TI): institutions and resources that contribute directly to a nation's capacity to develop produce and market new technology. Central to the concept are the ideas of economic investment and social support for technology absorption and utilization. These could take the forms of monetary payments, laws and regulations, and social institutions. Also included is the physical and human capital in place to develop, produce and market new technology;
- Productive Capacity (PC): the physical and human resources devoted to manufacturing products, and the efficiency with which those resources are used.

The results presented in Table 24 were extracted from the "High Tech Indicators Technology-based Competitiveness of 33 Nations 2007 Report" (Porter e tal, 2008). For this analysis it were considered the indicators reported for the sample of developing countries and those for the US and Japan as for comparative purposes.

Table 24 – Indicators of Technological Competitiveness, 2005 and 2007

Country	NO 05	NO 07	SE 05	SE 07	TI 05	TI 07	PC 05	PC 07
Brazil	59,9	55,1	51,3	50,3	36,9	36,6	49,3	46,5
Venezuela	36,5	33,5	47,8	40,6	27,2	22,5	38,5	32,2
China	74,3	62,6	60,4	61,2	64,7	60,0	72,4	85,2
Hungary	61,7	57,1	66,2	67	40,5	36,9	51,4	52,5
Poland	61,8	65,1	65,6	71,3	34,1	35,4	54,5	52,3
India	61,6	64,6	52,8	55,1	43,2	44,4	59,9	63,1
Indonesia	44,2	54,9	40,8	48,5	24,1	30,7	41,1	46,5
Malaysia	75,4	76,0	70,4	67,9	31,4	31,9	51,5	58,3
Mexico	55,1	59,0	48,7	50,7	30,4	34,5	45,8	53,4
Philippines	53,2	54,7	52,9	54,9	31,1	25,2	52,2	47,1
Thailand	58,7	63,7	53,2	61,1	25	25,9	42,5	43,4
Russia	42,0	57,7	59,2	65,4	43,9	47,8	45,1	49,9
South Africa	50,6	55,2	52,8	54,3	36,5	37,7	41,3	40,3
Japan	70,3	75,7	65,5	71,2	71,1	68,8	88,9	87,2
USA	79,2	78	84,2	87,9	91,9	95,5	88,7	93,4

Source: Porter et al, 2008

In terms of national orientation to technological sectors (NO) the results are, in general, considerable under those registered for the US and Japan, apart from Malaysia that had scores above Japan in both years. China had a high score as well in 2005, but declined significantly between 2005 and 2007. There, however, a general trend of improvement in this indicator.

Regarding the socioeconomic infrastructures (SE), the indicators also reveal significantly lower levels than those registered for Japan and the US. Only Malaysia, Hungary and Poland outperformed Japan in 2005 and Poland in 2007. As for previous indicator it is observed a general slight improvement.

In what concerns technological infrastructure (TI), there is a great ascendancy of China since 1995 (year analysed by Mani), although it dipped from 2005 to 2007. Yet, apart from China, all the other countries achieved very low scores in this indicator and there is even a general decreasing trend, evidencing that there are still a lot of necessary developments in the institutions and resources that contribute to a nation's capacity to develop, produce and market new technology.

Finally, in productive capacity (PC), China has leapt from a low 33.2, in 1995, to 85.2, in 2007, standing very near Japan in terms of the physical and human resources devoted to manufacturing products and the efficiency with which those resources are used. The rest of other countries are still very far from the levels achieved by the US and Japan.

4.4. Summary

The obtained results in this chapter did not eliminate the statistical *artifact* hypothesis.

By examining product specialization significant differences between groups could be observed. High tech exports from developing countries revealed to be most dependent on electronics, telecommunications and computing, much opened areas to the global fragmentation of value chains. Developed countries, on the other hand, have a more diversified specialization with great significance of the areas of pharmaceuticals and aerospace.

In terms of patenting activity, apart from China and India, no other country present significant improvements, what can reveal low levels of local innovation activity.

The analysis of competitiveness indicators demonstrated that developing countries have still a long way to trace in necessary areas to support technological activity, but especially in what concerns technological infrastructures and productive capacity. Only China revealed better and more consistent results.

5. Conclusions

The purpose of this work was to test the hypothesis that to consider developing countries as high tech exporters may be just the result of a statistical *artifact*, by taking a new look into the data. To accomplish the objectives, and in order to get an evolutionary perspective of the exports dynamics from developing countries, it was applied the methodology developed by Mani (2000) to the most recent available data regarding exports of high technology products, despite the lack of further disaggregation in the statistics. As discussed next, we could not reject the statistical *artifact* hypothesis.

The research allowed the conclusion that developing countries continue to improve its competitiveness in terms of the (1) manufacturing exports in general and (2) regarding high-tech exports in particular, clearly catching-up developed economies. The recovery in high tech is clearly evident when looking at the share and ratio of developing countries in high tech exports, and at the RCA indices. Regarding high tech exports, developing countries reveal to be catching-up mainly in computing and office equipment as well as electronics and telecommunications. Along with the growth of high tech exports we concluded that (3) developing countries are also importing high tech in great scale. Indeed, all developing countries except China had, in 2005, a negative net export ratio of high tech products. In this regard, one must highlight that many developed economies are also net importers of high technology.

A fourth conclusion from our analysis relies on (4) the heterogeneity among developing economies. Recall here that among developed economies there is also asymmetries in trade performance, but diversity within developing countries is considerable greater. We observed that high tech exports from developing countries is concentrated in a reduced number of countries. Moreover, only a handful number of developing countries show a level of technological content. It could be verified that China, Hungary, Malaysia and Mexico not only registered great improvement in their total exports of high tech exports, as, simultaneously, revealed high levels of technological content of their total manufactures exports and RCA indices sometimes above the average RCA of developed economies. Also Thailand, India and Brazil demonstrate relevant performance in high tech sector in terms of the total amount of this type of exports, but with less emphasis in respect to the correspondent technological content and comparative advantage.

Finally, from our results we cannot deny or contest fully the statistical *artifact* hypothesis. In terms of export specialization, we obtained considerable differences between developed and developing countries, even if some of the dominant exported products are the same. Not only developing countries are considerable dependent of just five types of products in terms of high tech exports, as all these products are from electronics, telecommunications and computing categories very affected by global fragmentation. Developed countries, despite the importance of electronics and telecommunications, have a much less concentrated high tech export structure being specialized in areas like pharmaceuticals and aerospace. The analysis of patenting activity did not support the idea of strong local capabilities in developing countries. Even the countries that presented the highest levels of technological intensity (Philippines, Malaysia, Hungary and Mexico) show very little patenting activity and minor improvements. Only China and India seems to have registered considerable progress over the period. The analysis based on the competitiveness indicators confirms that developing countries do have a long way to go, especially in what concerns technological infrastructures and productive capacity. Only China revealed better and more consistent results.

Our contribution relies mainly on the data and empirical analysis. There are also a few considerations to be included in future analysis in our line of work. First, future studies could try to investigate if developing countries are attracting manufacturing-based fragments of global production networks, while technology-intensive activities remain concentrated in developed countries, as Srholec (2007) argued. In our analysis we could not go so deep.

We revealed considerable differences among developing economies, and future studies may focus in some of them. China, India, Mexico, Malaysia or Hungary, do seem to be developing local skills. The remaining developing countries have a long way to trace. Even Philippines and Thailand that appeared to be very promising economies in the 1990's, do not seem to have developed their technological capabilities substantially.

While developed economies are deeply concerned with the competition emerging from these economies, developed countries must emphasize the development of internal skills. The challenges are clearly different among them.

References

- Akyüz, Y. (2004) Developing Countries in World Trade. Turkish Economic Association, Discussion Paper 2004/9.
- Bastos, Paulo and Manuel Cabral (2007) The dynamics of International trade Patterns. Forthcoming Review of World Economics, volume 143, Number 2/July 2007.
- Borbély D. (2004) EU Export Specialization Patterns of Selected Accession Countries. European Institute for International Economic Relations, EIIW Discussion Paper No. 116.
- Cabral, H. (2008) Export Diversification and Technological Improvement: Recent Trends in the Portuguese Economy. GEE Papers 0006, Gabinete de Estratégia e Estudos, Ministério da Economia e da Inovação, revised Apr 2008.
- Crespo Cuaresma, J. and Wörza, J. (2005) On Export Composition and Growth. Review of World Economics, Springer, 127:1, 33-49, April.
- Directorate for Science, Technology and Industry (2007) Nowcasting Patent Indicators, STI Working Paper 2007/3 Statistical Analysis of Science, Technology and Industry. Available on <<http://www.oecd.org/dataoecd/0/20/39485567.pdf>>. (Consulted on 25/03/2008).
- Heijs, J. y Estrada S. (2006): “Technological Behaviour and Export Probability in Developing Countries: the Case of Mexico”. Science, Technology & Society. Volume 11 number 2 (July - Dec) 2006
- Fagerberg, J., Knell, M. and Srholec, M. (2007) The Competitiveness of Nations: Why Some Countries Prosper While Others Fall Behind. World Development, Vol. 35 No 10 pp 1595-1620.
- Feenstra, R.C. and Rose, A.K. (2000) Putting things in order: trade dynamics and product cycles. Review of Economics and Statistics 82 3.
- Fertő, I and Hubbard, L.J. (2003) Revealed Comparative Advantage and Competitiveness in Hungarian Agri-Food Sectors. World Economy 26 (2).
- Godin, B (2004) The Obsession for Competitiveness and Its Impact on Statistics: The Construction of High-Technology Indicators. Canadian Science and Innovation Indicators Consortium.

- Hatzichronoglou, T. (1997) Revision of the High-technology Sector and Product Classification. Paris, OECD, STI Working Paper 1997/2.
- Hausmann, R.; Hwang, J. and Rodrik, D. (2005) What You Export Matters. NBER Working Paper, n° 11905.
- Huang, C., Zhang, M, Zhao, Y. and Amorim Varum, C. (2008) Determinants of Exports in China: A Microeconomic Analysis. European Journal of Development Research (forthcoming).
- International Trade Centre. (Online). Available on <<http://www.intracen.org/tradstat/sitc3-3d/indexpe.htm>>. (Consulted on 16/12/2007).
- Kravis, I. and Lipsey, R. (1992) Technological Characteristics of Industries and the Competitiveness of the U.S. and its Multinational Firms, NBER Working Papers 2933, National Bureau of Economic Research, Inc
- Lall, S. (2000) The technological structure and performance of developing country manufactured exports, 1985–98. Oxford Development Studies, 28, pp. 337–369.
- Mani, S. (2000) Exports of High Technology Products from Developing Countries: Is It a Real or Statistical Artifact? Maastricht, INTECH, Discussion Paper No. 2000-1.
- Meri T. (2008) Statistics in Focus, Science and Technology, 7/2008. Available on <http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-08-007/EN/KS-SF-08-007-EN.PDF>. (Consulted on 28/04/2008).
- OECD (2005) OECD finds that China is biggest exporter of Information Technology Goods in 2004, surpassing US and EU. Available on <http://www.oecd.org/document/8/0,3343,fr_2649_201185_35833096_1_1_1_1,00.html>. (Consulted on 12/01/2008).
- OCDE (2005) Stan Indicators database. (Online). Available on <<http://www.oecd.org/>>. (Consulted on 17/01/2006).
- OECD (2007) OECD Science, Technology and Industry Scoreboard 2007. Available on <<http://fiordiliji.sourceoecd.org/pdf/sti2007/922007081e1-e-7.pdf>>. (Consulted on 29/04/2008).
- Porter, A., Newman, N., Jin, X., Johnson, D. and Roessner, J. (2008) High Tech Indicators. Technology-based Competitiveness of 33 Nations. 2007 Report.

Available on

http://www.aimbe.org/assets/library/407_hti2007reportnsf012208.pdf.

(Consulted on 15/03/2008).

- Redding, S. (1999) Dynamic Comparative Advantage and the Welfare Effects of Trade, Oxford Economic Papers, Oxford University Press, vol. 51(1), pages 15-39, January.
- Rodrik, D. (2006) What's so Special About China Exports?. CEPR Discussion paper n° 5484, February.
- Srholec, M. (2007) High-tech Exports from Developing Countries: A Symptom of Technology Spurts or Statistical Illusion? Review of World Economics, 143, 227-255
- USPTO. (Online). Available on <http://www.uspto.gov/web/offices/ac/ido/oeip/taf/tafp.html>. (Consulted on 13/03/2008).
- Utkulu U, and Seymen D (2004) Revealed Comparative Advantage and Competitiveness: Evidence for Turkey vis-à-vis the EU/15. In Eur. TradeStudy Group 6th Annu. Conf. Nottingham, UK.
- World Bank Home Page. (Online). Available on <http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html>. (Consulted on 28/11/2007).
- World Trade Organization (2005) World Trade 2004, Prospects for 2005 Developing countries' goods trade share surges to 50-year peak. Available on http://www.wto.org/english/news_e/pres05_e/pr401_e.htm. (Consulted on 28/04/2008).
- World Trade Organization (2006). World trade developments in 2005 and prospects for 2006 Available on http://www.wto.org/english/res_e/statis_e/its2006_e/its06_general_overview_e.pdf. (Consulted on 23/05/2008).

List of Products - SITC, Revision 3

Codes (3 Digit)	Description
001	- Live animals except fish
011	- Meat of bovine animals, fresh, chilled or frozen
012	- Other meat and edible meat offal, fresh, chilled or frozen (except meat and meat offal unfit or unsuitable for human consumption)
016	- Meat and edible meat offal, salted, in brine, dried or smoked; edible flours and meals of meat or meat offal
017	- Meat and edible meat offal, prepared or preserved, n.e.s.
022	- Milk and cream and milk products other than butter or cheese
023	- Butter and other fats and oils derived from milk
024	- Cheese and curd
025	- Eggs, birds', and egg yolks, fresh, dried or otherwise preserved, sweetened or not; egg albumin
034	- Fish, fresh (live or dead), chilled or frozen
035	- Fish, dried, salted or in brine; smoked fish (whether or not cooked before or during the smoking process); flours, meals and pellets of fish, fit for human
036	- Crustaceans, molluscs and aquatic invertebrates, whether in shell or not, fresh (live or dead), chilled, frozen, dried, salted or in brine; crustaceans, in
037	- Fish, crustaceans, molluscs and other aquatic invertebrates, prepared or preserved, n.e.s.
041	- Wheat (including spelt) and meslin, unmilled
042	- Rice
043	- Barley, unmilled
044	- Maize (not including sweet corn), unmilled
045	- Cereals, unmilled (other than wheat, rice, barley and maize)
046	- Meal and flour of wheat and flour of meslin
047	- Other cereal meals and flours
048	- Cereal preparations and preparations of flour or starch of fruits or vegetables
054	- Vegetables, fresh, chilled, frozen or simply preserved (including dried leguminous vegetables); roots, tubers and other edible vegetable products, n.e.s.,
056	- Vegetables, roots and tubers, prepared or preserved, n.e.s.
057	- Fruit and nuts (not including oil nuts), fresh or dried
058	- Fruit, preserved, and fruit preparations (excluding fruit juices)
059	- Fruit juices (including grape must) and vegetable juices, unfermented and not containing added spirit, whether or not containing added sugar or other sweet
061	- Sugars, molasses and honey
062	- Sugar confectionery
071	- Coffee and coffee substitutes
072	- Cocoa
073	- Chocolate and other food preparations containing cocoa, n.e.s.
074	- Tea and maté
075	- Spices
081	- Feeding stuff for animals (not including unmilled cereals)
091	- Margarine and shortening
098	- Edible products and preparations, n.e.s.
111	- Non-alcoholic beverages, n.e.s.
112	- Alcoholic beverages
121	- Tobacco, unmanufactured; tobacco refuse
122	- Tobacco, manufactured (whether or not containing tobacco substitutes)
211	- Hides and skins (except furskins), raw
212	- Furskins, raw (including heads, tails, paws and other pieces or cuttings, suitable for furriers' use), other than hides and skins of group 211
222	- Oil-seeds and oleaginous fruits of a kind used for the extraction of soft fixed vegetable oils (excluding flours and meals)
223	- Oil-seeds and oleaginous fruits, whole or broken, of a kind used for the extraction of other fixed vegetable oils (including flours and meals of oil-seeds)
231	- Natural rubber, balata, gutta-percha, guayule, chicle and similar natural gums, in primary forms (including latex) or in plates, sheets or strip
232	- Synthetic rubber; reclaimed rubber; waste, parings and scrap of unhardened rubber
244	- Cork, natural, raw and waste (including natural cork in blocks or sheets)

List of Products - SITC, Revision 3

Codes (3 Digit)	Description
245	- Fuel wood (excluding wood waste) and wood charcoal
246	- Wood in chips or particles and wood waste
247	- Wood in the rough or roughly squared
248	- Wood, simply worked, and railway sleepers of wood
251	- Pulp and waste paper
261	- Silk
263	- Cotton
264	- Jute and other textile bast fibres, n.e.s., raw or processed but not spun; tow and waste of these fibres (including yarn waste and garnetted stock)
265	- Vegetable textile fibres (other than cotton and jute), raw or processed but not spun; waste of these fibres
266	- Synthetic fibres suitable for spinning
267	- Other man-made fibres suitable for spinning; waste of man-made fibres
268	- Wool and other animal hair (including wool tops)
269	- Worn clothing and other worn textile articles; rags
272	- Fertilizers, crude
273	- Stone, sand and gravel
274	- Sulphur and unroasted iron pyrites
277	- Natural abrasives, n.e.s. (including industrial diamonds)
278	- Other crude minerals
281	- Iron ore and concentrates
282	- Ferrous waste and scrap; remelting scrap ingots of iron or steel
283	- Copper ores and concentrates; copper mattes; cement copper
284	- Nickel ores and concentrates; nickel mattes, nickel oxide sinters and other intermediate products of nickel metallurgy
285	- Aluminium ores and concentrates (including alumina)
286	- Uranium or thorium ores and concentrates
287	- Ores and concentrates of base metals, n.e.s.
288	- Non-ferrous base metal waste and scrap, n.e.s.
289	- Ores and concentrates of precious metals; waste, scrap and sweepings of precious metals (other than of gold)
291	- Crude animal materials, n.e.s.
292	- Crude vegetable materials, n.e.s.
321	- Coal, whether or not pulverized, but not agglomerated
322	- Briquettes, lignite and peat
325	- Coke and semi-coke (including char) of coal, of lignite or of peat, whether or not agglomerated; retort carbon
333	- Petroleum oils and oils obtained from bituminous minerals, crude
334	- Petroleum oils and oils obtained from bituminous minerals (other than crude); preparations, n.e.s., containing by weight 70% or more of petroleum oils or o
335	- Residual petroleum products, n.e.s., and related materials
342	- Liquefied propane and butane
343	- Natural gas, whether or not liquefied
344	- Petroleum gases and other gaseous hydrocarbons, n.e.s.
345	- Coal gas, water gas, producer gas and similar gases, other than petroleum gases and other gaseous hydrocarbons
351	- Electric current
411	- Animal oils and fats
421	- Fixed vegetable fats and oils, soft, crude, refined or fractionated
422	- Fixed vegetable fats and oils, crude, refined or fractionated, other than soft
431	- Animal or vegetable fats and oils, processed; waxes; inedible mixtures or preparations of animal or vegetable fats or oils, n.e.s.
511	- Hydrocarbons, n.e.s., and their halogenated, sulphonated, nitrated or nitrosated derivatives
512	- Alcohols, phenols, phenol-alcohols, and their halogenated, sulphonated, nitrated or nitrosated derivatives
513	- Carboxylic acids and their anhydrides, halides, peroxides and peroxyacids; their halogenated, sulphonated, nitrated or nitrosated derivatives
514	- Nitrogen-function compounds
515	- Organo-inorganic compounds, heterocyclic compounds, nucleic acids and their salts, and sulphonamides
516	- Other organic chemicals
522	- Inorganic chemical elements, oxides and halogen salts

List of Products - SITC, Revision 3

Codes (3 Digit)	Description
523	- Metal salts and peroxysalts, of inorganic acids
524	- Other inorganic chemicals; organic and inorganic compounds of precious metals
525	- Radioactive and associated materials
531	- Synthetic organic colouring matter and colour lakes, and preparations based thereon
532	- Dyeing and tanning extracts, and synthetic tanning materials
533	- Pigments, paints, varnishes and related materials
541	- Medicinal and pharmaceutical products, other than medicaments of group 542
542	- Medicaments (including veterinary medicaments)
551	- Essential oils, perfume and flavour materials
553	- Perfumery, cosmetic or toilet preparations (excluding soaps)
554	- Soap, cleansing and polishing preparations
562	- Fertilizers, manufactured
571	- Polymers of ethylene, in primary forms
572	- Polymers of styrene, in primary forms
573	- Polymers of vinyl chloride or of other halogenated olefins, in primary forms
574	- Polyacetals, other polyethers and epoxide resins, in primary forms; polycarbonates, alkyd resins, polyallyl esters and other polyesters, in primary forms
575	- Other plastics, in primary forms
579	- Waste, parings and scrap, of plastics
581	- Tubes, pipes and hoses, and fittings therefor, of plastics
582	- Plates, sheets, film, foil and strip, of plastics
583	- Monofilament of which any cross-sectional dimension exceeds 1 mm, rods, sticks and profile shapes, whether or not surface-worked but not otherwise worked,
591	- Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up in form
592	- Starches, inulin and wheat gluten; albuminoidal substances; glues
593	- Explosives and pyrotechnic products
597	- Prepared additives for mineral oils and the like; prepared liquids for hydraulic transmission; anti-freezing preparations and prepared de-icing fluids; lub
598	- Miscellaneous chemical products, n.e.s.
611	- Leather
612	- Manufactures of leather or of composition leather, n.e.s.; saddlery and harness
613	- Furskins, tanned or dressed (including heads, tails, paws and other pieces or cuttings), unassembled, or assembled (without the addition of other materials)
621	- Materials of rubber (e.g., pastes, plates, sheets, rods, thread, tubes, of rubber)
625	- Rubber tyres, interchangeable tyre treads, tyre flaps and inner tubes for wheels of all kinds
629	- Articles of rubber, n.e.s.
633	- Cork manufactures
634	- Veneers, plywood, particle board, and other wood, worked, n.e.s.
635	- Wood manufactures, n.e.s.
641	- Paper and paperboard
642	- Paper and paperboard, cut to size or shape, and articles of paper or paperboard
651	- Textile yarn
652	- Cotton fabrics, woven (not including narrow or special fabrics)
653	- Fabrics, woven, of man-made textile materials (not including narrow or special fabrics)
654	- Other textile fabrics, woven
655	- Knitted or crocheted fabrics (including tubular knit fabrics, n.e.s., pile fabrics and openwork fabrics), n.e.s.
656	- Tullies, lace, embroidery, ribbons, trimmings and other smallwares
657	- Special yarns, special textile fabrics and related products
658	- Made-up articles, wholly or chiefly of textile materials, n.e.s.
659	- Floor coverings, etc.
661	- Lime, cement, and fabricated construction materials (except glass and clay materials)
662	- Clay construction materials and refractory construction materials
663	- Mineral manufactures, n.e.s.
664	- Glass

List of Products - SITC, Revision 3

Codes (3 Digit)	Description
665	- Glassware
666	- Pottery
667	- Pearls and precious or semiprecious stones, unworked or worked
671	- Pig-iron, spiegeleisen, sponge iron, iron or steel granules and powders and ferro-alloys
672	- Ingots and other primary forms, of iron or steel; semi-finished products of iron or steel
673	- Flat-rolled products of iron or non-alloy steel, not clad, plated or coated
674	- Flat-rolled products of iron or non-alloy steel, clad, plated or coated
675	- Flat-rolled products of alloy steel
676	- Iron and steel bars, rods, angles, shapes and sections (including sheet piling)
677	- Rails or railway track construction material, of iron or steel
678	- Wire of iron or steel
679	- Tubes, pipes and hollow profiles, and tube or pipe fittings, of iron or steel
681	- Silver, platinum and other metals of the platinum group
682	- Copper
683	- Nickel
684	- Aluminium
685	- Lead
686	- Zinc
687	- Tin
689	- Miscellaneous non-ferrous base metals employed in metallurgy, and cermets
691	- Structures and parts of structures, n.e.s., of iron, steel or aluminium
692	- Metal containers for storage or transport
693	- Wire products (excluding insulated electrical wiring) and fencing grills
694	- Nails, screws, nuts, bolts, rivets and the like, of iron, steel, copper or aluminium
695	- Tools for use in the hand or in machines
696	- Cutlery
697	- Household equipment of base metal, n.e.s.
699	- Manufactures of base metal, n.e.s.
711	- Steam or other vapour-generating boilers, superheated water boilers, and auxiliary plant for use therewith; parts thereof
712	- Steam turbines and other vapour turbines, and parts thereof, n.e.s.
713	- Internal combustion piston engines, and parts thereof, n.e.s.
714	- Engines and motors, non-electric (other than those of groups 712, 713 and 718); parts, n.e.s., of these engines and motors
716	- Rotating electric plant, and parts thereof, n.e.s.
718	- Power-generating machinery, and parts thereof, n.e.s.
721	- Agricultural machinery (excluding tractors), and parts thereof
722	- Tractors (other than those of headings 744.14 and 744.15)
723	- Civil engineering and contractors' plant and equipment; parts thereof
724	- Textile and leather machinery, and parts thereof, n.e.s.
725	- Paper mill and pulp mill machinery, paper-cutting machines and other machinery for the manufacture of paper articles; parts thereof
726	- Printing and bookbinding machinery, and parts thereof
727	- Food-processing machines (excluding domestic); parts thereof
728	- Other machinery and equipment specialized for particular industries; parts thereof, n.e.s.
731	- Machine tools working by removing metal or other material
733	- Machine tools for working metal, sintered metal carbides or cermets, without removing material
735	- Parts, n.e.s., and accessories suitable for use solely or principally with the machines falling within groups 731 and 733 (including work or tool holders,
737	- Metalworking machinery (other than machine tools), and parts thereof, n.e.s.
741	- Heating and cooling equipment, and parts thereof, n.e.s.
742	- Pumps for liquids, whether or not fitted with a measuring device; liquid elevators; parts for such pumps and liquid elevators
743	- Pumps (other than pumps for liquids), air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with
744	- Mechanical handling equipment, and parts thereof, n.e.s.

List of Products - SITC, Revision 3

Codes (3 Digit)	Description
745	- Non-electrical machinery, tools and mechanical apparatus, and parts thereof, n.e.s.
746	- Ball- or roller bearings
747	- Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, including pressure-reducing valves and thermostatically contr
748	- Transmission shafts (including camshafts and crankshafts) and cranks; bearing housings and plain shaft bearings; gears and gearing; ball screws; gearboxes
749	- Non-electric parts and accessories of machinery, n.e.s.
751	- Office machines
752	- Automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machine
759	- Parts and accessories (other than covers, carrying cases and the like) suitable for use solely or principally with machines falling within groups 751 and 7
761	- Television receivers (including video monitors and video projectors), whether or not incorporating radio-broadcast receivers or sound- or video-recording o
762	- Radio-broadcast receivers, whether or not incorporating sound-recording or reproducing apparatus or a clock
763	- Sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media
764	- Telecommunications equipment, n.e.s., and parts, n.e.s., and accessories of apparatus falling within groups 761, 762 and 763
771	- Electric power machinery (other than rotating electric plant of group 716), and parts thereof
772	- Electrical apparatus for switching or protecting electrical circuits or for making connections to or in electrical circuits (e.g., switches, relays, fuses,
773	- Equipment for distributing electricity, n.e.s.
774	- Electrodiagnostic apparatus for medical, surgical, dental or veterinary purposes, and radiological apparatus
775	- Household-type electrical and non-electrical equipment, n.e.s.
776	- Thermionic, cold cathode or photo-cathode valves and tubes (e.g., vacuum or vapour or gas-filled valves and tubes, mercury arc rectifying valves and tubes,
778	- Electrical machinery and apparatus, n.e.s.
781	- Motor cars and other motor vehicles principally designed for the transport of persons (other than motor vehicles for the transport of ten or more persons,
782	- Motor vehicles for the transport of goods and special-purpose motor vehicles
783	- Road motor vehicles, n.e.s.
784	- Parts and accessories of the motor vehicles of groups 722, 781, 782 and 783
785	- Motor cycles (including mopeds) and cycles, motorized and non-motorized; invalid carriages
786	- Trailers and semi-trailers; other vehicles, not mechanically-propelled; specially designed and equipped transport containers
791	- Railway vehicles (including hovertrains) and associated equipment
792	- Aircraft and associated equipment; spacecraft (including satellites) and spacecraft launch vehicles; parts thereof
793	- Ships, boats (including hovercraft) and floating structures
811	- Prefabricated buildings
812	- Sanitary, plumbing and heating fixtures and fittings, n.e.s.
813	- Lighting fixtures and fittings, n.e.s.
821	- Furniture and parts thereof; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings
831	- Trunks, suitcases, vanity cases, executive cases, briefcases, school satchels, binocular cases, camera cases, musical instrument cases, spectacle cases, gu
841	- Men's or boys' coats, capes, jackets, suits, blazers, trousers, shorts, shirts, underwear, nightwear and similar articles of textile fabrics, not knitted o
842	- Women's or girls' coats, capes, jackets, suits, trousers, shorts, shirts, dresses and skirts, underwear, nightwear and similar articles of textile fabrics,
843	- Men's or boys' coats, capes, jackets, suits, blazers, trousers, shorts, shirts, underwear, nightwear and similar articles of textile fabrics, knitted or cr
844	- Women's or girls' coats, capes, jackets, suits, trousers, shorts, shirts, dresses and skirts, underwear, nightwear and similar articles of textile fabrics,
845	- Articles of apparel, of textile fabrics, whether or not knitted or crocheted, n.e.s.
846	- Clothing accessories, of textile fabrics, whether or not knitted or crocheted (other than those for babies)
848	- Articles of apparel and clothing accessories of other than textile fabrics; headgear of all materials

List of Products - SITC, Revision 3

Codes (3 Digit)	Description
851	- Footwear
871	- Optical instruments and apparatus, n.e.s.
872	- Instruments and appliances, n.e.s., for medical, surgical, dental or veterinary purposes
873	- Meters and counters, n.e.s.
874	- Measuring, checking, analysing and controlling instruments and apparatus, n.e.s.
881	- Photographic apparatus and equipment, n.e.s.
882	- Photographic and cinematographic supplies
883	- Cinematographic film, exposed and developed, whether or not incorporating soundtrack or consisting only of soundtrack
884	- Optical goods, n.e.s.
885	- Watches and clocks
891	- Arms and ammunition
892	- Printed matter
893	- Articles, n.e.s., of plastics
894	- Baby carriages, toys, games and sporting goods
895	- Office and stationery supplies, n.e.s.
896	- Works of art, collectors' pieces and antiques
897	- Jewellery, goldsmiths' and silversmiths' wares, and other articles of precious or semiprecious materials, n.e.s.
898	- Musical instruments and parts and accessories thereof; records, tapes and other sound or similar recordings (excluding goods of groups 763 and 883)
899	- Miscellaneous manufactured articles, n.e.s.
931	- Special transactions and commodities not classified according to kind
961	- Coin (other than gold coin), not being legal tender
971	- Gold, non-monetary (excluding gold ores and concentrates)

World Bank list of economies (July 2007)

	<i>Economy</i>	<i>Code</i>	<i>Region</i>	<i>Income group</i>	<i>Lending category</i>	<i>Other</i>
1	Afghanistan	AFG	South Asia	Low income	IDA	
2	Albania	ALB	Europe & Central Asia	Lower middle income	Blend	
3	Algeria	DZA	Middle East & North Africa	Lower middle income	IBRD	
4	American Samoa	ASM	East Asia & Pacific	Upper middle income	..	
5	Andorra	ADO	..	High income: nonOECD	..	
6	Angola	AGO	Sub-Saharan Africa	Lower middle income	IDA	
7	Antigua and Barbuda	ATG	..	High income: nonOECD	IBRD	
8	Argentina	ARG	Latin America & Caribbean	Upper middle income	IBRD	
9	Armenia	ARM	Europe & Central Asia	Lower middle income	Blend	
10	Aruba	ABW	..	High income: nonOECD	..	
11	Australia	AUS	..	High income: OECD	..	
12	Austria	AUT	..	High income: OECD	..	EMU
13	Azerbaijan	AZE	Europe & Central Asia	Lower middle income	Blend	
14	Bahamas, The	BHS	..	High income: nonOECD	..	
15	Bahrain	BHR	..	High income: nonOECD	..	
16	Bangladesh	BGD	South Asia	Low income	IDA	
17	Barbados	BRB	..	High income: nonOECD	..	
18	Belarus	BLR	Europe & Central Asia	Lower middle income	IBRD	
19	Belgium	BEL	..	High income: OECD	..	EMU
20	Belize	BLZ	Latin America & Caribbean	Upper middle income	IBRD	
21	Benin	BEN	Sub-Saharan Africa	Low income	IDA	HIPC
22	Bermuda	BMU	..	High income: nonOECD	..	
23	Bhutan	BTN	South Asia	Lower middle income	IDA	
24	Bolivia	BOL	Latin America & Caribbean	Lower middle income	Blend	HIPC
25	Bosnia and Herzegovina	BIH	Europe & Central Asia	Lower middle income	Blend	
26	Botswana	BWA	Sub-Saharan Africa	Upper middle income	IBRD	
27	Brazil	BRA	Latin America & Caribbean	Upper middle income	IBRD	
28	Brunei Darussalam	BRN	..	High income: nonOECD	..	
29	Bulgaria	BGR	Europe & Central Asia	Upper middle income	IBRD	
30	Burkina Faso	BFA	Sub-Saharan Africa	Low income	IDA	HIPC
31	Burundi	BDI	Sub-Saharan Africa	Low income	IDA	HIPC
32	Cambodia	KHM	East Asia & Pacific	Low income	IDA	
33	Cameroon	CMR	Sub-Saharan Africa	Lower middle income	IDA	HIPC
34	Canada	CAN	..	High income: OECD	..	
35	Cape Verde	CPV	Sub-Saharan Africa	Lower middle income	IDA	
36	Cayman Islands	CYM	..	High income: nonOECD	..	
37	Central African Republic	CAF	Sub-Saharan Africa	Low income	IDA	HIPC
38	Chad	TCD	Sub-Saharan Africa	Low income	IDA	HIPC

39	Channel Islands	CHI	..	High income: nonOECD	..	
40	Chile	CHL	Latin America & Caribbean	Upper middle income	IBRD	
41	China	CHN	East Asia & Pacific	Lower middle income	IBRD	
42	Colombia	COL	Latin America & Caribbean	Lower middle income	IBRD	
43	Comoros	COM	Sub-Saharan Africa	Low income	IDA	HIPC
44	Congo, Dem. Rep.	ZAR	Sub-Saharan Africa	Low income	IDA	HIPC
45	Congo, Rep.	COG	Sub-Saharan Africa	Lower middle income	IDA	HIPC
46	Costa Rica	CRI	Latin America & Caribbean	Upper middle income	IBRD	
47	Côte d'Ivoire	CIV	Sub-Saharan Africa	Low income	IDA	HIPC
48	Croatia	HRV	Europe & Central Asia	Upper middle income	IBRD	
49	Cuba	CUB	Latin America & Caribbean	Lower middle income	..	
50	Cyprus	CYP	..	High income: nonOECD	..	
51	Czech Republic	CZE	..	High income: OECD	..	
52	Denmark	DNK	..	High income: OECD	..	
53	Djibouti	DJI	Middle East & North Africa	Lower middle income	IDA	
54	Dominica	DMA	Latin America & Caribbean	Upper middle income	Blend	
55	Dominican Republic	DOM	Latin America & Caribbean	Lower middle income	IBRD	
56	Ecuador	ECU	Latin America & Caribbean	Lower middle income	IBRD	
57	Egypt, Arab Rep.	EGY	Middle East & North Africa	Lower middle income	IBRD	
58	El Salvador	SLV	Latin America & Caribbean	Lower middle income	IBRD	
59	Equatorial Guinea	GNQ	Sub-Saharan Africa	Upper middle income	IBRD	
60	Eritrea	ERI	Sub-Saharan Africa	Low income	IDA	HIPC
61	Estonia	EST	..	High income: nonOECD	..	
62	Ethiopia	ETH	Sub-Saharan Africa	Low income	IDA	HIPC
63	Faeroe Islands	FRO	..	High income: nonOECD	..	
64	Fiji	FJI	East Asia & Pacific	Lower middle income	IBRD	
65	Finland	FIN	..	High income: OECD	..	EMU
66	France	FRA	..	High income: OECD	..	EMU
67	French Polynesia	PYF	..	High income: nonOECD	..	
68	Gabon	GAB	Sub-Saharan Africa	Upper middle income	IBRD	
69	Gambia, The	GMB	Sub-Saharan Africa	Low income	IDA	HIPC
70	Georgia	GEO	Europe & Central Asia	Lower middle income	IDA	
71	Germany	DEU	..	High income: OECD	..	EMU
72	Ghana	GHA	Sub-Saharan Africa	Low income	IDA	HIPC
73	Greece	GRC	..	High income: OECD	..	EMU
74	Greenland	GRL	..	High income: nonOECD	..	
75	Grenada	GRD	Latin America & Caribbean	Upper middle income	Blend	
76	Guam	GUM	..	High income: nonOECD	..	
77	Guatemala	GTM	Latin America & Caribbean	Lower middle income	IBRD	
78	Guinea	GIN	Sub-Saharan Africa	Low income	IDA	HIPC
79	Guinea-Bissau	GNB	Sub-Saharan Africa	Low income	IDA	HIPC
80	Guyana	GUY	Latin America & Caribbean	Lower middle income	IDA	HIPC

81	Haiti	HTI	Latin America & Caribbean	Low income	IDA	HIPC
82	Honduras	HND	Latin America & Caribbean	Lower middle income	IDA	HIPC
83	Hong Kong, China	HKG	..	High income: nonOECD	..	
84	Hungary	HUN	Europe & Central Asia	Upper middle income	..	
85	Iceland	ISL	..	High income: OECD	..	
86	India	IND	South Asia	Low income	Blend	
87	Indonesia	IDN	East Asia & Pacific	Lower middle income	Blend	
88	Iran, Islamic Rep.	IRN	Middle East & North Africa	Lower middle income	IBRD	
89	Iraq	IRQ	Middle East & North Africa	Lower middle income	IBRD	
90	Ireland	IRL	..	High income: OECD	..	EMU
91	Isle of Man	IMY	..	High income: nonOECD	..	
92	Israel	ISR	..	High income: nonOECD	..	
93	Italy	ITA	..	High income: OECD	..	EMU
94	Jamaica	JAM	Latin America & Caribbean	Lower middle income	IBRD	
95	Japan	JPN	..	High income: OECD	..	
96	Jordan	JOR	Middle East & North Africa	Lower middle income	IBRD	
97	Kazakhstan	KAZ	Europe & Central Asia	Upper middle income	IBRD	
98	Kenya	KEN	Sub-Saharan Africa	Low income	IDA	
99	Kiribati	KIR	East Asia & Pacific	Lower middle income	IDA	
100	Korea, Dem. Rep.	PRK	East Asia & Pacific	Low income	..	
101	Korea, Rep.	KOR	..	High income: OECD	IBRD	
102	Kuwait	KWT	..	High income: nonOECD	..	
103	Kyrgyz Republic	KGZ	Europe & Central Asia	Low income	IDA	HIPC
104	Lao PDR	LAO	East Asia & Pacific	Low income	IDA	
105	Latvia	LVA	Europe & Central Asia	Upper middle income	..	
106	Lebanon	LBN	Middle East & North Africa	Upper middle income	IBRD	
107	Lesotho	LSO	Sub-Saharan Africa	Lower middle income	IDA	
108	Liberia	LBR	Sub-Saharan Africa	Low income	IDA	HIPC
109	Libya	LBY	Middle East & North Africa	Upper middle income	IBRD	
110	Liechtenstein	LIE	..	High income: nonOECD	..	
111	Lithuania	LTU	Europe & Central Asia	Upper middle income	..	
112	Luxembourg	LUX	..	High income: OECD	..	EMU
113	Macao, China	MAC	..	High income: nonOECD	..	
114	Macedonia, FYR	MKD	Europe & Central Asia	Lower middle income	IBRD	
115	Madagascar	MDG	Sub-Saharan Africa	Low income	IDA	HIPC
116	Malawi	MWI	Sub-Saharan Africa	Low income	IDA	HIPC
117	Malaysia	MYS	East Asia & Pacific	Upper middle income	IBRD	
118	Maldives	MDV	South Asia	Lower middle income	IDA	
119	Mali	MLI	Sub-Saharan Africa	Low income	IDA	HIPC
120	Malta	MLT	..	High income: nonOECD	..	
121	Marshall Islands	MHL	East Asia & Pacific	Lower middle income	IBRD	
122	Mauritania	MRT	Sub-Saharan Africa	Low income	IDA	HIPC

123	Mauritius	MUS	Sub-Saharan Africa	Upper middle income	IBRD	
124	Mayotte	MYT	Sub-Saharan Africa	Upper middle income	..	
125	Mexico	MEX	Latin America & Caribbean	Upper middle income	IBRD	
126	Micronesia, Fed. Sts.	FSM	East Asia & Pacific	Lower middle income	IBRD	
127	Moldova	MDA	Europe & Central Asia	Lower middle income	IDA	
128	Monaco	MCO	..	High income: nonOECD	..	
129	Mongolia	MNG	East Asia & Pacific	Low income	IDA	
130	Montenegro	MNE	Europe & Central Asia	Upper middle income	IBRD	
131	Morocco	MAR	Middle East & North Africa	Lower middle income	IBRD	
132	Mozambique	MOZ	Sub-Saharan Africa	Low income	IDA	HIPC
133	Myanmar	MMR	East Asia & Pacific	Low income	IDA	
134	Namibia	NAM	Sub-Saharan Africa	Lower middle income	IBRD	
135	Nepal	NPL	South Asia	Low income	IDA	HIPC
136	Netherlands	NLD	..	High income: OECD	..	EMU
137	Netherlands Antilles	ANT	..	High income: nonOECD	..	
138	New Caledonia	NCL	..	High income: nonOECD	..	
139	New Zealand	NZL	..	High income: OECD	..	
140	Nicaragua	NIC	Latin America & Caribbean	Lower middle income	IDA	HIPC
141	Niger	NER	Sub-Saharan Africa	Low income	IDA	HIPC
142	Nigeria	NGA	Sub-Saharan Africa	Low income	IDA	
143	Northern Mariana Islands	MNP	East Asia & Pacific	Upper middle income	..	
144	Norway	NOR	..	High income: OECD	..	
145	Oman	OMN	Middle East & North Africa	Upper middle income	..	
146	Pakistan	PAK	South Asia	Low income	Blend	
147	Palau	PLW	East Asia & Pacific	Upper middle income	IBRD	
148	Panama	PAN	Latin America & Caribbean	Upper middle income	IBRD	
149	Papua New Guinea	PNG	East Asia & Pacific	Low income	Blend	
150	Paraguay	PRY	Latin America & Caribbean	Lower middle income	IBRD	
151	Peru	PER	Latin America & Caribbean	Lower middle income	IBRD	
152	Philippines	PHL	East Asia & Pacific	Lower middle income	IBRD	
153	Poland	POL	Europe & Central Asia	Upper middle income	IBRD	
154	Portugal	PRT	..	High income: OECD	..	EMU
155	Puerto Rico	PRI	..	High income: nonOECD	..	
156	Qatar	QAT	..	High income: nonOECD	..	
157	Romania	ROM	Europe & Central Asia	Upper middle income	IBRD	
158	Russian Federation	RUS	Europe & Central Asia	Upper middle income	IBRD	
159	Rwanda	RWA	Sub-Saharan Africa	Low income	IDA	HIPC
160	Samoa	WSM	East Asia & Pacific	Lower middle income	IDA	
161	San Marino	SMR	..	High income: nonOECD	..	
162	São Tomé and Príncipe	STP	Sub-Saharan Africa	Low income	IDA	HIPC
163	Saudi Arabia	SAU	..	High income: nonOECD	..	
164	Senegal	SEN	Sub-Saharan Africa	Low income	IDA	HIPC

165	Serbia	SRB	Europe & Central Asia	Upper middle income	IBRD	
166	Seychelles	SYC	Sub-Saharan Africa	Upper middle income	IBRD	
167	Sierra Leone	SLE	Sub-Saharan Africa	Low income	IDA	HIPC
168	Singapore	SGP	..	High income: nonOECD	..	
169	Slovak Republic	SVK	Europe & Central Asia	Upper middle income	IBRD	
170	Slovenia	SVN	..	High income: nonOECD	..	EMU
171	Solomon Islands	SLB	East Asia & Pacific	Low income	IDA	
172	Somalia	SOM	Sub-Saharan Africa	Low income	IDA	HIPC
173	South Africa	ZAF	Sub-Saharan Africa	Upper middle income	IBRD	
174	Spain	ESP	..	High income: OECD	..	EMU
175	Sri Lanka	LKA	South Asia	Lower middle income	IDA	
176	St. Kitts and Nevis	KNA	Latin America & Caribbean	Upper middle income	IBRD	
177	St. Lucia	LCA	Latin America & Caribbean	Upper middle income	Blend	
178	St. Vincent and the Grenadines	VCT	Latin America & Caribbean	Upper middle income	Blend	
179	Sudan	SDN	Sub-Saharan Africa	Low income	IDA	HIPC
180	Suriname	SUR	Latin America & Caribbean	Lower middle income	IBRD	
181	Swaziland	SWZ	Sub-Saharan Africa	Lower middle income	IBRD	
182	Sweden	SWE	..	High income: OECD	..	
183	Switzerland	CHE	..	High income: OECD	..	
184	Syrian Arab Republic	SYR	Middle East & North Africa	Lower middle income	IBRD	
185	Tajikistan	TJK	Europe & Central Asia	Low income	IDA	
186	Tanzania	TZA	Sub-Saharan Africa	Low income	IDA	HIPC
187	Thailand	THA	East Asia & Pacific	Lower middle income	IBRD	
188	Timor-Leste	TMP	East Asia & Pacific	Low income	IDA	
189	Togo	TGO	Sub-Saharan Africa	Low income	IDA	HIPC
190	Tonga	TON	East Asia & Pacific	Lower middle income	IDA	
191	Trinidad and Tobago	TTO	..	High income: nonOECD	IBRD	
192	Tunisia	TUN	Middle East & North Africa	Lower middle income	IBRD	
193	Turkey	TUR	Europe & Central Asia	Upper middle income	IBRD	
194	Turkmenistan	TKM	Europe & Central Asia	Lower middle income	IBRD	
195	Uganda	UGA	Sub-Saharan Africa	Low income	IDA	HIPC
196	Ukraine	UKR	Europe & Central Asia	Lower middle income	IBRD	
197	United Arab Emirates	ARE	..	High income: nonOECD	..	
198	United Kingdom	GBR	..	High income: OECD	..	
199	United States	USA	..	High income: OECD	..	
200	Uruguay	URY	Latin America & Caribbean	Upper middle income	IBRD	
201	Uzbekistan	UZB	Europe & Central Asia	Low income	Blend	
202	Vanuatu	VUT	East Asia & Pacific	Lower middle income	IDA	
203	Venezuela, RB	VEN	Latin America & Caribbean	Upper middle income	IBRD	
204	Vietnam	VNM	East Asia & Pacific	Low income	IDA	
205	Virgin Islands (U.S.)	VIR	..	High income: nonOECD	..	
206	West Bank and Gaza	WBG	Middle East & North Africa	Lower middle income	..	

207	Yemen, Rep.	YEM	Middle East & North Africa	Low income	IDA	
208	Zambia	ZMB	Sub-Saharan Africa	Low income	IDA	HIPC
209	Zimbabwe	ZWE	Sub-Saharan Africa	Low income	Blend	
1	World	WLD				
2	Low income	LIC				
3	Middle income	MIC				
4	Lower middle income	LMC				
5	Upper middle income	UMC				
6	Low & middle income	LMY				
7	East Asia & Pacific	EAP				
8	Europe & Central Asia	ECA				
9	Latin America & Caribbean	LAC				
10	Middle East & North Africa	MNA				
11	South Asia	SAS				
12	Sub-Saharan Africa	SSA				
13	High income	HIC				
14	European Monetary Union	EMU				
15	High income: OECD	OEC				
16	High income: nonOECD	NOC				
17	Heavily indebted poor countries (HIPC)	HPC				
18	Least developed countries: UN classification	LDC				

This table classifies all World Bank member economies, and all other economies with populations of more than 30,000. For operational and analytical purposes, economies are divided among income groups according to 2006 gross national income (GNI) per capita, calculated using the World Bank Atlas method. The groups are: low income, \$905 or less; lower middle income, \$906–3,595; upper middle income, \$3,596–11,115; and high income, \$11,116 or more. Other analytical groups based on geographic regions are also used.

Geographic classifications and data reported for geographic regions are for low-income and middle-income economies only. Low-income and middle-income economies are sometimes referred to as developing economies. The use of the term is convenient; it is not intended to imply that all economies in the group are experiencing similar development or that other economies have reached a preferred or final stage of development. Classification by income does not necessarily reflect development status.

Lending category: IDA countries are those that had a per capita income in 2006 of less than \$1,065 and lack the financial ability to borrow from IBRD. IDA loans are deeply concessional—interest-free loans and grants for programs aimed at boosting economic growth and improving living conditions. IBRD loans are nonconcessional. Blend countries are eligible for IDA loans because of their low per capita incomes but are also eligible for IBRD loans because they are financially creditworthy.

Note: Income classifications are in effect until 1 July 2008.

Total of Exports by Section and by Group of Countries, 2001 to 2005 (000\$)

		Section 0	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6	Section 7	Section 8	Section 9
Developed Countries	2001	231.544.705	45.657.945	120.870.489	314.593.219	9.159.185	522.093.697	616.504.763	2.069.275.952	545.509.171	123.001.559
	2002	239.449.963	48.565.883	123.891.561	269.222.246	11.758.539	577.621.543	639.380.867	2.021.610.728	533.677.287	126.155.931
	2003	276.739.248	56.246.535	144.117.154	340.869.923	13.620.052	692.903.103	730.763.134	2.283.249.241	604.597.351	180.315.719
	2004	311.745.013	62.033.835	176.783.109	441.738.530	15.072.618	835.082.477	885.158.653	2.496.267.125	698.176.613	192.942.163
	2005	308.696.577	63.820.466	192.727.041	473.390.263	15.418.220	886.968.750	939.634.187	2.070.644.986	695.172.920	268.508.201
Developing Countries	2001	109.630.924	10.772.449	58.640.819	240.041.720	9.518.956	67.213.338	209.571.861	399.725.509	216.828.268	32.208.998
	2002	117.167.831	10.719.726	61.642.452	238.904.875	12.941.660	73.290.640	225.167.763	449.779.792	238.299.610	35.328.453
	2003	135.356.428	11.724.725	76.656.074	303.460.434	17.376.219	88.360.632	274.833.491	551.882.296	281.261.595	38.615.946
	2004	146.931.604	13.644.036	99.051.737	358.716.472	21.043.894	114.859.858	371.946.879	692.234.289	322.588.252	65.104.257
	2005	157.068.379	14.980.519	114.641.738	358.475.246	21.422.455	138.260.596	430.836.855	704.185.787	339.721.651	77.373.269
Total 2001	341.175.629	56.430.394	179.511.308	554.634.939	18.678.141	589.307.035	826.076.624	2.469.001.461	762.337.439	155.210.557	
Total 2002	356.617.794	59.285.609	185.534.013	508.127.121	24.700.199	650.912.183	864.548.630	2.471.390.520	771.976.897	161.484.384	
Total 2003	412.095.676	67.971.260	220.773.228	644.330.357	30.996.271	781.263.735	1.005.596.625	2.835.131.537	885.858.946	218.931.665	
Total 2004	458.676.617	75.677.871	275.834.846	800.455.002	36.116.512	949.942.335	1.257.105.532	3.188.501.414	1.020.764.865	258.046.420	
Total 2005	465.764.956	78.800.985	307.368.779	831.865.509	36.840.675	1.025.229.346	1.370.471.042	2.774.830.773	1.034.894.571	345.881.470	
Total Section	2.034.330.672	338.166.119	1.169.022.174	3.339.412.928	147.331.798	3.996.654.634	5.323.798.453	13.738.855.705	4.475.832.718	1.139.554.496	

Source: Own elaboration based on COMTRADE database

High Tech Products List – 3 Digit Level

Group	Product
Aerospace	Product group: 792 - Aircraft and associated equipment; spacecraft (including satellites) and spacecraft launch vehicles; parts thereof
	Product group: 714 - Engines and motors, non-electric (other than those of groups 712, 713 and 718); parts, n.e.s., of these engines and motors
Computing and office equipment	Product group: 751 - Office machines
	Product group: 752 - Automatic data-processing machines and units thereof; magnetic or optical readers, machines for transcribing data onto data media in coded form and machine
Electronics and telecommunication	Product group: 772 - Electrical apparatus for switching or protecting electrical circuits or for making connections to or in electrical circuits (e.g., switches, relays, fuses,
	Product group: 763 - Sound recorders or reproducers; television image and sound recorders or reproducers; prepared unrecorded media
	Product group: 764 - Telecommunications equipment, n.e.s., and parts, n.e.s., and accessories of apparatus falling within groups 761, 762 and 763
	Product group: 776 - Thermionic, cold cathode or photo-cathode valves and tubes (e.g., vacuum or vapour or gas-filled valves and tubes, mercury arc rectifying valves and tubes,
Electric equipment	Product group: 778 - Electrical machinery and apparatus, n.e.s.
Non electric equipment	Product group: 714 - Engines and motors, non-electric (other than those of groups 712, 713 and 718); parts, n.e.s., of these engines and motors
	Product group: 718 - Power-generating machinery, and parts thereof, n.e.s.
	Product group: 731 - Machine tools working by removing metal or other material
	Product group: 733 - Machine tools for working metal, sintered metal carbides or cermets, without removing material
	Product group: 737 - Metalworking machinery (other than machine tools), and parts thereof, n.e.s.
Scientific instruments	Product group: 774 - Electrodiagnostic apparatus for medical, surgical, dental or veterinary purposes, and radiological apparatus
	Product group: 871 - Optical instruments and apparatus, n.e.s.
	Product group: 874 - Measuring, checking, analysing and controlling instruments and apparatus, n.e.s.
	Product group: 881 - Photographic apparatus and equipment, n.e.s.
	Product group: 884 - Optical goods, n.e.s.
	Product group: 899 - Miscellaneous manufactured articles, n.e.s.
Chemicals	Product group: 522 - Inorganic chemical elements, oxides and halogen salts
	Product group: 525 - Radioactive and associated materials
	Product group: 531 - Synthetic organic colouring matter and colour lakes, and preparations based thereon
	Product group: 591 - Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up in form
Pharmaceuticals	Product group: 541 - Medicinal and pharmaceutical products, other than medicaments of group 542
	Product group: 542 - Medicaments (including veterinary medicaments)
Armaments	Product group: 891 - Arms and ammunition